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FDI spillovers and channels of transmission in the EU: The role of regional financial markets

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Abstract

This paper considers financial development as one of the key conditions determining FDI spillovers in EU regions, introducing new evidence on the economic geography of finance and its contribution to growth and the absorptive capacity of regions. It posits that the notion of absorptive capacity at the regional level could emphasize the role of local factors moderating the impact of FDI on regional growth. By using firm level data aggregated to the regional level and employing a newly constructed dataset, the paper shows that FDI can be considered an important ingredient to boost regional growth. Using both panel fixed effects and Generalized Methods of Moments (GMM), the paper supports the hypothesis that FDI spillovers materialize when the region has well-developed financial markets system to absorb FDI externalities. By bridging recent interest in economic geographies of finance and longer standing literatures on international business and economic geography, our analysis aims to highlight the spatial nature of "financialisation" and its significance for facilitating FDI spillovers.

Key words: *FDI spillovers, Absorptive Capacity, EU regions, Financial Development, Regional Growth*

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INTRODUCTION

As academic research has shown, FDI can exert positive impact on the domestic economy's growth potential through various channels. Such impact can occur either via demonstration effects and imitation strategies, (Sinani and Meyer, 2004; Meyer and Sinani 2009), either via labour mobility (Balsvik, 2011), or via local sourcing such as forming backward and forward linkages with domestic firms (Fu, 2008; Nicolini and Resmini, 2010). Previous research conducted at the EU regional level has shown that FDI spillovers can be conditional on various local factors such as geographical and institutional proximity among foreign and indigenous firms (Monastiriotis, 2016; Resmini, 2019), or on the origin of MNEs and the degree of foreignness (Crespo and Fontoura, 2007). Moreover, sometimes FDI spillovers do not accrue homogeneously across all EU regions (Casi and Resmini, 2017).

In this paper, the impact of FDI on growth is examined at the regional level, aiming to show that spatially concentrated FDI can contribute to regions' economic growth and that its impact is emphasized by local conditions. As documented in Crespo et al. (2009), the occurrence of spillovers can encapsulate a sense of space because it is likely that FDI externalities will disseminate to neighboring regions, allowing for greater geographical proximity to play a prominent role in this effect and, because the magnitude and direction of FDI externalities depends strongly on regional characteristics. A lesser distance and geographical proximity might encourage the dissemination of FDI benefits to the local economy, especially when the latter has the capacity to absorb these externalities. The question that arises is the following: what are the parameters that could determine a region's absorptive capacity with respect to FDI spillovers?

The conditional effect of foreign investment on growth has not been examined thoroughly at the EU regional level, urging us to investigate the role of absorptive capacity for FDI spillovers at the level of the EU NUTSII regions. So far, many studies have analysed the effect of various determining factors which render the firm more inclined to "import" foreign knowledge. Most of said factors were restricted in assessing the firm's internal competences, but not the surrounding environment's absorption capacity to identify the determinants of FDI spillovers. This paper considers financial development as one of the key conditions determining FDI spillovers for EU regions, thus introducing new evidence on the economic geographies of finance and their contribution to regional growth and absorptive capacity. By bridging recent interest in economic geographies of finance and longer standing literatures on international business and economic geography, our analysis aims to highlight the spatial nature of "financialisation" and its significance for facilitating FDI spillovers. Therefore, the role of regional financial development is tested as both a determinant of economic development and as an element of the regions' absorptive capacity, hence placing finance into the center of economic geography (Pike and Pollard, 2010; Sokol, 2013).

Using FDI firm level data aggregations downloaded from the Amadeus[1] database, as well as firm level data aggregations of banking deposits obtained from the Bankscope[2] database, we have constructed a newly collected dataset, consisting of data on FDI and financial development at the EU regional level. To date, this unique dataset has not been utilised extensively; however, it will help us estimate the impact of FDI and financial development on regional growth for 259 EU NUTSII regions in the EU-25[3]. The aim of this paper is to measure the role of FDI presence at EU NUTSII level on regions' growth for the EU-25 and account for local absorptive capacity parameters such as R&D, population density and financial development. In other words, the paper will examine whether the effect of spatially concentrated FDI on EU regional growth has been positive during the years 2005-2013 and whether regional conditions - such as regional R&D and regional financial development - determine this impact.

This paper is structured in five sections. The first section analyses the importance of R&D expenditure and financial development as two elements of absorptive capacity at the regional level. Section 2 discusses the empirical methods used and section 3 presents the empirical results obtained. Section 4 explains the need to perform endogeneity checks using a GMM model in order to account for endogeneity. The final section concludes with a summary of the key findings and their implications for future research related to the role of financialisation as an element of absorptive capacity at the regional level.

1. ABSORPTIVE CAPACITY AND FDI SPILLOVERS AT THE REGIONAL LEVEL

Whether the benefits foreign firms can disseminate to the domestic economy occur automatically, or, on the contrary, they are strongly determined by local conditions such as the indigenous environment's capacity to absorb these benefits, has been of great controversy so far (Phelps, 2008; Gallagher and Zarsky, 2004). Various studies highlight the vital role of the host economy's "absorptive capacity" in determining the impact of FDI on growth and suggest that the realization of spillovers depends on the recipient economy's ability to assimilate them (Cohen and Levinthal, 1990; Sanchez-Sellero et al,

1 Amadeus by Bureau Van Dijk is a comprehensive database of 21 million companies across Europe and it can be used to apply research on individual companies. The financial information is portrayed in a standard format so it makes it easy to compare companies across borders. As well as company finances, Amadeus also includes among many others, detailed sections on companies' activities and corporate structures. For further information see: https://www.bvdinfo.com/en-us/our-products/data/international/amadeus

2 Bankscope from Bureau Van Dijk contains financials and finance reports, as well as ownership and subsidiary information for about 30,000 public and private banks across the globe.

3 The following countries were excluded from the analysis: Denmark, Croatia and Cyprus. This is due to the fact that Denmark regions did not report sufficient data on all the years of the analysis, Croatia joined the EU in 2013 and finally Cyprus was not included because the FDI data could be "over-inflated" due to Russian investment on "shell" companies.

2014; Hermes and Lensink, 2003; Fu, 2008). The parameters that have mostly been identified by the literature as key factors determining the local economy's capacity to reap FDI benefits are a high level of human capital (helping to absorb external knowledge), R&D expenditure (making the local economy more innovation prone), entrepreneurship spirit and institutional quality (Monastiriotis, 2016). A factor that has been less explored as a facilitator of FDI spillovers is the level of local financial development and the degree of access to finance in the localized host economy. The studies that have examined this link, have shown that the higher the level of local financial development, the easier for the local economy to exploit FDI externalities and to increase its growth potential (Alfaro et al, 2009; Hermes and Lensink, 2003).

2.1 Regional R&D expenditure

When a firm invests on R&D and innovation, it reinforces various channels through which it enhances its ability to benefit from externally available information such as external knowledge generated by foreign enterprises and ultimately knowledge spillovers. An innovative firm focuses on taking advantage of externally driven sources of knowledge and develops communication networks with various economic agents such as suppliers, industrial conglomerates or research centres that subsequently improve its learning capabilities and thus its absorptive capacity (Cohen and Levinthal, 1990). This is being driven by the fact that when a firm conducts R&D in a specialized field (either high tech or low tech, industry related or intellectually driven), it acquires experience and specialized knowledge on that field which increases its propensity to understand or assimilate external knowledge even more (Griffith et al, 2003). During this process, the firm increases its non-codified knowledge or "tacit" knowledge, which is an intangible asset and thus facilitates the better absorption of external information as well as the better understanding of other firms' discoveries. Therefore, a firm having invested on its own expertise and being already specialized in its field has higher propensity to develop technical capabilities in the future and thus a higher absorptive capacity than laggards' firms, which fall behind in R&D investment.

Despite the significance of these findings, it is vital to take into account the firm's environment in moderating its conduciveness to enhancing its absorptive capacity through R&D expenditure. A non-research-oriented environment, despite the firm's investment on R&D, might impede the firm's absorptive capacity. For that reason, it is necessary to account for the development of the institutional environment when analysing R&D investment as a determinant for absorptive capacity. Various studies have emphasized the importance of the region's receptiveness to new ideas and its ability to capture external knowledge as determinants of positive FDI spillovers. When studying the FDI effect on regional innovation and economic growth in the Chinese regions, it was shown that the coastal areas - abundant in university and research labs as well as those developed in computer infrastructure and high-tech industries - are

more successful in absorbing R&D externalities from FDI and hence increase their growth due to FDI presence. On the contrary, inland regions that lack these sorts of services tend to show a smaller tendency to absorb similar spillovers (Fu, 2008).

Reviewing the literature regarding the effect of R&D on the firm's absorptive capacity, it is noticeable the impact of FDI on the domestic firms' growth is determined by the level of R&D investment or R&D intensity of the local firm. Nevertheless, it should be noted that the effect of FDI on the local firms' growth might be influenced significantly by the *region's* capacity to invest in R&D and hence by the region's absorptive capacity. For example the degree of a region's engagement with research, resulting from its high quality universities or its advanced research collaborations between universities and business, can pave the way for the region's technological upgrading and can contribute to achieving full social returns of R&D investment (D'Este and Pari, 2007). Therefore, the degree to which local firms build their absorptive capacity from R&D can also be signalled from the firm's outside environment and this is something that demands further research in the future.

2.2 Regional Financial Development

A less explored element acting as a potential channel of FDI spillovers is the level of local financial development and its role as a component of the host region's ability to exploit FDI. Less developed financial markets at the national and local level can restrict an economy's ability to benefit from potential FDI spillovers (Hermes and Lensink, 2003). The financial system - i.e. the banking sector and the stock market- act as lubricants in the economy by providing easy access to capital for local and foreign enterprises. Better access to capital is considered a key advantage for the host economy because it encourages the easy flow of funds, thus creating an efficient environment where positive externalities arising from FDI can be well received by the domestic sector. In other words, *the spillover process is optimized when domestic firms have easy access to financing*.

A well-functioning and developed financial system prevents productive enterprises from using their hard assets (e.g. fixed assets) as physical collateral when they request financing from a financial institution. In an underdeveloped financial system, where accounting standards and credit markets are unyielding, firms are required to use a significant amount of their hard assets as collateral in order to be considered as eligible for external financing (bank loan) due to the inefficiency and non-flexibility of the financial sector (e.g. illiquid banks). Therefore, when a firm is forced to use its physical assets e.g. buildings and machinery as collateral for a bank loan, this is considered a "distortion" because in case of default of the loan the bank seizes the tangible assets of the business, which shrinks. As a result, firms that own fixed assets might miss the opportunity to invest those holding assets into a project (Rajan and Zingales, 2001) because they would be bound by a loan contract. For instance, when a domestic firm

tries to capture knowledge spillovers from a foreign enterprise or imitate its managerial, operational or production methods, it might need to adopt new rules internally and embark upon the implementation of new practices. In order for a local firm to better accomplish these purposes, it might need to reorganize its internal structure (buy new machines, hire new manager, train the employees) and therefore it might need external financing to do so (Alfaro et al, 2009).

In other words, the development of the host economy's financial system might act as a channel through which FDI spillovers on growth are optimized. Hermes and Lensink (2003) have argued that financial development can act as a mobilizing factor of spreading technology from foreign firms to domestic ones. They state that "a more developed financial system contributes positively to the process of technological diffusion associated with FDI" (Hermes and Lensink, 2003 pp: 2). An efficient financial system plays a decisive role in helping local firms channel FDI benefits by providing liquidity and helping them upgrade and re-organize their technological systems in order to foster a highly "absorptive" environment and be open to new information (Alfaro et al, 2009). In other words, the domestic financial system acts as a complementary force to the spillover effect of FDI by helping the domestic firms remain competitive enough to be able to maximize the value of the various linkages they form with foreign subsidiaries. Therefore, the easier local firms can access funds for their daily or long-term operations, the more prone they are to capture and implement external knowledge.

In this paper, the role of financial system as a facilitator of FDI spillovers obtains a geographical dimension and acts as integral part of the region and as a channel, connecting the geographies of business to the regional economy (Pike and Pollard, 2010). As geography matters for firms and business, regionalized financial networks also can play an important role in shaping a region's ability to achieve economic growth and absorb foreign knowledge. After all, local banks enjoy various benefits from geographical proximity with their client firms such as better access to firms' information that is not publicly available and greater knowledge of the local business environment (Pollard, 2003). Therefore, since information asymmetries between lenders and borrowers are lowered, there is a better selection of productive investment projects (Hasan et al, 2011). As a result, information asymmetries are reduced and knowledge flows better between business and financial regional networks that are in close proximity. In other words, one could argue that the "geographies of finance" are intertwined with the "geographies of business" and through co-location mechanisms and agglomeration economies, pecuniary externalities are achieved which enhance the dissemination of FDI spillovers.

Table 1 summarizes four notable contributions in the literature on different ways through which financial development could enhance firm's absorptive capacity for FDI spillovers as well as channels through which a developed financial system could act as a mobilizing factor capturing FDI externalities. In this paper, accounting for the role of

absorptive capacity on capturing FDI spillovers from a regional perspective, we aim to demonstrate that the development of the regional financial sector plays a prominent role in shaping the region's absorptive capacity for FDI in part or in whole because of the sorts of effects summarized in Table 1.

2. THE IMPACT OF FDI ON EU REGIONAL GROWTH AND ABSORPTIVE CAPACITY: THE EMPIRICAL MODEL

According to the World Bank Global Financial Development Database (2017) introduced by Čihák et al (2012) in "Čihák, M., Demirgüç-Kunt, A., Feyen, E. and Levine, R., 2012. Benchmarking financial systems around the world", there are several indicators of the level of financial development in a geographical territory. Financial development can be proxied by indicators measuring financial access, financial depth, financial efficiency and financial stability. In the paper, financial depth is used as a proxy for financial development. Financial depth can be measured by the ratio of banking deposits divided by GDP and its effect is tested on economic growth and simultaneously as a "condition" moderating the impact of FDI on economic growth.

In this paper, FDI is measured as foreign affiliates' presence and is calculated as $\frac{\text{Foreign Firms' Turnover}}{\text{Total Turnover}}$ at the EU NUTSII level and comprises our main explanatory variable in the beta-convergence model specified below. Due to the fact that the EU NUTSII data on FDI were constructed from the database of Amadeus[4] (Bureau van Dijk) and firm-level data were aggregated at the regional level, the number of years of analysis is rather limited (9 years). Therefore the model does not entail a long time dimension but still sufficient for a fully-fledged medium run assessment of the impact. After aggregating the firm level data from Amadeus to regional level data (NUTSII), a panel dataset containing observations on foreign affiliates' presence for 259 EU NUTSII regions for 9 years covering the period 2005-2013, was constructed.

In other words the main explanatory variables are FDI - measured as a ratio of foreign firms' turnover to total turnover at the NUTSII level ($\frac{\text{Foreign Firms' Turnover}}{\text{Total Turnover}}$) and FINANCE - measured as a ratio of banking deposits to gross domestic product ($\frac{\text{Banking Deposits}}{\text{GDP}}$) and they are two newly constructed variables. The latter has not been

[4] The original dataset that was downloaded from Amadeus contained information on 32,587,778 observations for all firms (domestic & foreign) located in EU-28 countries from 2005-2013. The location of the firms was given by their postcode ("Zip Code" in Amadeus) and their country of registration ("Country ISO code"). Amadeus provides information on many financial figures such as "Total Assets", "Turnover", and "Sales". For our research purposes we used the variable "Operating Revenue (Turnover)" in order to generate our main explanatory variable which is foreign firms' presence: on NUTSII level. In order to derive the FDIREGION variable from the above dataset we first had to distinguish between foreign firms (in our analysis we consider a firm "foreign" if the country of residence is different from the GUO country and if the percentage of foreign ownership exceeds 10% of the firm's total shares) and total firms (domestic and foreign).

sufficiently explored so far as a driver of growth at the regional level and this paper, using disaggregated data on regional deposits provided by Bankscope sheds some light on potential connection between financial development and the regions' growth.

The growth model estimates the role of FDI (foreign firms' presence), financial depth, human capital, R&D expenditure, Capital-Labor Ratio, and past levels of GDP per capita in determining economic performance in the 259 EU NUTSII regions. In addition, the variables of R&D, population density and financial depth will act as pre-conditions for capturing positive FDI spillovers and will help us define the notion of "regional absorptive capacity" as a facilitator of FDI spillovers. The purpose of our empirical analysis is to estimate the effects of regional foreign presence (FDI at the NUTSII level) on regional economic growth and to examine among others the role of regional financial development as a pre-condition of FDI spillovers. So far, the role of financial markets as a channel of FDI benefits has been explored only at the national level (Alfaro et al, 2009). Nevertheless various externalities from FDI can be more "localized" or subnational (Wang et al, 2016; Xu and Sheng, 2012; Bajo-Rubio et al, 2010; Fu, 2008), and subsequently the role of various channels through which FDI spillovers are realized can be geographically bound, therefore it is paramount to explore this at the regional level.

For the assessment of the FDI's impact on regional growth, an extended beta-convergence model is estimated, including the effect of FDI presence on growth: it will be tested whether FDI affects positively the EU regions' growth rates and it will be estimated whether the effect of foreign firms' presence on EU regional growth is conditional on the following characteristics:

- Regional Financial Depth
- Regional R&D expenditure

A fully-fledged longitudinal panel data methodology has been adopted. In order to control for unobserved (omitted) variables that differ across regions but stay constant through time, a fixed effects regression model will be used and in particular both time and region fixed effects will be used during the panel regression. On the one hand, the time fixed effects will help us control for any possible external shocks that might have taken place during the period 2005-2013 and might have affected commonly all 259 NUTSII regions i.e. the 2008-2009 economic crisis. On the other hand, in order to control for any unobservable or time invariant factors that are stable across EU regions, we are using region fixed effects.[5]

[5] FE modelling offers clear advantages over OLS because it controls for unobserved time invariant variables that differ from one region to the other, by accounting for regions' unobserved heterogeneity and by addressing collinearity problems and incorporating more degrees of freedom (Stock and Watson, 2007). Additionally, it helps to better examine the link between FDI and growth because it adds a time-series nature into the model, with a time period of 9 years.

Relying on a beta-convergence framework at the regional level, where regional GDP per capita growth rate is regressed on the initial regional GDP per capita level, we employ a similar specification with Sala-i-Martin (1996) and Crescenzi and Rodríguez-Pose (2012) and we estimate the following panel equation:

(1) ln G_{it} = $\beta_1$lnG_{it-1} + β_2FDI$_{it-1}$ + β_3INTERACTION$_{it}$ + β_4CONTROLS$_{it}$ + Time Dummies + u_{it}

(2) *Growth*$_{it}$ = a + β_1GDPCAP$_{it-1}$ + β_2FDI$_{it-1}$ + β_3INTERACTION$_{it}$ + β_4CONTROLS$_{it}$ + Time Dummies + u_{it}

where *i* takes values from 1 to 259 EU regions and *t* takes values from 2005 to 2013. *Growth* is the real (constant 2010 prices) growth variable which measures the annual growth rate of regional GDP per capita and is used as a proxy for the economic performance of the region, GDPCAP is the independent level variable which is included as lagged variable in the model, *a* is the constant term, β_1, β_2, β_3 and β_4 are the coefficients of the independent convergence variable (GDPCAP$_{t-1}$), of the main explanatory variable (FDI), of the vector of interaction terms and the vector of control variables respectively and u is the error term. In addition, in order to account for potential endogeneity issues arising from the relationship between growth and foreign affiliates' presence as well as acknowledge that the impact of foreign presence on the region's growth might have a delayed effect, it is important to consider the time-lag effects of FDI on regional growth. FDI impact on regional growth might take effect with a lag of one year, hence we should examine the influence of FDI in T-1 on regional growth, and this is why Growth$_t$ is regressed on FDI$_{t-1}$.

The vector CONTROLS includes standard explanatory variables that have been used in the literature to predict GDP per capita growth rate: capital-labor Ratio (CAPLAB) measured as gross fixed capital formation divided by labor (Boschma et al, 2012), financial depth (FINANCE) defined as banking deposits divided by GDP (Cihak et al, 2012), R&D expenditure (RD) measured as public R&D expenses per inhabitant (Fu, 2008; Frenken et al, 2005), human capital (HC) measured as the percentage of tertiary education graduates per population (Fu, 2008; Boschma, 2012), gravity (GRAV) defined as the sum of distances among the centroids of each pair of regions weighted by their populations (Petrakos, 2011) and population density (POPDEN) measured as number of inhabitants per square metre (Fujita and Thisse, 1996). INTERACTION is a vector of interaction terms, which will test if the impact of FDI on growth is conditional on several factors such as FINANCE (financial depth) and RD (R&D expenditure).

The empirical model will test 4 equations including certain interactions and control variables which are shown below:

$$(3a)\ GROWTH_{it} = a + \beta_1 GDPCAP_{it-1} + \beta_2 FDI_{it-1} + \beta_3 RD_{it-1} + \beta_4 HC_{it-1} + \beta_5 FINANCE_{it-1} + \beta_6 CAPLAB_{it-1} + \beta_7 POPDEN_{it-1} + \beta_8 GRAV_{it-1} + u_{it}$$

$$(3b)\ GROWTH_{it} = a + \beta_1 GDPCAP_{it-1} + \beta_2 FDI_{it-1} + \beta_3 RD_{it-1} + \beta_4 HC_{it-1} + \beta_5 FINANCE_{it-1} + \beta_6 CAPLAB_{it-1} + \beta_7 POPDEN_{it-1} + \beta_8 GRAV_{it-1} + \beta_9 (FDI_{it-1} * FINANCE_{it-1}) + u_{it}$$

$$(3c)\ GROWTH_{it} = a + \beta_1 GDPCAP_{it-1} + \beta_2 FDI_{it-1} + \beta_3 RD_{it-1} + \beta_4 HC_{it-1} + \beta_5 FINANCE_{it-1} + \beta_6 CAPLAB_{it-1} + \beta_7 POPDEN_{it-1} + \beta_8 GRAV_{it-1} + \beta_9 (FDI_{it-1} * RD_{t-1}) + u_{it}$$

$$(3d)\ GROWTH_{it} = a + \beta_1 GDPCAP_{it-1} + \beta_2 FDI_{it-1} + \beta_3 RD_{it-1} + \beta_4 HC_{it-1} + \beta_5 FINANCE_{it-1} + \beta_6 CAPLAB_{it-1} + \beta_7 POPDEN_{it-1} + \beta_8 GRAV_{it-1} + \beta_9 (FDI_{it-1} * POPDEN_{t-1}) + u_{it}$$

3. EMPIRICAL RESULTS

Table 2 illustrates the empirical results from the four Equations above where FDI at the NUTSII level is being tested as a key regressor for determining regional GDP growth in the EU 259 NUTSII regions for the period 2005-2013. First, all columns in Table 2 show that the coefficient of $GDPCAP_{t-1}$ is statistically significant with negative value in all the estimated models, hence depicting that the poorer EU NUTSII regions have been converging towards the wealthier ones during the period 2005-2013. This finding is consistent with previous studies reporting convergence (Sala-i-Martin, 1996), however the speed of convergence varies from study to study. For instance, when in Sala-i-Martin (1996), 90 regions are analyzed for the period 1950-1990, an absolute beta-convergence pattern is detected with an annual convergence rate of 1.5%. In another study estimating a non-linear EU regional growth model in EU regions the authors concluded that GDP per capita developed a J shaped pattern of regional growth where until a certain income threshold, EU regions appeared to converge but after this threshold, divergence patterns seemed to take place (Petrakos et al, 2011). Finally, we observe that the speed of convergence, given by the value of the coefficient of lagged GDP per capita (0.2%), is low which implies that the poorer EU regions tend to converge towards the wealthier ones at a low pace.

With regard to the impact of FDI on growth, Table 2 depicts that the coefficient of FDI_{t-1} is statistically significant, hence suggesting that FDI at the regional level plays an important role for supporting regional economic performance for the EU 259 NUTSII regions in the period 2005-2013 and that the positive benefits of FDI on growth materialize with a time lag. This means that regions can benefit from co-location with foreign affiliates and that geographical proximity with multinationals enhances the possibility for absorbing FDI externalities at the local level or in other words, firms located in the region can absorb FDI productivity spillovers and knowledge externalities due to close proximity and neighbouring relations with foreign investors. This finding is in line with previous studies depicting that FDI-induced spillovers are enabled when foreign and indigenous firms are located in close proximity, confirming the notion that the realization of positive FDI spillovers is not an automatic process (Resmini, 2019). As a result, demonstration effects can become localised and industries can have more

direct and frequent communication with foreign affiliates, which would reduce the information asymmetries and transaction costs and would potentially increase the opportunities for collaboration and for developing backward and forward linkages. (Crespo et al, 2009; Monastiriotis and Jordaan, 2010).

The coefficient of the control variable of R&D expenditure (RD) has the expected sign and is statistically significant in all the columns, which implies that the amount of expenses that a region devotes to R&D matters for its economic growth. R&D expenditure is perceived to measure the amount of public resources dedicated to research and innovation-generating activities that could potentially generate new knowledge and ideas and is thus expected to affect economic growth positively (Crescenzi and Rodriguez-Pose, 2012).

The coefficient of the FINANCE variable, estimating the effect of local financial development on regional growth, is positive and statistically significant denoting that the more developed the financial markets are at the regional level, the higher the economic performance of the region. This finding is quite important as it illustrates that even though capital markets are currently globalized, especially in the EU where there is ongoing integration of the financial sector, financial intermediation at the local level and therefore access to local capital, still matters. Thereby, even when accounting for time and region fixed effects, the results mark the depth of the regions' financial system as an important driver for economic growth at the regional level.

Additionally, we have used interaction terms in our main regression to measure the potential conditional impact of FDI on growth at the regional level. Column (2) in Table 2 estimates the conditional impact of FDI on growth where local financial development is estimated both as an explanatory variable and as part of the interaction term FDI*FINANCE, expressing the interactive effect of FDI and financial development on growth. In other words, column (2) estimates equation 3b above. The regression coefficients in Column (2) inform us that FDI, FINANCE and their interaction seem to exert a significant impact on the dependent variable which means that the interactive effect of FDI and financial development matters for growth. Since we have included an interaction term in the above equation (Brambor, 2005), in order for FDI to have a positive and significant impact on GROWTH, the following condition must be satisfied: $\boldsymbol{\theta}$GROWTH/$\boldsymbol{\theta}$FDI = $\beta_2 + \beta_9$ ($FINANCE_{t-1i}$) > 0, in other words $\boldsymbol{\theta}$GROWTH/$\boldsymbol{\theta}$FDI = 6.453-11.188 ($FINANCE_{it-1}$) > 0 $\Rightarrow$ $FINANCE_{it-1}$ < 0.57 which means that in order for FDI to have a positive impact on growth, the ratio of banking deposits to GDP in the region should not exceed 0.57. In our sample this level corresponds to 1873 observations or 208 regions. In other words, for most of the regions in our sample (the total number of regions is 259), given their levels of financial development, FDI spillovers are positive. This result might imply that the EU regions should not exceed a certain level of financial depth in order to benefit from FDI externalities and that the majority of the EU regions have reached satisfactory levels of financial intermediation to enable them to channel

better FDI spillovers. What is important to observe is that comparing columns (1) and (2) in Table 2, when the interactive effect of FDI*FINANCE is added in column (2), the coefficient of FDI_{t-1} doubles in size compared to column (1), which implies that when FDI interacts with local financial development, its effect becomes stronger on influencing regional growth positively.

Column (3) estimates equation 3c and tests the conditional impact of FDI on growth where R&D expenditure is estimated both as an explanatory variable and as part of the interaction term FDI*R&D, expressing the interactive effect of FDI and R&D on growth. As explained previously, R&D can act as an important determinant of absorptive capacity, especially through the channel of innovation. In order to interpret the effect of FDI on growth and in order for FDI to have a positive and significant impact on GROWTH, the following condition must be satisfied: $\boldsymbol{\theta}$GROWTH/$\boldsymbol{\theta}$FDI = $\beta_2 + \beta_9 (R\&D_{-1i}) > 0$, in other words $\boldsymbol{\theta}$GROWTH/$\boldsymbol{\theta}$FDI = 5.457 - 0.007 $(RD_{it-1}) > 0 \Rightarrow RD_{it-1} < 779$ which means that in order for FDI to have a positive impact on growth, the amount of public R&D expenditure of the region should not exceed 779 euro per inhabitant. This corresponds to 1897 observations out of 2,033, or to 210 out of 259 regions. A plausible explanation for this result might be that R&D expenditure (EUR per inhabitant) might not be a good proxy for R&D intensity (measured as R&D spending per GDP ratio) or that simply R&D expenditure, being only one of the few parameters of innovation, doesn't always lead to the expected innovation output and subsequently, even if a region spends a lot on R&D spending, innovative products are not always materialized and hence the regions' innovation capacity is not advanced (Fu, 2008). An alternative explanation for the above interpretation of the interaction term could be that public R&D expenditure does not build up a region's ability to assimilate new ideas and knowledge the same way that private R&D investment does. Perhaps private firms' investment on R&D can create a more entrepreneurial and innovation prone environment than public R&D expenditure and could enhance the region's ability to absorb new technologies and ideas from foreign investors. In other words, it is implied that only a moderate level of R&D is needed to boost the regions' absorptive capacity and that too high or too low values signal either that firms are too close to the technological frontier to benefit from foreign knowledge, or that they lack the basic skills to absorb FDI externalities (Resmini, 2019).

Column (4) estimates equation 3d and tests the conditional impact of FDI on growth where population density is estimated both as an explanatory variable and as part of the interaction term FDI*POPDEN, expressing the interactive effect of FDI and population density on growth. When the sample was split between the least densely populated areas (bottom 25% of the sample) and the most densely populated areas (top 75% of the sample)[6], it was shown that for the regions with the least urban density, FDI had a positive impact on growth whereas for the most urbanized EU regions, the impact of FDI

[6] Table 1 in Appendix

on growth was not significant. This differential effect urges us to investigate the impact of FDI on growth, subject to population density levels in the EU. Therefore, solving the condition $\boldsymbol{\theta}$GROWTH/$\boldsymbol{\theta}$POPDEN = $\beta_2 + \beta_9$ (POPDEN$_{-1i}$) $>$ 0, in other words $\boldsymbol{\theta}$GROWTH/$\boldsymbol{\theta}$FDI = 3.987- 0.003 (POPDEN$_{it-1}$) > 0 $\Rightarrow$ POPDEN$_{it-1}$ < 1.329 which means that in order for FDI to have a positive impact on growth, the number of inhabitants per sqm of the region should not exceed 1.329. Hence, this implies that FDI has a higher impact on growth for the less densely populated areas in EU, thus initiating a debate about whether agglomeration economies facilitate or impede the occurrence of FDI spillovers at the EU regional level.

Finally, the variables of HC (human capital), CAPLAB (capital-labor ratio), POPDEN (population density) and GRAV (gravity index) constitute the usual control variables added in a beta-convergence model. Firstly, the control variable of capital-labor ratio, used as a proxy of capital intensity seems to be a significant determinant of economic growth, thus adhering to previous empirical findings (Boschma et al, 2012; Frenken et al, 2005) supporting that the more capital intensive the region the higher its economic performance. The coefficients of certain control variables do not seem to have the expected sign and significance level. For instance human capital and the gravity index seem to appear statistically insignificant for determining regional growth, which is not consistent with the current literature as education and geographical centrality play a crucial role for achieving economic growth at the regional level (Cuaresma et al, 2014; Frenken et al, 2005). Moreover, the coefficient of POPDEN (population density) is statistically significant but does not have the expected sign. Population density is a proxy for agglomeration economies arising from economic activity densely concentrated in large urban areas. Such concentration of production generates pecuniary externalities for the firms and through the realization of forward-backward linkages and knowledge spillovers, there is a proliferation of city services which spurs economic growth (Fujita and Thisse, 1996)[7].

4. ENDOGENEITY AND ROBUSTNESS CHECKS

When estimating Equation (2), we develop a dynamic panel data model where the dependent variable (GDP per capita growth) is partially explained by its past value (GDP

[7] It is likely that the non-significant or negative coefficients of the above control variables are attributed to the fact that when using region fixed effects, we “over control” for certain unobservable characteristics of the regions, which might result in “absorbing” the within-region impact of these control variables on growth. In other words, since some of our regional control variables do not vary significantly from year to year i.e. population density, the gravity index and human capital, applying a fixed effects model might result in limiting the proper assessment of the effect of these variables due to their small intra-group variation. The use of regional fixed effects implies the introduction to the model of 258 (n-1) new dummy variables that are assigned to each region and absorb some or most of the explanatory power of variables that are space sensitive and not strongly time variant, such as agglomeration effects or locational advantages. Another plausible explanation for the negative sign of POPDEN is that the most urbanised regions in EU were more affected by the financial crisis of 2008 than the less urbanised ones (see Table 1 in Appendix).

per capita$_{t-1}$) and other variables such as FDI, R&D, financial depth etc. When two-way fixed effects (static) method is used to estimate the effect of the aforementioned variables on growth, it allows on the one hand to control for all time invariant unobservable characteristics of the regions and time trends but on the other hand could lead to biased estimates. The biasedness could occur from the dynamic panel bias: our panel data model is dynamic in the sense that a lagged dependent variable appears as explanatory variable (GDPCAP$_{t-1}$), therefore the regressors' strict exogeneity no longer holds. In other words, while the LSDV (least square dummy variable) estimator is consistent with the fixed effects static model, in dynamic panel data models it is inconsistent (Nickell, 1981). In order to address such potential biasedness in our model created by the correlation between the explanatory variables and the error term but also to check for robustness, we will apply an Arellano-Bond two step difference GMM approach. Difference GMM is a method of accounting for the dynamic nature of growth models and correcting any possible endogeneity that might arise from the relationship between FDI and economic growth. The difference GMM method is instrumenting with lags that are related to lag values of the dependent variable and the instruments are drawn from within the panel dataset (when the model is a dynamic linear panel data model). In this case the instruments are related to the dependent variable but not to the error term (Roodman, 2009). The difference GMM approach deals with this inherent endogeneity by transforming the data to remove the fixed effects.

Equation (2) follows the same approach of the GMM beta-convergence model used by Próchniak and Witkowski (2013) where the dependent variable is the logarithm of GDP per capita change and the logarithm of lagged GDP per capita is the convergence explanatory variable. Due to the fact that our model (Equation (2)) has few time periods, hence a small T (9 years) and a relatively large N (259 NUTSII regions), it is a linear regression, it has a dynamic left hand side variable and it has independent variables that are not strictly exogenous, therefore might be correlated with the error term, it is compelling to use the GMM estimator to control for these biases. An additional assumption is that some of the explanatory variables might be predetermined (correlated with past values of the error term, but uncorrelated with current and future values of the error term) but not strictly exogenous such as the regressor capturing the past value of the dependent variable. Finally, unlike the method of instrumental variables, the method of system GMM assumes that the "best available" instruments are internal to the panel dataset, thereby it uses always lags of explanatory variables as instruments (Roodman, 2009).

Following the approach of previous studies on beta-convergence using dynamic panel data models (Badinger et al, 2004; Elhorst et al, 2010), we employ the GMM estimator in first differences as was introduced by Arellano and Bond (1991). Therefore, we embark on estimating Equation (2) the same way we did previously, although this time we do not use fixed effects but a two-step difference GMM estimator (diff2-GMM) with

heteroscedastic robust standard errors to account for potential endogeneity in our model.

When starting the analysis of the model's coefficients, as a first reaction it is shown that in all the models the coefficient of the lagged dependent variable has the expected sign and statistical significance which confirms the previous panel fixed effects estimation results that there has been some weak signs of convergence in the EU NUTSII during the time period under study. In addition, it is observed that the lagged value of FDI is positive and statistically significant in the last 3 models where FDI is interacted with other variables and not in the first model, implying that FDI per se does not have a significant impact on growth. This finding is slightly different with the results depicted in Table 2 and since it accounts for endogeneity bias, we consider it a more "trustworthy" finding. In other words, it is implied that FDI depends on other economic forces such as finance, R&D and population density, to exert positive impact on regional growth.

Models (2) and (3) are in line with the results of Table 2 and inform us that the positive effect of FDI on growth is conditional on the level of financial development and on the level of R&D, thus confirming the robustness of our results. More specifically if we solve $\boldsymbol{\theta}$GROWTH/$\boldsymbol{\theta}$FDI = $\beta_2 + \beta_9(FINANCE_{t-1i}) > 0$, we get $13.447 - 26.431FINANCE_{t-1} > 0 \Rightarrow FINANCE_{t-1} < 0.51$ which means that only for regions with financial depth levels lower than 0.51 FDI impacts growth positively. This again corresponds to the majority of the regions in our sample hence it is implied that for most regions with current level of financial development, FDI has a positive impact on regional growth (same finding as in Table 2). Therefore, this is also a robust finding compared to our initial results because both the within and the two-step difference GMM estimator showed that financial development is an important condition for FDI spillovers and as long as regions do not exceed a certain level of financial depth, they absorb FDI spillovers efficiently (the coefficient of FDI almost doubles when FINANCE is included in the interaction). In addition, solving $\boldsymbol{\theta}$GROWTH/$\boldsymbol{\theta}$FDI = $\beta_2 + \beta_9 (R\&D_{-1i}) > 0$, in other words $\boldsymbol{\theta}$GROWTH/$\boldsymbol{\theta}$FDI = $9.940 - 0.015 (RD_{it-1}) > 0 \Rightarrow RD_{it-1} < 662$, it means that FDI affects growth positively only for regions with R&D levels lower than this threshold, showing again a robust result. Finally, in the last column, the statistical significance of the interaction term FDI_{t-1}*$POPDEN_{t-1}$ is not confirmed[8], hence denoting that when we account for endogeneity bias, population density is not a statistically significant condition for positive FDI spillovers.

Furthermore, the coefficients of the control variables RD (R&D), HC (human capital) and FINANCE (financial depth) have the expected signs and statistical significance (positive and significant) which is aligned also with the findings of Table 2[9]. This is a positive sign when it comes to checking robustness in our results, especially with regard to the role of

[8] Its p-value is 0.109 which is not too far from the 10% significance level.

[9] In Table 2 human capital was not statistically significant but when we accounted for endogeneity bias, it appeared positive and significant.

regional financial development proving to be a robustly important determinant for regional economic growth[10].

CONCLUSION

Using FDI firm level data aggregations downloaded from the Amadeus database, as well as firm level data aggregations of banking deposits obtained from the Bankscope database, we have constructed a newly collected dataset, consisting of data on FDI and financial development at EU regional level. In this paper, we have estimated FDI as "foreign affiliates' presence" measured as the ratio of $\frac{Foreign\ Firms'\ Turnover}{Total\ Turnover}$ and financial development as "financial depth" measured as the ratio of $\frac{bank\ deposits\ NUTSII}{GDP\ NUTSII}$.

This paper provides a unique estimation of the role of foreign affiliates' presence at regional level for determining the regional growth patterns of EU NUTSII regions. The period of analysis covers the years 2005-2013, which draws special attention as this period includes the 2008-2009 financial crisis. In addition, the analysis offers a first insight on the potential determinants of FDI spillovers at the regional level and introduces the concept of "regional absorptive capacity" whereby certain characteristics of the EU regions act as conditional parameters for determining the regions' "capacity" to benefit from FDI externalities.

The role of FDI for EU regional growth has been tested using an extended beta-convergence model where GDP per capita growth was regressed on the initial level of GDP per capita and other parameters affecting regional growth, using multiple model specifications such as panel fixed effects and dynamic GMM models. According to the findings, the effect of FDI on regional growth (after robustness checks) was shown to be positive and statistically significant. The findings suggest that, when domestic firms are in close proximity and co-location with foreign affiliates, they can benefit from knowledge and technology externalities from FDI, thus improving their economic performance (Sinani and Meyer, 2004; Meyer and Sinani, 2009; Crespo et al, 2009; Monastiriotis and Jordaan, 2010).

In addition, the results show that the financial system plays a role in conditioning the impact of FDI on growth. Moreover, up to a threshold, that includes the great majority of regions, financial depth has an augmenting impact on the FDI effect on regional growth. This urges us to assume that, in more advanced financial markets, perhaps less traditional sources of financial intermediation - such as the stock exchange, venture capital and bond markets - might play a more crucial role in channeling FDI spillovers to the host economy (Rajan and Zingales, 2001; Alfaro et al, 2009). To the best of our knowledge, this conditional effect had not been previously examined at the regional

[10] The coefficient of FINANCE seems to be statistically significant only in one column (whereas in the previous table it was significant in all models)

level; therefore, this paper, using data on bank deposits from Bankscope and performing aggregations at the NUTSII level, offers a unique insight on the role of regional financial development as a channel for regional FDI spillovers.

The paper highlights the role of regional financial development in helping the local economy absorb FDI spillovers, delineating the importance of local bank branches for affecting the host economies' capacity to absorb FDI benefits. This might lead us to the conclusion that access to finance has a localised role to play when it comes to improving the local economy's ability to gain FDI externalities. This finding "revitalises" the discussion over the benefits of "financialisation" and recommends that financial development and access to finance remain key elements of a region's absorptive capacity. Despite recent discussion on negative aspects of financial institutions and financialisation, especially the rhetoric around the negative consequences of securitization, subprime mortgages and globalization of financial markets (Crotty, 2009; Lapavitsas, 2013; DeYoung and Torna, 2013), this paper showed that financial intermediation through traditional bank lending, is still a vital element of regions' growth.

Nevertheless, after a certain threshold of financial development (in very advanced financial markets), less traditional sources of financial intermediation such as the stock exchange, venture capital and bond markets might play a more crucial role in channeling FDI spillovers to the host economy. Therefore, the paper shows that traditional bank lending is a key element of the absorptive capacity of a region; however, after a certain threshold, other financial mechanisms might emerge as elements of regional absorptive capacity.

The role of absorptive capacity, analysed in this paper at regional level, could be further explored at firm level, especially when testing the impact of FDI on domestic firm productivity and the role of local absorptive capacity. Future research might analyse some of the aggregate regional-level findings presented here in firm-level quantitative analyses and in qualitative analysis drawing on insights from the financial, FDI policy and MNE and SME communities. Thus, in subsequent research we will seek to show that access to finance constitutes a key pre-condition for Greek domestic firms to capture FDI externalities and increase their productivity. With recourse to qualitative methods of research, we seek to explore precisely *how* MNE embeddedness and interaction with local financial institutions is considered a significant factor for boosting absorptive capacity and facilitating FDI spillovers.

TABLES

Table 1. Financial Development as determinant of absorptive capacity

Authors	Year	Function of the financial system	Effect of well-advanced financial system on absorptive Capacity for local firms
Alfaro, Chanda, Kalemli-Ozcan & Sayek; Pollard	2009 2003	Banking Sector & Stock Market	- Easy access to capital for local enterprises (borrowing or issuing shares) - Facilitates the reorganization of the local firms' internal structure and helps capturing external knowledge
Rajan & Zingales	2001	Banking Sector	Helps the firm retain its hard assets and not use them as collateral when it requests credit hence leading to non-distortion of assets
Palacin-Sanchez	2015	Banking Sector	Helps SMEs of the host economy lift their credit restrictions
Rajan & Zingales	1996	Banking Sector & Stock Market	Re-allocation of funds from wealthy individuals to start up investor firms so that transaction costs are kept low

Table 2. Beta-Convergence panel data model with FDI as main regressor: 2005-2013. 259 EU NUTSII regions (Region FE-within estimator)

VARIABLES	(1) No interaction	(2) Interaction with Finance	(3) Interaction with R&D	(4) Interaction with Population Density
$GDPCAP_{t-1}$	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
FDI_{t-1}	2.945*	6.453***	5.457***	3.987**
	(1.779)	(1.811)	(1.939)	(1.871)
RD_{t-1}	0.004**	0.004**	0.006***	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)
$FINANCE_{t-1}$	2.111*	5.026***	2.059*	2.090*
	(1.168)	(1.487)	(1.189)	(1.172)
HC_{t-1}	-0.122	-0.140	-0.112	-0.123
	(0.087)	(0.089)	(0.086)	(0.087)
$CAPLAB_{t-1}$	0.000**	0.000*	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
$POPDEN_{t-1}$	-0.007***	-0.007***	-0.006***	-0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
$GRAV_{t-1}$	-0.002	-0.002	-0.002	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)
FDI_{t-1}*$FINANCE_{t-1}$		-11.188**		
		(4.580)		
FDI_{t-1}*RD_{t-1}			-0.007*	
			(0.004)	
FDI_{t-1}*$POPDEN_{t-1}$				-0.003**
				(0.001)
Fixed Effects	Year Region	Year Region	Year Region	Year Region
Constant	41.162***	41.722***	40.186***	40.621***
	(4.074)	(4.020)	(4.023)	(4.202)
Observations	2,032	2,032	2,032	2,032
R-squared	0.513	0.516	0.514	0.514
Number of NUTSII	256	256	256	256
F	73.92	69.77	69.62	68.16

*Notes: *Significant at the 10% level; **significant at the 5% level; and ***significant at the 1% level. Robust standard errors are given in parentheses*[11]

[11] When checking for heteroscedasticity (Breusch-Pagan test) it was shown that the variance of the residuals is non-constant, in other words the residual variance is said to be "heteroscedastic." Therefore we have accounted for heteroscedasticity in all the models.

Table 3. Beta-Convergence GMM model with FDI as main regressor: 2005-2013. 259 EU NUTSII regions. Two-Step Difference GMM (diff2)

VARIABLES	(1) No interaction	(2) Interaction with Finance	(3) Interaction with R&D	(4) Interaction with Population Density
$GDPCAP_{t-1}$	-0.002***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
FDI_{t-1}	5.497	13.447***	9.940***	7.150*
	(3.760)	(3.290)	(3.618)	(3.777)
$FINANCE_{t-1}$	1.910	8.809***	1.887	2.028
	(1.529)	(1.796)	(1.564)	(1.457)
HC_{t-1}	0.446**	0.350	0.379*	0.350*
	(0.217)	(0.223)	(0.207)	(0.207)
RD_{t-1}	0.007*	0.008**	0.011***	0.007*
	(0.004)	(0.004)	(0.004)	(0.004)
$CAPLAB_{t-1}$	0.000	0.000	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
$POPDEN_{t-1}$	-0.008**	-0.010**	-0.008**	-0.006**
	(0.004)	(0.004)	(0.004)	(0.003)
$GRAV_{t-1}$	-0.012	-0.009	-0.008	-0.005
	(0.011)	(0.011)	(0.010)	(0.010)
FDI_{t-1}*$FINANCE_{t-1}$		-26.431***		
		(5.190)		
FDI_{t-1}*RD_{t-1}			-0.015**	
			(0.008)	
FDI_{t-1}*$POPDEN_{t-1}$				-0.004
				(0.002)
FE	Time	Time	Time	Time
Observations	1,775	1,775	1,775	1,775
Number of NUTSII	256	256	256	256
ar1p	0	0	0	0
ar2p	0.00858	0.0112	0.0127	0.00536
Sarganp	0.00	0.00	0.00	0.00
Hansenp	0.0703	0.307	0.286	0.300
Nº of instruments	231	259	259	259

*Notes: *Significant at the 10% level; **significant at the 5% level; and ***significant at the 1% level. Robust standard errors are given in parentheses*

APPENDIX

Table 1. Beta-Convergence panel data model with FDI as main regressor: 2005-2013 (stratified sample)

VARIABLES	(1) **Growth rate** Lower Density regions	(2) **Growth rate** Highest Density regions
gdpcapt_1	-0.002***	-0.001***
	(0.000)	(0.000)
L.fdi	8.482**	3.227
	(3.275)	(2.690)
L.rd	0.020***	0.000
	(0.005)	(0.002)
L.findepth	4.534**	1.408
	(1.812)	(1.333)
L.hc	-0.327**	0.119
	(0.145)	(0.194)
L.caplab	0.000***	-0.000
	(0.000)	(0.000)
L.popden	-0.143	-0.005**
	(0.362)	(0.002)
L.grav	-0.032	0.004
	(0.042)	(0.010)
FE	Year	Year
	Region	Region
Constant	57.938***	35.067**
	(12.947)	(13.782)
Observations	511	513
R-squared	0.531	0.544
Number of NUTSII	68	66
F	27.76	28.22

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