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# Spatial complexity and interactions in the FDI attractiveness of regions

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**Abstract**

This study investigates the factors that drive the distribution of foreign direct investments (FDI) in European regions, and attempts to disentangle the spatial complexity of this phenomenon. In particular, we argue that the capacity of regions to attract FDI is affected by the own-country effect, which can take two different forms: the first relates to the relative performance in Europe of the country of which the region is part (the between-country effect), while the second concerns the relative performance of regions within their own countries (the within-country effect). We find that the own-country effect does exist, and that it affects the attractiveness of regions through several channels. Most importantly, our findings indicate that the within-country effect is weaker than the between-country effect. This means that successful regions in unsuccessful countries do not on average enjoy any extra-FDI premium, while unsuccessful regions in successful countries generally do so.

**Key words**: Foreign direct investments, country effect, spatial econometrics

**JEL codes**: F23, R12, C21

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## 1. INTRODUCTION

Over the past decades, foreign direct investment (FDI) has played a major role as a means to internationalize economic activity. Indeed, FDI is one of the most prominent features of the recent wave of globalization, recording growth rates higher than those of international trade flows and GDP. The importance of FDI, however, is not limited to the quantitative aspects of the phenomenon; rather, it depends on the fact that FDI is one of the most important vehicles for transferring not only financial capital but also technologies, know-how and capabilities across space and national borders (Romer; 1993, OECD, 2007). Most of the worldwide inflows of FDI have been directed towards the European Union (EU), reflecting both the increasing internationalization of European economies and the aims of the European integration process (Barrell and Pain, 1999; Van Aarle, 1996; Mold, 2003). FDI inflows to the EU rose from about USD 97 billion in 1990 to USD 420 billion in 2011. Despite the negative impact of the global downturn on FDI inflows, the EU as a whole still represents the most important recipient area for FDI worldwide (Unctad, 2012).

Notwithstanding this overall exceptional result, the distribution of foreign investments over space within Europe is very scattered, with some countries, and certain regions within each country, performing much better than others in attracting foreign firms. Although the focus of European Regional Policy may be "*to reduce the significant economic, social and territorial disparities that still exist between Europe's regions*" [1], the highly unequal effect of globalization on European regions, which is partly driven by the varying distribution of foreign investments among them, cannot be ignored.

A number of interesting questions are still awaiting a proper, albeit partial answer in this regard: is it regions or countries that compete to attract foreign investments? Do regions and countries compete in absolute or relative terms to attract FDI? Is the absolute performance of a country able to affect the attractiveness of its own regions, and if yes, through what channels?

The aim of this paper is to provide answers to these questions through an empirical analysis of what forces are at work in shaping territorial attractiveness and competition among different locations. In so doing, it will uncover the spatial complexity that characterizes FDI determinants. While this will prove valuable in and of itself, its significance is greatly magnified by the fact that it can be translated into policy lessons and recommendations which can further support FDI promotion activities in Europe and worldwide.

[1] See the purpose of the EU regional policies (http://ec.europa.eu/regional_policy/what/index_en.cfm, last access 28 February 2013).

The factors driving FDI and the location choices of multinational enterprises (MNEs) have been extensively explored in the literature both at a theoretical and empirical level.[2] Nonetheless, spatial interdependencies in the determinants of FDI – the primary focus of this paper – have only recently been taken into consideration. The few studies that do exist suggest that interdependencies across host markets may arise through two channels: one related to trade in final goods, and the other associated with factor mobility. Previous empirical works have mainly studied the first channel of interdependence across host countries, and have identified a positive third-country effect (market potential). Associated works have also found interdependences with respect to both observable and unobservable variables captured by disturbances in the empirical model (Baltagi et al., 2007; Blonigen et al., 2007; Head and Mayer, 2004). Overall, the evidence has been interpreted as pointing to the activity of complex MNEs in general and to export-platform activities in particular (Yeaple, 2003; Ekholm et al., 2007; Ekholm and Forslid, 2001).

A further step towards considering the spatial complexity of the determinants of FDI has been taken by analysing patterns of FDI at sub-national level. Here, the empirical literature is less rich, mainly because of the lack of disaggregated data. Existing studies suggest three main channels for spatial effects: surrounding market potential, which, of course, becomes relevant in large countries only, agglomeration effects among foreign firms, modelled through a spatially-lagged FDI-dependent variable, and the characteristics of neighbouring locations, modelled through spatially-lagged FDI determinants (Coughlin and Segev, 2000; Ledyaeva, 2009; Bobonis and Shatz, 2007; Bode et al., 2012). These studies aid understanding of the impact of omitting spatial effects, but they ignore other potential sources of spatial interdependencies, an investigation of which may further improve our understanding of FDI patterns.

One of these is the potential interplay of country and regional FDI determinants. Whether it is regions or countries that compete to attract FDI is not a new issue, and the literature on location choices on the part of foreign firms both within and across countries is rich with interesting and stimulating contributions (Mucchielli and Puech, 2003; Basile et al., 2009; Bartik, 1985; Hansen, 1987; Carlton, 1983; Guimarães et al., 2000; Hogenbirk and Narula, 2004; Pusterla and Resmini, 2007; Disdier and Mayer, 2003; Braunerhjelm and Svensson, 1996). By applying multilevel regression analysis, these studies show that competition to attract FDI takes place at a regional rather than country level. This implies that regions may compete not only with other regions of the same country but also with regions of other countries, and that the basis for this competition may differ. These studies assume, however, that location advantages at a regional level depend on location advantages at a country level, but they do not explore either the channels of this interaction or the extent to which competition among countries affects competition among regions; and these are two crucial issues, especially from a policy perspective. The work of Basile et al. (2005) offers an

[2] Barba Navarretti and Venables, 2004; Blonigen, 2005; Blomstrom et al., 2001; and Markusen, 1995 represent good surveys of this huge literature, the analysis of which is beyond the scope of this paper.

initial, though incomplete, answer to these questions. In their analysis of the capacity of Italian regions to attract FDI, the authors introduce the idea that regional performance can be affected by national-level characteristics, and demonstrate that unobserved country-specific effects have negatively affected the capacity of Italian regions to attract FDI. Since this paper has a single-country perspective, it is not clear *a priori* whether the results are peculiar to Italy or can be generalized to other countries.

This paper follows this rather promising field of analysis by explicitly modelling and estimating the potential effects of the interplay between country and regional characteristics and implicitly controlling for other spatial effects linked to neighbouring regions' characteristics able to drive FDI. In particular, we argue that FDI attractiveness at a sub-national level is affected by a sort of own-country effect which can be decomposed into two separate effects:

– the *within-country effect*, which relates to the relative performance of a region within the country it belongs to; and

– the *between-country effect*, which refers to the relative performance of the country to which a region belongs within the EU.

An explicit consideration of these two different components of the own-country effect first allows us to understand whether the least attractive region in the most attractive country is likely to attract more or fewer foreign firms than an attractive region in an unattractive country. Second, it enables us to compare the relative attractiveness of regions in attractive and unattractive countries. Once the within- and between-country components of factors that can attract FDI have been identified, more effective FDI promotion policies can be envisaged at both a national and a regional level.

Our results suggest that the own-country effect does exist, although the 'within' component is weaker than the 'between' one, which is generally able to further boost a region's capacity to attract FDI. This means that the relative performance of a country may magnify the relative attractiveness its own regions: more precisely, successful regions in unsuccessful countries do not on average enjoy any extra-FDI premium, while unsuccessful regions in successful countries generally do so.

The structure of this article is as follows. Section 2 provides a short overview of spatial patterns of FDI across and within EU Member States, as well as initial evidence on the interplay between region- and country-level effects in FDI patterns. Section 3 explains how we model the own-country effects and spatial interactions among regional attractiveness. Section 4 discusses our main findings, while Section 5 concludes with some final remarks and policy implications.

## 2. SPATIAL EFFECTS AND FDI: THE EMPIRICAL EVIDENCE

### *2.1 Data description*

Needless to say, we need reliable data on FDI at a regional level in order to achieve our research objectives. Given the lack of publicly-available official data for each EU country, we were obliged to extrapolate them from alternative sources. Starting from the Amadeus dataset, we built up an original database, FDIRegio, which contains disaggregated data on FDI at geographical and sectoral levels.[3] In particular, we counted the number of foreign firms established in each EU region during the period from 2005 to 2007.[4] We chose a three-year period in order to minimize the fluctuations that usually characterize FDI inflows. We stopped at 2007 because the financial crisis and the following economic downturn seem to have altered FDI patterns, not only in Europe but also worldwide. The inclusion of recent years may therefore introduce structural breaks into patterns of FDI which may depend more on exogenous financial shocks than on potential changes to structural FDI determinants.

Table 1 provides figures of FDI inflows in the EU25.[5] Both the number of newly-established firms and the monetary values of FDI flows are reported. This exercise allows us firstly to consider the spatial distribution of FDI among EU countries at an aggregate level, and secondly to understand whether, and to what extent, measuring FDI flows in terms of the number of firms rather than monetary values alters patterns of FDI in the EU.

*(insert Table 1 about here)*

If we look at the number of newly-established foreign firms, three groups of countries can be identified. Romania and the United Kingdom make up the first, which represents about 65 per cent of total inward FDI in the EU. The second group comprises Ireland, France, and Poland, which together represent 16 per cent of total FDI inflows to Europe. Another 15 per cent is collected by other eight countries: Austria, Belgium, Germany, Spain, Italy, the Netherlands, and Sweden. The remaining EU countries have the residual share (about 4 per cent). An analysis of the pattern of FDI flows measured in monetary values suggests a slightly different grouping. The United Kingdom ranks first, with about 27 per cent of all FDI flows into the EU. It is followed by four countries – France, Belgium, Germany, and the Netherlands – which account for about 40 per cent of total FDI inflows into the EU. The third group includes another five countries – Austria, Spain, Italy, Poland, and Sweden – which receive another 20 per cent of inflows. At an aggregate level, the two rankings do not seem

[3] FDI has been defined as a long-term investment relationship between a resident and a non-resident entity which usually presupposes that the investor exerts significant managerial influence within the company it has invested in. The accepted threshold for a foreign direct investment relationship, as defined by the OECD, is 10 per cent: that is, the foreign investor must own 10 per cent or more of the voting stock or ordinary shares of the investee company (OECD, 2008).

[4] FDIRegio also includes information on the number of foreign firms established in two further periods: 1997-1999 and 2001-2003.

[5] Cyprus and Malta have not been considered because of a lack of data at a firm level.

to be particularly dissimilar, as suggested by the rank correlation (0.65, p>0.000); and the differences may be explained by the fact that some countries have attracted fewer, but larger, foreign investments than others. The position of Romania is somewhat ambiguous: it ranks second according to the number of foreign firms, but falls to eleventh when monetary values are taken into consideration, too large a difference to argue that Romania has attracted a huge number of small foreign firms compared with other EU countries. Rather, it may hide differences in the collection and/or the quality of firm level data because of different accounting and balance sheet reporting regulations. Given the lack of plausible explanations, we prefer not to include Romania in the empirical analysis.[6] It is worth noting, however, that although measuring FDI flows by number rather than by monetary value does not significantly alter patterns of FDI, at least at an aggregate level as shown by Table 1, it may have certain disadvantages. In particular, this method implicitly assumes that FDI inflows increase only with the number of foreign firms. Although this is true, as the data at a country level seem to suggest, the main consequence is a potential underestimation of total FDI flows, which also include subsequent investments and potential loans among fellow enterprises. Given the objectives of this paper, this point does not seem relevant, at least from a short-term perspective, since the capacity to attract FDI mainly refers to the creation of new foreign firms rather than to the financial consolidation of existing ones.[7] Another limitation relates to the fact that we are assuming that all foreign firms have potentially the same size. Although this hypothesis is rather restrictive, it does not affect our result, since we are not estimating the potential impact of FDI on the host economy, but rather its capacity to attract foreign firms. While it is fairly obvious that firm size may have a significant impact on the magnitude of the effects that foreign firms can exert on host economies – especially in terms of employment and productive and export capacity – the literature, at least to our knowledge, has not identified significant differences in factors driving multinationals of different sizes. These factors, in fact, depend on location advantages and motivations for becoming multinational, which are independent of the size of a firm. Bearing these considerations in mind, we can now proceed by focusing on the spatial allocation of FDI within EU countries, a discussion which will allow us to close in on our research objective.

### *2.2 The distribution of FDI across EU regions: a descriptive analysis*

Table 2 shows the number of foreign firms per million inhabitants, and the minimum and maximum level that this index of FDI density can reach within each country. Only five countries show a density of FDI above the EU average: the United Kingdom, Romania – although its position remains questionable – Ireland, Austria, Belgium, and Estonia. Various

[6] When Romania is dropped from the sample, the rank correlation increases to 0.88 (p>0.000).

[7] Moreover, the primary source for our data – Amadeus – captures all new foreign investments and mergers and acquisitions and other non-equity forms of foreign investments provided that they result in a change to the name of the company. This potential distortion, even if it exists, is therefore negligible.

reasons, which cannot necessarily be treated as being mutually exclusive, may explain the supremacy of these countries compared with all the other EU countries: Romania and Estonia offer a low-cost, skilled labour force, especially in manufacturing activities, as well as good locations close to the growing emerging markets of important neighbouring countries such as the Russian Federation and Ukraine. Ireland has implemented very effective FDI promotion policies, while Austria and Belgium offer good locations close to the EU core markets. Last but not least, most of these countries have a tax system that is particularly favourable to enterprises.

*(insert Table 2 about here)*

More importantly, Table 2 indicates that the distribution of FDI within countries is rather uneven, as suggested by the large difference between maximum and minimum values in the FDI density index. In all EU countries but three, the highest density of FDI is recorded in the region around the capital. The exceptions are Germany and Italy, where these regions are not the most important economic and financial centres of the country, and - rather surprisingly - Greece, where the capital region instead plays this role, hosting about 36 per cent of the total population and about two-thirds of foreign firms located in the country. We therefore believe that the relative low density of FDI recorded in the capital region reflects a statistical effect rather than a lower capacity to attract FDI compared with the region with the highest FDI density.[8]

Overall, the advantages enjoyed by capital regions in attracting FDI lie in their political and administrative functions, better transportation facilities at both a national and international level, and, generally speaking, a socio-economic environment that is more conducive to foreign investment.[9]

If we look at the distribution of FDI across NUTS2 regions, other interesting spatial patterns emerge.[10] As indicated by Figure 1, there seems to be a significant positive correlation between FDI in one region and the FDI received by neighbouring regions. This can be explained by both agglomeration economies at a local or global level and third market effects, which may involve regions belonging to the same or different countries.

*(Figure 1. The Moran I scatterplot)*

[8] The region hosting the highest number of foreign firms per million inhabitants is Anatoliki, Makedonia and Thraki, which in the period from 2005 to 2007 hosted 18 per cent of all foreign firms located in Greece, but only 6 per cent of the total population.

[9] We are aware that this result might also be due to the fact that the database may contain firm-level information rather than the plant-level information that would be needed to study the geographical distribution of foreign affiliates across Europe. This may potentially bias location in favour of the regions where headquarters tend to locate, which are typically capital city regions. Previous studies using similar data have demonstrated that this bias is minor in Amadeus. See EC, 2005, and Resmini and Pusterla, 2007.

[10] The Baltic Republics are considered at NUTS1 level.

We can also use a map to illustrate the geographical distribution of FDI across European regions. As Figure 2 indicates, this is characterized by spatial clusters of similar values: that is, groups of regions with an FDI penetration above or below the EU mean. Sometimes these clusters coincide with (or do not cross) national borders - as is the case of the United Kingdom, Ireland, Belgium, and Poland - and sometimes they do not. In particular, FDI density is high along the French-German border, the Scandinavian-Baltic border, and the Austrian-Hungarian border. The lack of attractiveness of South-Western countries and regions and regions along the Eastern borders - not considering Romania, of course – is striking.

*(Figure 2. The geography of FDI in Europe)*

We can infer several preliminary conclusions from this discussion. First of all, the location of FDI is affected by spatial patterns, and the attractiveness of each region does not appear to be independent from that of neighbouring regions, a result which is not new in the literature.[11] Secondly, there is evidence that FDI attractiveness may vary not only across countries, but also across regions within countries. Figure 2 suggests that the United Kingdom's capacity to attract FDI is much better than that of Sweden, Austria, or France, and that all these countries perform better than Italy and Spain in terms of FDI penetration. However, several French regions are as attractive as some British or Irish regions, and there are regions in Italy and Spain which perform much better than their respective countries in the FDI tournament.

Let us consider the case of Lombardy, for example. This region attracts about 50 per cent of all FDI flowing into Italy and about 100 foreign firms per million inhabitants, which makes it an outperformer in the Italian panorama. However, Italy cannot be considered to be a favourite location for foreign firms, since it ranks only 11$^{th}$ when FDI flows are measured in number of foreign firms, and 7$^{th}$ when one considers the monetary values of FDI inflows (see Table 1).

If we compare Lombardy's performance with that of other EU regions, it becomes apparent that FDI in Lombardy (ITc4) is as dense as it is in Darmstadt (DE71), Zachodniopomorskie (PL42) and Gelderland (NL22), and a little denser than in West Wales and the Valleys (UKl1). However, these regions are not among the best performers within their own countries, which rank better than Italy, being in 6$^{th}$, 4$^{th}$,7$^{th}$ and 1$^{st}$ place respectively in the EU rankings. Has Lombardy's performance been penalized by Italy's poor performance, or have West Wales and the Valleys and Zachodniopomorskie been advantaged by the improved performance of their own countries compared with Italy? In other words, in the competition for FDI, is it better to be a high-performing region in a laggard country, like Lombardy, or, *vice versa*, a laggard region in a high-performing country? What matters more for attracting

[11] Spatial effects in FDI location have been studied at country level by Blonigen et al., 2007, Garretsen and Peeters, 2009, and Baltagi et al., 2007, and within large host countries by Coughlin and Segev, 2000, Bobonis and Shatz, 2007, Ledyaeva, 2009, and Bode et al., 2012

consistent flows of FDI: the potential of the country or the region? And how do they interact with each other? The next Sections will seek to answer these questions.

## 3. EMPIRICAL STRATEGY

The starting point for our analysis is a simple assessment of the location advantages of European regions. More specifically, our benchmark model is the following specification:

eq. (1) $$y = \boldsymbol{X}\beta + \varepsilon$$

where $y$ is *nx1* cross-regional vector representing the FDI density index in each EU region during the period 2005-2007. The *nxk* matrix **X** contains year 2004 socio-economic characteristics of EU regions, to be described later. As usual, the *nx1* disturbance term $\varepsilon$ is a vector distributed as a multivariate normal, with zero mean and variance-covariance matrix $\sigma^2 I$. Finally the *kx1* vector $\beta$ includes parameters associated with control variables.

Table 3 shows the explanatory variables used in the model, along with some descriptive statistics.[12] The choice of these region-level variables was motivated by a need to understand what location advantages allow regions to be competitive in the FDI attraction game. These variables were chosen to reflect both demand- and supply-side factors, as well as the level of friendliness of the business environment. Among the former, there are local market growth prospects (GDP growth rate) and market potential. We expect both variables to enter with a positive sign. The supply-side factors, on the other hand, include labour costs, the economic specialization of the regions, and human capital endowments. We expect to find a positive relationship between FDI flows and regional specialization, given the interest of MNEs in developing client-supplier links with local producers. Finally, since foreign firms are attracted by regions with a skilled, but cheap, labour force, we expect to find that FDI flows react positively to human capital proxies and negatively to labour costs.[13] Also, we expect to find a larger number of foreign firms in regions characterized by a friendly business environment, proxied by previous FDI inflows. Finally, we consider two additional dummy variables, one identifying capital regions and the other identifying regions in new EU member states of Central and Eastern Europe. These variables allow us to capture potential biases in the sample of data or in patterns of FDI between Western and Eastern EU countries.

[12] See the Statistical Annex for information on sources of data and the measurement units of each variable (Table A1).

[13] As measures for regional industry specialization, we considered three manufacturing macro-branches (the low tech, medium-tech, and high-tech sectors), and one service sector (business services). As for human capital endowments, we preferred to use information on occupation rather than years of schooling, since it signals the skills of a labour force more effectively than educational attainments (Florida et al., 2008; Bacolod et al., 2009). Since our measure for FDI flows does not separate out the activities of the foreign affiliates, we consider different kinds of skills as a proxy for human capital, such as cognitive (scientists), managerial (corporate and SME managers and clerks) and motor occupations (plant and machine workers) as proxies for various labour force skills (Johansson and Klaesson, 2011).

*(Insert Table 3 about here)*

The information on these variables refers to 2004 or previous years, according to the availability of data. This allows us to take into account the fact that foreign firms need time to evaluate the characteristics of a location before making investments. Of course, this also mitigates potential endogeneity problems.

In estimating eq. (1), we started from a non-spatial log-linear regression model, estimated by traditional OLS techniques, and then progressively increased the complexity of the model in order to account for the differing spatial interactions that may affect the distribution of FDI across regions, as discussed in Section 2. To this end, we followed two different strategies.

First of all, we departed from Eq. (1) to model the complex spatial relationship between FDI inflows and its determinants at national and sub-national level explicitly. Our prior is that this may lie in the relative importance of two different effects: the within- and the between-country effects. The former refers to the relative attractiveness of a region compared with other regions of the same country, while the latter refers to the relative performance of the country to which a region belongs compared with the other countries of the EU with regard to attracting investments from abroad. The potential effect on FDI inflows may be due, *ceteris paribus*, to a combination of the within- and between-country effects. Four possible specific cases can be identified:

1. Regions performing better than the respective national mean and located in a country that performs better than the EU mean.

2. Regions performing better than the respective national mean but located in a country that underperforms compared with the EU mean.

3. Regions performing worse than the respective national mean but belonging to a country that performs better than the EU mean.

4. Regions performing worse than the respective national mean and belonging to a country that underperforms compared with the EU mean.

In order to capture the potential interplays between regional and national location advantages and the effects the latter may have on the former, for every explanatory variable we compare each region's performance with its own-country average, and each country's performance with the EU average. From an empirical point of view this means augmenting eq. (1) with two sets of dummy variables:

eq. (2) $$\mathrm{y} = \mathbf{I}\beta_0 + \boldsymbol{D_1}\gamma + \boldsymbol{D_2}\delta + \boldsymbol{X}\beta_1 + \varepsilon$$

where:

- **I** is a (*nx3*) matrix which includes the constant term and the dummies for new EU member states and capital regions;

- **$D_1$** is a *(nxk)* matrix that collects *k* dummy variables $d_1$, one for each explanatory variable *x* included in equation (1). $d_1$ equals 1 if the variable *x* assumes in region *j* a value which is above the mean of the country which region *j* belongs to and 0 otherwise. This set of dummy variables allows us to identify the within-country effect;

- **$D_2$** is a (*nxk*) matrix that collects *k* dummy variables $d_2$, one for each explanatory variable *x* included in equation (1). $d_2$ equals 1 if region *j* belongs to a country which performs better than the EU in the variable *x* and 0 otherwise. This set of dummy corresponds to the between-country effect variable;

- **X** is the (*nxk*) matrix of regressors, where *j* is the number of regions and *k* is the number of variables through which the attractiveness of regions is assessed.[14]

Eq. (2) should already capture most of spatial dependence affecting the data, if any exists. This is due to inclusion of the above-mentioned sets of country- and region-specific fixed effects, which allows us to control for cross-sectional spatial dependence (Garretsen and Peeters, 2009; Blonigen et al., 2007).

A systematic treatment of spatial interdependencies should not, however, be limited *a priori* to one or just a few possibilities, but should include as many as possible of the channels through which spatial interdependencies might affect the distribution of FDI across space. To this end, spatial econometrics – our second strategy for dealing with spatial interactions – may be helpful.

The most frequently-used spatial econometric specifications fall into two broad categories: those modelling spatial dependence in the error terms and those treating them through the dependent variable. Although we cannot identify the right nature of spatial dependence *a priori*, we decided to use a spatial lag model, since we believed it fit better with our research objectives. In particular, it allowed us to quantify spatial spillovers (LeSage, 2011) and is rooted in FDI theory (Baltagi et al., 2007; Garretsen and Peeters, 2009).

According to LeSage and Pace (2009), spatial spillovers occur when changes in the explanatory variables in region *i* affect the dependent variable in region $j \neq i$. Therefore, in eq. (2), spatial spillovers correspond to the cross-partial derivatives $\frac{\partial y}{\partial x_k}$. In the spatial error model, these cross-partial derivatives are by definition zero, as they are in the non-spatial regression model, such as Eq. (1).[15]

[14] Note that when both $d_1$ and $d_2$ are equal to zero, eq. (2) is equal to eq. (1). This corresponds to the benchmark case, in which the capacity of regions to attract foreign firms depends only on their particular socio-economic characteristics. In this case, the intercept term ($\beta_o$) assumes the usual meaning.

[15] Spatial dependence in the disturbances can be formalized as follows: $y = \boldsymbol{X}\beta + u$, where $u = \rho \boldsymbol{W} u + \varepsilon$: hence, the above results of cross-partial derivatives equal zero.

There are a number of theoretical motivations that connect the spatial lag model to FDI. Baltagi et al. (2007) and Garretsen and Peetersen (2009) argue that the potential correlation between FDI in region *i* and FDI in neighbouring regions depends on the motivations underlying the foreign investments. In particular, spatial dependence may arise in the case of efficiency-seeking (vertical) FDI, export-platform FDI and more complex vertical FDI, while it is absent in the case of market-seeking (horizontal) FDI.[16] Besides motivations for becoming multinationals, there are other cross-regional forces that may generate agglomeration incentives. These forces may arise from unobserved or latent influences related to culture, infrastructures, incentives, or other topographic characteristics that may positively or negatively affect the attractiveness of neighbouring regions. This type of spatial dependence is modelled through the error terms, but the theory offers little support on whether to expect these effects and their nature.

For these reasons, we further augment our model by adding a spatial lag vector including the average FDI density from neighbouring regions to eq. (2) to help explain the variation in FDI density across regions:

eq. (3) $$y = \mathbf{I}\beta_0 + \boldsymbol{D_1}\gamma + \boldsymbol{D_2}\delta + \boldsymbol{X}\beta_1 + \lambda \boldsymbol{W}\, y + \varepsilon$$

eq. (4) $$y = (I - \lambda W)^{-1}[\mathbf{I}\beta_0 + \boldsymbol{D_1}\gamma + \boldsymbol{D_2}\delta + \boldsymbol{X}\beta_1] + \ (I - \lambda W)^{-1}\varepsilon$$

where $\varepsilon$ is the error term with the usual properties, $\lambda$ is the spatial autoregressive parameter to be estimated, and $\boldsymbol{W}$ is a *nxn* spatial weight matrix. The term $(I - \lambda W)^{-1}$ is the *spatial multiplier effect of global interaction* (LeSage and Pace, 2009). This implies that each marginal change in region's *i* capacity to attract FDI associated with any of the regressors considered affects not only region *i* but also all the other regions. The spatial autoregressive model can therefore be considered a system of simultaneous equations linking multiple locations.

As for the specification of the distance matrix, we choose a simple inverse distance function, where the shortest distance within the sample – the 10.7 kilometres separating Brussels (BE10) from Leuven (BE24) – is given a weight of unity and all other distances are given a weight that declines according to the following formula (Blonigen et al., 2007; Garretsen and Peeters, 2009):

(eq. 5) $$w(d_{ij}) = \frac{10.7}{d_{ij}} \quad \forall i \neq j$$

[16] Horizontal FDI occurs when firms set up a production plant abroad in order to exploit local markets and save trading costs. Vertical FDI, on the other hand, occurs when firms evaluate all potential destinations in order to identify the one with the lowest costs for the activity to be outsourced (Markusen, 1995; Barba Navarretti and Venables, 2004). More complex forms of FDI include export-platform FDI, which occurs when most of a foreign affiliate's production is sold in third markets rather than in the host or parent markets, and complex vertical FDI, in which a multinational firm sets up production plants in multiple locations to exploit the differences in factor prices (Ekholm et al., 2007; Grossman and Rossi-Hansberg, 2006; Yeaple, 2003).

where $d_{ij}$ is the distance between hosts *i* and *j*, measured as a great circle distance between regional centroid.

One final consideration concerns the calculation of the magnitude of the spatial effects. As we have said, a spatial lag model formally represents an equilibrium outcome of a process of spatial interactions – such as peer effects, neighbourhood effects, and spatial externalities – among local economies and their agents. This implies that the outcome in a location is affected not only by the exogenous characteristics of that region but also by the characteristics of all the other locations through the inverse spatial transformation $(\mathrm{I} - \lambda \mathrm{W})^{-1}$ defined above. More specifically, depending on the statistical relevance of coefficients $\beta_0, \gamma, \delta, \beta_1$ and $\lambda$, it is possible to compute the following spatial effects (LeSage and Pace, 2009):

- The *Average Total Direct Impact* (ATDI) on the dependent variable ($\hat{y}$) of a marginal change in the *k-th* explanatory variable $x_k$, computed as the average over all regions of the changes in $\hat{y}(x_k)$ due to the change in the corresponding $x_k$:

  eq. (6) $$\frac{\partial \hat{y}(x_k)}{\partial x_k} = n^{-1}\, \beta_k tr[(I - \lambda W)^{-1}]$$

- The Average Total Impact (ATI) on the dependent variable ($\hat{y}$) of a marginal change in the k-th explanatory variable ($\mathrm{x_k}$), computed as the average effect of the simultaneous change of $\mathrm{x_k}$in all regions' j=1,2,…,n:

  eq. (7) $$\frac{1}{n}\sum_{j=1}^{n} \frac{\partial \hat{y}(x_k)}{\partial x_{rk}} = n^{-1}\beta_k \sum_{i=1}^{n}\sum_{j=1}^{n}[(I - \lambda W)^{-1}]_{i,j};$$

- The Average Total Indirect Impact (ATII): i.e. the difference between the ATI and the ATDI.

These three effects are discussed in the next Section, along with the results obtained from the various specifications just outlined.

## 4. EMPIRICAL RESULTS

### *4.1 The basic model*

As stated above, we started with analysis of the location advantages that explain the spatial patterns of foreign firms across EU regions, without considering any potential effects of spatial interrelations. Columns (1) and (2) in Table 4 report the estimation results for eq. (1) obtained through OLS regression analysis with two different specifications. In particular, specification (2) does not include the capital region dummy, which turns out to be not significant in specification (1). The massive advantage of capital regions in attracting foreign firms that emerged in section 2 does not, therefore, seem to be determined by sample biases or other unobserved specific effects; rather, it is univocally identified by explicitly considered socio-economic characteristics. As for the new EU member state dummy, it is

positive and significant in all specifications, indicating that regions of Central and Eastern European countries are *ceteris paribus* more attractive than Western European regions.

*(insert Table 4 about here)*

Our initial results, which are reported in columns (1) and (2), indicate that the capacity of regions to attract foreign firms relies more on supply-side than demand-side characteristics. The latter have the expected sign but are only weakly significant. This result may reflect the fact that most FDI is undertaken by EU firms, which have direct access to the whole EU market from their country of origin. The accessibility of regions is not, therefore, among the most important factors for explaining the distribution of foreign investments across regions since it may matter for extra-EU foreign firms only.

The supply-side advantages, instead, are highly significant, although not all of them show the expected sign. We are referring here to specialization in high-tech manufacturing sectors within regions and their endowment of a specific form of human capital: SME managers. According to our results, the higher the concentration of regional production activities in high-tech manufacturing sectors, the lower the FDI inflows that these regions are able to attract. This may depend on the existence of competitive effects between indigenous and foreign firms which discourage foreign firms from locating in these regions: this result is new in the literature on FDI (Görg and Strobl, 2001; Görg and Greenaway, 2004). This effect is at work in high-tech manufacturing sectors, while medium- to low-tech manufacturing sectors seem to be characterized by intra-sectoral spillovers, a location advantage which foreign firms exploit. As for the negative sign of the estimated coefficient for the SME manager variable, it may signal that MNEs are not interested in developing supplier relationships locally, but prefer to rely on international networks of production, which have recently become the prevalent way of organizing production chains at an international level.[17] The space available for technological spillovers *à la* Marshall therefore becomes negligible, and foreign firms compete with local enterprises on intermediate and local labour markets.

Among the other location advantages that warrant attention, it is worth mentioning labour costs, which are negative, as expected, but not statistically significant, and regions' specialization in business services. Both become significant when spatial interactions are included, so we will postpone our discussion of these results until later in this paper. Finally, our findings indicate that the attractiveness of regions strongly depends on their capacity to attract FDI in the past, as the estimated coefficient of the time–lagged FDI variable indicates. This result, too, is not new in the literature, and may be explained by agglomeration incentives among foreign firms or by the fact that the magnitude of previous FDI inflows signals the quality of the local business environment to potential new entrants (Pusterla and Resmini, 2007).

[17] On the importance of international production networks for multinational firms, see Felker, 2003 and Ravenhill, 1998.

As expected, the spatial diagnostics summarized in the panel at the bottom of Table 4 indicate the presence of spatial dependence in both the dependent variable and the error terms. For this reason, we need to switch to estimation techniques that will be able to take the spatial structure of the data into account.

### *4.2 Spatial complexity: the between- and within-country effects*

Column (3) of Table 4 summarizes the results of estimating eq. (2), from which a number of interesting considerations may be drawn. First of all, it is worth noting that FDI determinants are quite robust to the inclusion of country effects, since most of the results are consistent across specifications (1) to (3). Secondly, the country effect does exist, and it affects the attractiveness of regions through several channels; however, the within-country effect is weaker than the between-country effect, as it is only significant in a very limited number of cases. This implies that it is the absolute performance of the country of which a region is a part that matters, rather than the relative performance of the region within its own country. Interestingly, the within-country effect relies on supply-side location advantages only, and seems to be relevant for foreign firms of a specific type: those that have an interest in exploiting large endowments of unskilled and cheap labour. By contrast, the between-country effect occurs as a result of both demand- and supply-side location advantages. The former are stronger than in the baseline model: thus, a failure to take account of the various spatial effects linked to the interplay between countries and regions will lead to an underestimation of the demand-side advantages. Growth prospects matter at both regional and country level, with the latter effect reinforcing the former. Market accessibility is now significant, but only at a country level, which indicates that regions of countries located at the core of the EU attract more FDI than regions located in peripheral countries, all other things being equal. This extra flow of FDI may be related to foreign investments motivated by the intent to exploit large, dynamic national markets.

As for the supply-side characteristics, the between-country effect reinforces the role of agglomeration forces and labour force skills as a factor that can drive FDI. Since the dependent variable measures the total number of newly-created foreign firms without distinguishing the business sector, several proxies for these forces turn out to be significant. It is worth noting, however, that the between-country effect is not always positive, and sometimes hampers the attractiveness of regions. We are referring to three specific variables here: the time-lagged FDI variable, the degree of specialization in high-tech manufacturing sectors, and the share of professionals and scientists in total regional employment. Our findings indicate that regions of countries with a performance superior to the EU average in these variables are, *ceteris paribus*, less attractive than regions located elsewhere. This implies, for example, that regions of countries that had attracted more FDI than the EU average in the previous period are now less attractive than other regions, all things being equal. These results confirm that technological spillovers generated by (skilled)

labour pooling or agglomeration effects are localized, and can then only be captured at a regional level. At a country level, competition effects arise, and overcome possible spillovers.[18] If these results are coupled with the purely regional effect, on the other hand, they indicate that high-performing regions in poorly-performing countries stand out, and will probably attract the entire flow of investments from foreign firms interested in their country into their territory. From this perspective, high-performing regions of poorly performing countries receive a "bonus" in terms of FDI attraction.

These findings confirm the idea that absolute regional characteristics will not suffice to explain the ability of EU regions to attract FDI. Any explanation of regional attractiveness formulated in terms of purely regional effects is therefore only partial, and may potentially be misleading in driving FDI promotion policies. These results tell us more than what we would have learnt by including simple country and/or region dummies, which is what the previous literature did, as they allow us to disentangle the interplay between region and country effects.

We would make one final remark on spatial dependence. A comparison of spatial diagnostics in the bottom panel of Table 4 leads to two important conclusions. First of all, the inclusion of fixed country effects implies that the LM test for spatial error decreases substantially (from 52.17 to 6.50) and becomes less significant. This finding signals that most of the spatial heterogeneity and the spatial autocorrelation due to unobserved variables has been picked up by the country effects. Secondly, despite the inclusion of country effects, the LM test for spatial lag is not only still significant, but is larger than it had previously been. This leads us to conclude that FDI spatial effects are not of a fully cross-sectional nature, as has already been demonstrated by Garretsen and Peeters (2009), for example. In order to control for patterns of spatial dependence generated by the dependent variable, we need to depart from OLS and estimate eq. (4) with ML techniques.

### *4.3 Spatial complexity: Does spatial dependence alter country effects?*

Eq. (4) allows us to consider simultaneously and compare the effects of all possible forms of spatial dependence on regions' attractiveness. Table 5 shows the results.

*(insert Table 5 about here)*

First of all, FDI determinants at a regional level are fairly robust, since they maintain their significance and expected signs. As for country effects, they are still present, and are only marginally affected by spatial dependence. As before, the within-country effect relies on supply side variables linked to the presence of an inexpensive, unskilled labour force, and specialization in low value added manufacturing sectors. Conversely, the between-country

[18] The unexpected sign of human capital proxies at country level might depend on the fact that they do not capture skill levels because of national differences in educational systems.

effect continues to have contrasting effects on the attractiveness of regions. In particular, it helps regions to attract extra FDI flows through demand-side variables,[19] while it reduces regional FDI flows, *ceteris paribus,* through supply-side variables because of the interplay of spillovers arising at a regional level and competition effects that arise when larger territorial units are taken into consideration.

If we now turn to spatial dependence, it is worth noting that the lambda coefficient is positive and significantly different from zero. It indicates the presence of clustering effects in FDI location patterns, thus confirming the descriptive picture provided by the Moran I test discussed in Section 2. In order to assess the contribution of each explanatory variable to spatial dependence in FDI patterns, we turn to the summary measures of indirect (ATII), direct (ATDI), and total (ATI) impacts presented in Table 6.

From this Table we see that the direct and indirect impacts of changes in any of the explanatory variables move in the same direction. This means, for example, that an increasing GDP growth rate in region *i* will increase FDI flows in that region, and that an increased GDP growth rate in neighbouring regions will increase FDI flows in region *i* as well; this seems to be an intuitively plausible result, since an improvement in the economic performance of neighbouring regions means better business opportunities for foreign firms. This complementarity suggests that spatial spillovers magnify the attractiveness of regions with a self-reinforcing agglomeration effect. This picture remains unchanged when country effects are considered. To take another example, regions located in a country with greater market accessibility than the EU average enjoy, *ceteris paribus*, extra FDI flows. The same effect will be present if a region is surrounded by regions in a country with market accessibility superior to the EU average, since this ensures improved market opportunities for foreign firms.[20] Therefore, country effects and spatial dependence among regions are different and independent phenomena which affect regions' attractiveness in terms of foreign investments.

*(insert Table 6 about here)*

### *4.4 Robustness*

The choice of the spatial matrix is crucial, and represents the fundamental underlying assumption of spatial models. The literature has engaged in a wide debate on the idea that

[19] Previous studies suggest that the combination of a positive spatial lag coefficient with a positive market potential coefficient is compatible with complex vertical FDI with agglomeration economies (Garretsen and Peeters, 2009; Blonigen et al., 2007).

[20] Needless to say, this reasoning applies to negative effects as well. A region with a labour cost higher than the national average is less attractive than other regions located in the same country, since foreign firms are not able to exploit the inexpensive local workforce. Being surrounded by regions with a labour cost higher than the respective national averages will reduce a region's attractiveness for the same reason, i.e. the impossibility of exploiting the inexpensive labour force in neighbouring regions.

the structure of spatial dependence of the data is known, and therefore does not need to be estimated. It has also been recognized that imposing an *a priori* spatial structure is a less strong assumption than forcing spatial independence (Anselin and Bera, 1998; Anselin, 2002). Given the objectives of this paper, we believe that the most appropriate structure for capturing the underlying spatial patterns of FDI inflows is the simple inverse distance matrix used to obtain the baseline results discussed above. Indeed, foreign investors entering Europe are theoretically interested in the EU market as a whole rather than that of the host location, especially if it is a small territorial unit, such as a NUTS2 region. This assumption holds regardless of the fact that the further the distance the more difficult it is to develop supplier and/or client linkages due a variety of reasons that can be broadly labelled as the costs of doing business at a distance.

Despite this, in this section we explore the robustness of the reported findings by using different specifications of the spatial weighting scheme. The results are reported in Table 7, where two different specifications are presented and compared. In specification (5), we consider a spatial weighting matrix that relies on squared inverse distances which imply more rapid distance decay. Specification (6), on the other hand, is based on a first-order contiguity spatial weight matrix. By comparing these results with those shown in Table 5, we can conclude that on average, our results are fairly robust to the choice of the spatial weighting scheme. This is true for FDI determinants at a regional level, the significance and expected signs of which remain unaltered, and for the within-country effect. As for the between-country effect, most of its negative consequences for the attractiveness of regions are no longer significant when estimated with a first order contiguity spatial matrix. This may be due to the fact that by considering a first order contiguity matrix, we are implicitly reinforcing localized spillover effects and weakening competition effects, which are becoming less and less localized because of the single market.

*(insert table 7 about here)*

## 5. CONCLUSIONS

This paper has explored the spatial distribution of FDI across EU regions, and sought to understand whether the capacity of regions to attract FDI is affected by own-country attractiveness. In order to achieve our research objectives, we first explored FDI drivers at a regional level. In so doing, inspired by the economic literature, we introduced a number of variables that represent traditional determinants of foreign investments. We found that foreign firms are attracted by regions of dynamic countries with good access to the countrywide market, though the latter effect is weaker than the former. A strong presence of foreign multinationals in a region signals a good business environment for new foreign firms, and emerges as an important determinant of FDI attraction. Supply conditions are also important for foreign investments. In particular, we found evidence that labour costs matter

within countries but not across them, which highlights the idea that MNEs establishing in Europe are not pursuing a cost-saving strategy: rather, they are seeking access to local markets or high-quality production inputs and highly-specialized know-how. Agglomeration forces arise and drive FDI in the medium-to low-tech and business services sectors. These specialization effects are important at both a regional and country level.

One general result that emerges from our findings is that regional and country performance are interlinked. In particular, we consider two different effects: the first relates to the relative performance of a region within the country it belongs to, while the second concerns the relative performance of that country in the EU. We demonstrate that the latter effect is stronger and more significant than the former along many dimensions, as discussed above. In particular, we find that the between-country effect further boosts the capacity of regions to attract FDI through demand-side variables, while it reduces their attractiveness through supply-side variables, where competition effects may arise and overcome localized spillovers.

All in all, this paper adds to the FDI literature in two ways. First, it demonstrates that FDI location processes may be affected not only by third-country effects but also by own-country effects. Second, it provides a spatial picture of the determinants of FDI across EU regions, a perspective which has so far been lacking in the empirical literature. Although a detailed discussion of this issue falls outside the scope of this paper, our results are also informative for FDI promotion policies, which must take account of the complex relationship between regional and country characteristics and their spatial interlinkages if they are to be really effective. When considered from a spatial perspective, the lack of co-ordination between these two levels of governance may provide a possible explanation for the currently unsatisfactory performance of a number of European regions, mainly those located in the South-Western countries. This is an issue that deserves further specific analysis in the future.

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**Figure 1.The Moran's I scatterplot**

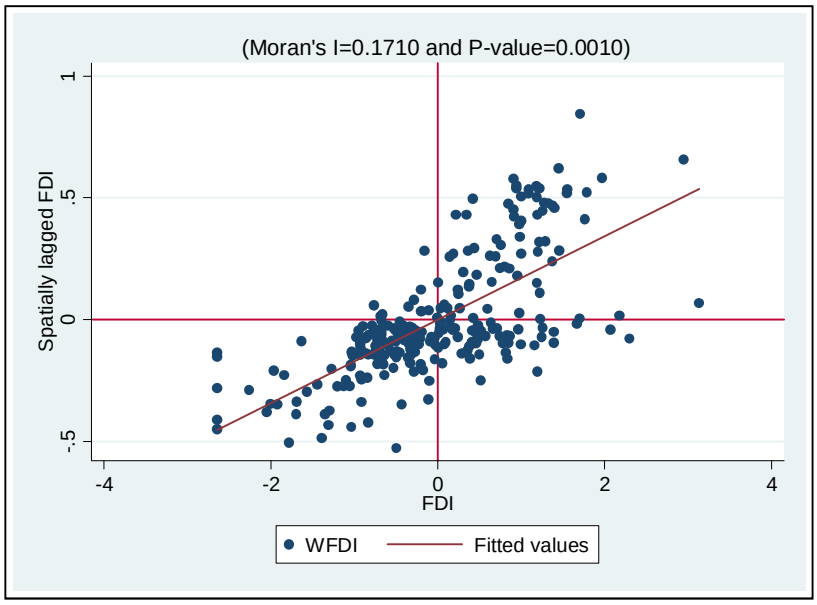


**Figure 2. The geography of FDI in Europe: Moran Scatterplot Map**

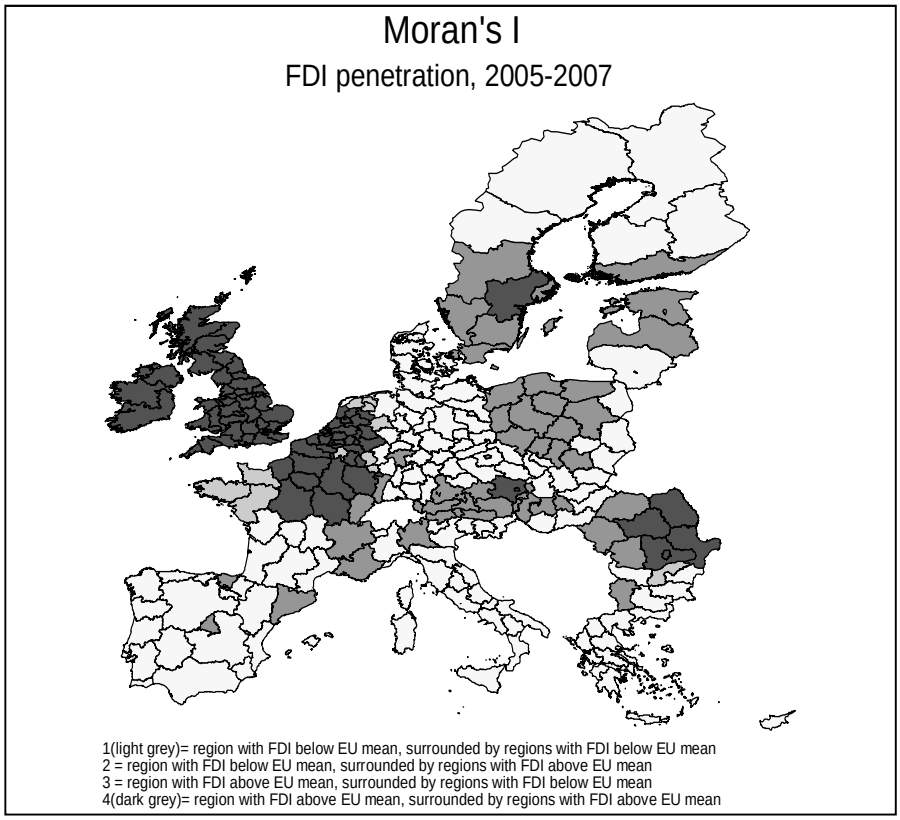

**Table 1. The distribution of FDI across EU countries, 2003-2005.**

| Country | ALL EU25 countries | | | | Without Romania | | | |
|---|---|---|---|---|---|---|---|---|
| | n. of firms | | FDI flows (mln of $) | | n. of firms | | FDI flows (mln of $) | |
| | total | % | total | % | total | % | total | % |
| Austria | 2701 | 2.44 | 16624 | 2.58 | 2701 | 3.48 | 16624 | 2.62 |
| Belgium | 2894 | 2.62 | 62231 | 9.67 | 2894 | 3.72 | 62231 | 9.82 |
| Bulgaria | 869 | 0.79 | 8038 | 1.25 | 869 | 1.12 | 8038 | 1.27 |
| Czech Republic | 498 | 0.45 | 9187 | 1.43 | 498 | 0.64 | 9187 | 1.45 |
| Germany | 2984 | 2.70 | 61091 | 9.50 | 2984 | 3.84 | 61091 | 9.64 |
| Denmark | 419 | 0.38 | 9125 | 1.42 | 419 | 0.54 | 9125 | 1.44 |
| Estonia | 334 | 0.30 | 2461 | 0.38 | 334 | 0.43 | 2461 | 0.39 |
| Spain | 1988 | 1.80 | 40029 | 6.22 | 1988 | 2.56 | 40029 | 6.31 |
| Finland | 471 | 0.43 | 8284 | 1.29 | 471 | 0.61 | 8284 | 1.31 |
| France | 8431 | 7.62 | 84339 | 13.11 | 8431 | 10.85 | 84339 | 13.30 |
| Greece | 165 | 0.15 | 2696 | 0.42 | 165 | 0.21 | 2696 | 0.43 |
| Hungary | 786 | 0.71 | 6159 | 0.96 | 786 | 1.01 | 6159 | 0.97 |
| Ireland | 3687 | 3.33 | -4175 | -0.65 | 3687 | 4.74 | -4175 | -0.66 |
| Italy | 1819 | 1.65 | 36574 | 5.69 | 1819 | 2.34 | 36574 | 5.77 |
| Lithuania | 84 | 0.08 | 1620 | 0.25 | 84 | 0.11 | 1620 | 0.26 |
| Luxembourg | 66 | 0.06 | 3380 | 0.53 | 66 | 0.08 | 3380 | 0.53 |
| Latvia | 169 | 0.15 | 1564 | 0.24 | 169 | 0.22 | 1564 | 0.25 |
| Netherlands | 2951 | 2.67 | 57469 | 8.93 | 2951 | 3.80 | 57469 | 9.06 |
| Poland | 5375 | 4.86 | 17819 | 2.77 | 5375 | 6.92 | 17819 | 2.81 |
| Portugal | 217 | 0.20 | 5967 | 0.93 | 217 | 0.28 | 5967 | 0.94 |
| Romania | 32864 | 29.72 | 9257 | 1.44 | - | - | - | - |
| Sweden | 1348 | 1.22 | 22858 | 3.55 | 1348 | 1.73 | 22858 | 3.61 |
| Slovenia | 14 | 0.01 | 915 | 0.14 | 14 | 0.02 | 915 | 0.14 |
| Slovak Republic | 195 | 0.18 | 3567 | 0.55 | 195 | 0.25 | 3567 | 0.56 |
| United Kingdom | 39244 | 35.49 | 176194 | 27.39 | 39244 | 50.50 | 176194 | 27.79 |
| | | | | | | | | |
| EU15 | 69385 | 62.75 | 582687 | 90.58 | 69385 | 89.29 | 582687 | 91.90 |
| NMS | 41188 | 37.25 | 60587 | 9.42 | 8324 | 10.71 | 51330 | 8.10 |
| EU | 110573 | 100.00 | 643274 | 100.00 | 77709 | 100.00 | 634017 | 100.00 |
| Rank correlation coefficient | | 0.65 | *** | | | 0.88 | *** | |

*** indicates significance at one per cent level.
Source: Own calculation from FDIRegio and Unctad.

**Table 2. The distribution of FDI within EU countries, 2003-2005.**

| country | Total FDI | % | FDI/pop | MIN | MAX | capital |
|---|---|---|---|---|---|---|
| Austria | 2701 | 2.44 | 327.54 | 118.25 | 719.33 | 719.33 |
| Belgium | 2894 | 2.62 | 275.25 | 43.59 | 837.16 | 837.16 |
| Bulgaria | 869 | 0.79 | 112.57 | 13.56 | 352.89 | 352.89 |
| Czech Republic | 498 | 0.45 | 48.57 | 14.37 | 201.68 | 201.68 |
| Germany | 2984 | 2.70 | 36.20 | 11.06 | 121.54 | 42.41 |
| Denmark | 419 | 0.38 | n.a. | n.a. | n.a. | n.a. |
| Estonia | 334 | 0.30 | 248.35 | 248.35 | 248.35 | 248.35 |
| Spain | 1988 | 1.80 | 45.43 | 9.22 | 123.62 | 123.62 |
| Finland | 471 | 0.43 | 89.61 | 16.57 | 154.42 | 154.42 |
| France | 8431 | 7.62 | 133.37 | 6.80 | 366 | 366 |
| Greece | 165 | 0.15 | 14.83 | 1.66 | 47.74 | 25.73 |
| Hungary | 786 | 0.71 | 77.98 | 18.91 | 186.25 | 186.25 |
| Ireland | 3687 | 3.33 | 875.72 | 160.73 | 1136.8 | 1136.8 |
| Italy | 1819 | 1.65 | 30.94 | 0.80 | 100.83 | 28.01 |
| Lithuania | 84 | 0.08 | 24.67 | 0.08 | 0.08 | 0.08 |
| Luxembourg | 66 | 0.06 | 140.77 | 0.06 | 0.06 | 0.06 |
| Latvia | 169 | 0.15 | 73.67 | 0.15 | 0.15 | 0.15 |
| Netherlands | 2951 | 2.67 | 180.68 | 35.8 | 350.31 | 350.31 |
| Poland | 5375 | 4.86 | 140.88 | 30.85 | 381.51 | 381.51 |
| Portugal | 217 | 0.20 | 20.54 | 2.40 | 46.8 | 46.8 |
| Romania | 32864 | 29.72 | 1520.69 | 371.57 | 6788.8 | 6788.8 |
| Sweden | 1348 | 1.22 | 148.83 | 29.44 | 387.61 | 387.61 |
| Slovenia | 14 | 0.01 | 6.99 | 3.71 | 10.82 | 10.82 |
| Slovak Republic | 195 | 0.18 | 36.18 | 11.84 | 167.26 | 167.26 |
| United Kingdom | 39244 | 35.49 | 649.61 | 59.07 | 5110.61 | 5110.61 |
| | | | | | | |
| EU15 | 69385 | 62.75 | 180.51 | 0.06 | 5110.61 | |
| NMS | 41188 | 37.25 | 402.81 | 0.08 | 6788.8 | |
| EU | 110573 | 100.00 | 227.22 | 0.06 | 6788.90 | |

Source: Own calculation from FDIRegio.

**Table 3. Descriptive statistics**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| FDI (dep. variable) | 252 | 3.95 | 1.45 | 0.00 | 8.55 |
| Time-lagged FDI | 252 | 4.34 | 1.41 | 0.00 | 8.36 |
| GDP growth rate | 252 | 3.56 | 2.81 | -2.90 | 13.32 |
| Labour Cost | 252 | 10.11 | 1.20 | 5.59 | 11.08 |
| Market Accessibility | 252 | 3.10 | 1.30 | 0.00 | 8.45 |
| Low-tech manufacturing sectors | 252 | 0.06 | 0.02 | 0.00 | 0.14 |
| Medium-tech manufacturing sectors | 252 | 0.09 | 0.05 | 0.00 | 0.21 |
| High-tech manufacturing sectors | 252 | 0.02 | 0.02 | 0.00 | 0.10 |
| Business Services | 252 | 0.26 | 0.06 | 0.12 | 0.49 |
| Corporate Managers | 252 | 0.04 | 0.03 | 0.00 | 0.14 |
| SME Managers | 252 | 0.04 | 0.02 | 0.01 | 0.13 |
| Professionals and Scientists | 252 | 0.13 | 0.03 | 0.04 | 0.23 |
| Clerks | 252 | 0.11 | 0.03 | 0.04 | 0.19 |
| Plant and Machine Operators | 252 | 0.09 | 0.03 | 0.03 | 0.18 |

**Table 4. FDI determinants and the country effects**

| | (1) | (2) | Main | (3) within country effect | between country effect |
|---|---|---|---|---|---|
| time-lagged FDI | 0.333*** | 0.333*** | 0.643*** | 0.022 | -0.349* |
| | (0.058) | (0.059) | (0.067) | (0.146) | (0.195) |
| GDP growth rate | 0.031 | 0.040* | 0.040* | -0.090 | 0.483** |
| | (0.024) | (0.024) | (0.022) | (0.089) | (0.204) |
| Labour Cost | -0.052 | -0.046 | -0.04 | -0.207* | 0.171 |
| | (0.062) | (0.062) | (0.058) | (0.111) | (0.359) |
| Market Accessibility | 0.088 | 0.111* | 0.008 | 0.134 | 0.374** |
| | (0.060) | (0.061) | (0.047) | (0.090) | (0.151) |
| Low-tech manufacturing sectors | 5.658** | 6.257** | 7.084** | -0.138 | 0.772** |
| | (2.717) | (2.707) | (2.989) | (0.106) | (0.363) |
| Medium-Tech manufacturing sectors | 2.268 | 1.602 | 3.528* | -0.105 | 0.436** |
| | (1.794) | (1.788) | (1.886) | (0.114) | (0.208) |
| High-Tech manufacturing sectors | -11.261*** | -10.654*** | -2.042 | 0.069 | -0.713*** |
| | (2.800) | (2.889) | (4.440) | (0.104) | (0.266) |
| Business Services | 0.826 | 1.528 | 2.742* | -0.006 | 0.410* |
| | (1.675) | (1.632) | (1.625) | (0.150) | (0.246) |
| Corporate Managers | 23.260*** | 21.797*** | 8.877** | -0.043 | 0.899*** |
| | (2.779) | (2.614) | (4.451) | (0.115) | (0.277) |
| SME Managers | -10.258** | -9.751** | -11.833* | 0.142 | -0.392 |
| | (4.049) | (4.163) | (6.405) | (0.092) | (0.261) |
| Professionals and Scientists | 3.393 | 4.106* | 7.559** | -0.101 | -1.213*** |
| | (2.373) | (2.378) | (3.023) | (0.131) | (0.227) |
| Clerks | 5.749** | 5.540** | 2.371 | 0.125 | -0.238 |
| | (2.686) | (2.597) | (3.165) | (0.097) | (0.276) |
| Plant and Machine Operators | 3.219 | 3.384 | -4.286 | 0.263** | -0.493 |
| | (2.866) | (2.800) | (2.993) | (0.112) | (0.310) |
| EU12 | 0.386* | 0.460** | 0.841*** | | |
| | (0.220) | (0.225) | (0.320) | | |
| Capital Region | 0.375 | | | | |
| | (0.246) | | | | |
| Constant | 0.053 | -0.301 | -2.379** | | |
| | (0.767) | (0.809) | (0.927) | | |
| Observations | 252 | 252 | 252 | | |
| R-squared | 0.753 | 0.749 | 0.891 | | |

| Spatial diagnostics | (1) | (2) | (3) |
|---|---|---|---|
| *Spatial error:* | | | |
| Lagrange multiplier | 48.07*** | 52.17*** | 6.50** |
| Robust Lagrange multiplier | 40.64*** | 48.22*** | 1.04 |
| *Spatial lag:* | | | |
| Lagrange multiplier | 8.18** | 5.94** | 10.65*** |
| Robust Lagrange multiplier | 0.76 | 1.98 | 5.19** |

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

**Table 5. Spatial Lag model**

| | | (4) | |
|---|---|---|---|
| | Main | within country effect | between country effect |
| Time-lagged FDI | 0.635*** | 0.017 | -0.378** |
| | (0.056) | (0.117) | (0.176) |
| GDP growth rate | 0.041* | -0.069 | 0.350** |
| | (0.022) | (0.085) | (0.167) |
| Labour Cost | -0.043 | -0.190** | 0.005 |
| | (0.056) | (0.094) | (0.296) |
| Market Accessibility | -0.017 | 0.149 | 0.248* |
| | (0.048) | (0.094) | (0.144) |
| Low-tech manufacturing sectors | 7.783*** | -0.161* | 0.626** |
| | (2.467) | (0.097) | (0.312) |
| Medium-tech manufacturing sectors | 3.325** | -0.120 | 0.420** |
| | (1.568) | (0.107) | (0.169) |
| High-tech manufacturing sectors | -0.701 | 0.079 | -0.737*** |
| | (3.935) | (0.088) | (0.217) |
| Business Services | 3.505*** | -0.057 | 0.168 |
| | (1.340) | (0.129) | (0.255) |
| Corporate Managers | 4.134 | -0.031 | 0.802*** |
| | (3.938) | (0.094) | (0.215) |
| SME Managers | -8.714** | 0.122 | -0.470** |
| | (4.046) | (0.083) | (0.192) |
| Professionals and Scientists | 8.764*** | -0.068 | -1.201*** |
| | (2.596) | (0.111) | (0.195) |
| Clerks | 1.389 | 0.140 | -0.068 |
| | (2.639) | (0.090) | (0.258) |
| Plant and Machine Operators | -3.074 | 0.231** | -0.537** |
| | (2.751) | (0.100) | (0.271) |
| EU12 | 0.816*** | | |
| | (0.280) | | |
| Constant | -4.505*** | | |
| | (1.010) | | |
| *Lambda* | 0.677*** | | |
| | (0.192) | | |
| *Sigma* | 0.217*** | | |
| | (0.019) | | |
| Observations | 252 | | |

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

## Table 6. Average total direct and indirect effects

| | main | | | within country effect | | | between country effect | | |
|---|---|---|---|---|---|---|---|---|---|
| | ATI | ATDI | ATII | ATI | ATDI | ATII | ATI | ATDI | ATII |
| Time-lagged FDI | **1.96** | **0.64** | **1.32** | 0.05 | 0.02 | 0.04 | **-1.17** | **-0.38** | **-0.79** |
| GDP growth rate | **0.13** | **0.04** | **0.09** | -0.21 | -0.07 | -0.14 | **1.09** | **0.35** | **0.73** |
| Labour Costs | -0.13 | -0.04 | -0.09 | **-0.59** | **-0.19** | **-0.40** | 0.02 | 0.00 | 0.01 |
| Market Accessibility | -0.05 | -0.02 | -0.04 | 0.46 | 0.15 | 0.31 | **0.77** | **0.25** | **0.52** |
| Low-tech manufacturing sectors | **24.13** | **7.85** | **16.28** | **-0.50** | **-0.16** | **-0.34** | **1.94** | **0.63** | **1.31** |
| Medium-tech manufacturing sectors | **10.31** | **3.35** | **6.96** | -0.37 | -0.12 | -0.25 | **1.30** | **0.42** | **0.88** |
| High-tech manufacturing sectors | -2.17 | -0.71 | -1.47 | 0.25 | 0.08 | 0.17 | **-2.29** | **-0.74** | **-1.54** |
| Business Services | **10.87** | **3.53** | **7.33** | -0.18 | -0.06 | -0.12 | 0.52 | 0.17 | 0.35 |
| Corporate Managers | 12.82 | 4.17 | 8.66 | -0.10 | -0.03 | -0.07 | **2.49** | **0.81** | **1.68** |
| SME Managers | **-27.01** | **-8.78** | **-18.23** | 0.38 | 0.12 | 0.25 | **-1.46** | **-0.47** | **-0.98** |
| Professionals Scientists | **27.17** | **8.83** | **18.33** | -0.21 | -0.07 | -0.14 | **-3.72** | **-1.21** | **-2.51** |
| Clerks | 4.30 | 1.40 | 2.90 | 0.43 | 0.14 | 0.29 | -0.21 | -0.07 | -0.14 |
| Plant and Machine Operators | -9.53 | -3.10 | -6.43 | **0.72** | **0.23** | **0.48** | **-1.67** | **-0.54** | **-1.12** |

Coefficients in bold are significant at least at 5 per cent.

## Table 7. Sensitivity analysis of the spatial lag model

| | | (5) | | | (6) | |
|---|---|---|---|---|---|---|
| | Main | within country effect | between country effect | Main | within country effect | between country Effect |
| Time-lagged FDI | 0.635*** | 0.023 | -0.367** | 0.606*** | 0.066 | -0.255 |
| | -0.056 | -0.117 | -0.175 | (0.061) | (0.115) | (0.169) |
| GDP growth rate | 0.040* | -0.06 | 0.384** | 0.049** | -0.081 | 0.341** |
| | -0.021 | -0.085 | -0.165 | (0.021) | (0.082) | (0.159) |
| Labour Cost | -0.038 | -0.204** | 0.001 | -0.045 | -0.216** | 0.100 |
| | -0.055 | -0.093 | -0.296 | (0.058) | (0.090) | (0.308) |
| Market Accessibility | 0.003 | 0.117 | 0.261* | 0.030 | 0.087 | 0.396** |
| | -0.047 | -0.094 | -0.143 | (0.046) | (0.091) | (0.162) |
| Low-tech manufacturing sectors | 8.194*** | -0.182* | 0.609* | 6.633*** | -0.151 | 0.780** |
| | -2.474 | -0.098 | -0.313 | (2.405) | (0.094) | (0.309) |
| Medium-tech manufacturing sectors | 3.189** | -0.123 | 0.380** | 2.626* | -0.119 | 0.278* |
| | -1.565 | -0.107 | -0.17 | (1.513) | (0.103) | (0.166) |
| High-tech manufacturing sectors | -0.9 | 0.073 | -0.722*** | 0.575 | 0.021 | -0.539** |
| | -3.92 | -0.088 | -0.216 | (3.782) | (0.085) | (0.212) |
| Business Services | 3.233** | -0.062 | 0.18 | 2.209* | -0.005 | 0.401 |
| | -1.327 | -0.129 | -0.254 | (1.281) | (0.125) | (0.252) |
| Corporate Managers | 3.932 | -0.055 | 0.768*** | 3.345 | -0.030 | 0.731*** |
| | -3.968 | -0.094 | -0.216 | (3.672) | (0.090) | (0.207) |
| SME Managers | -9.432** | 0.131 | -0.462** | -12.878*** | 0.129 | -0.293 |
| | -4.001 | -0.083 | -0.191 | (4.103) | (0.080) | (0.190) |
| Professionals and Scientists | 9.066*** | -0.061 | -1.187*** | 6.053** | 0.005 | -0.961*** |
| | -2.605 | -0.111 | -0.194 | (2.603) | (0.108) | (0.198) |
| Clerks | 1.466 | 0.128 | -0.057 | 1.025 | 0.107 | -0.365 |
| | -2.631 | -0.089 | -0.258 | (2.586) | (0.087) | (0.288) |
| Plant and Machine Operators | -2.906 | 0.249** | -0.520* | -5.730** | 0.287*** | -0.169 |
| | -2.752 | -0.099 | -0.27 | (2.683) | (0.095) | (0.290) |
| EU12 | 0.745*** | | | 0.409 | | |
| | -0.281 | | | (0.297) | | |
| Constant | -3.029*** | | | -2.395*** | | |
| | (0.832) | | | (0.811) | | |
| *Lambda* | 0.293*** | | | 0.253*** | | |
| | -0.086 | | | (0.051) | | |
| *Sigma* | 0.216*** | | | 0.198*** | | |
| | (0.019) | | | (0.018) | | |
| Observations | 252 | | | 249 | | |

Robust standard error in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Specification (5) is based on a squared inverse distance matrix, while specification (6) relies on a first order contiguity spatial weight matrix.

## Annex

### Table A.1. The variables: description and sources

| Variables | Description and sources |
|---|---|
| GDP growth | % change in real regional GDP (2004). Data source: Eurostat |
| Labour Cost | Average annual labour cost: salaries and wages in 2004 (excluding apprentices and trainees). Data source: Eurostat |
| Market accessibility | Weighted average of GDP of all European regions *j* other than *i*. The weights are the reciprocal of the bilateral distances between the respective capitals. Reference year: 2004. Data source: Eurostat and DGRegio |
| FDI | Number of new foreign firms per million inhabitants. Reference period: 2005-07 for the dependent variable and 2001-2003 for the independent variable. Data source: FDIRegio |
| Low-tech manufacturing sectors | Share of regional value added generated by sectors with low technological intensity on total value added generated by the region. Reference year: 2004. Source: Eurostat |
| Medium-tech manufacturing sectors | Share of regional value added generated by sectors with medium technological intensity on total value added generated by the region. Reference year: 2004. Source: Eurostat |
| High-tech manufacturing sectors | Share of regional value added generated by sectors with high technological intensity on total value added generated by the region. Reference year: 2004. Source: Eurostat |
| Business Services | Share of regional value added generated by business services sectors on total value added generated by the region. Reference year: 2004. Source: Eurostat |
| Corporate Managers | ISCO-88/12 employment share on total regional employment (three-year average, 2002-2004). Data provided by DGRegio |
| SME Managers | ISCO-88/13 employment share on total regional employment (three-year average, 2002-2004). Data provided by DGRegio |
| Professionals and Scientists | ISCO-88/2 employment share on total regional employment (three-year average, 2002-2004). Data provided by DGRegio |
| Clerks | ISCO-88/4 employment share on total regional employment (three-year average, 2002-2004). Data provided by DGRegio |
| Plant and machine operators | ISCO-88/8 employment share on total regional employment (three-year average, 2002-2004). Data provided by DGRegio |