Evidence on the determinants of foreign direct investment: the case of EU regions

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Abstract

This study analyses the determinants of Foreign Direct Investment (FDI) at regional level. While the determinants of FDI in Europe have been extensively analysed at the country level, the literature on location patterns and on the determinants of FDI at the regional level is only at its beginning. This study follows this line of empirical research by using original data on the number of foreign investments over the 2005-07 period disaggregated by regions of the EU27 and by sectors. We perform a detailed analysis of the location determinants of foreign investments using different econometric specifications in order to consider a large set of variables potentially explaining FDI location. We attempt, on the one hand, to demonstrate whether variables usually employed to explain the determinants of FDI at the country level also influence the location of FDI at the regional level, and on the other hand to identify which locational advantages are able to attract FDI into EU regions. In so doing, we control for firm, sector and spatial heterogeneity in order to capture potential differences in the patterns of location of different kinds of foreign firms.

Key words: foreign direct investment, regions

JEL classification: F20, O18, R10

1. Introduction

The current wave of globalization, which has been affecting world economy since the beginning of the past decade, has seen Multinational Enterprises (MNEs) playing a leading role in shaping and driving cross-border integration through the transfer of production facilities, functions and or

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technology across space (Baldwin and Martin, 1999; OECD, 2007). These trends have been reinforced by the liberalization of new markets, especially in the service sectors, the reduction of capital movement restraints, and the creation of a friendly environment for Foreign Direct Investment (FDI) in a growing number of countries. The EU has been a major player in these processes, since they coincided with three important milestones of the European integration process, such as the single market program, the introduction of the Euro and the Easter enlargement. Despite the cyclical character of FDI flows and their dependence on economic fundamentals, inward FDI stocks in the EU have increased exponentially since the 1980s reaching their peak in 2007 with more than 7,000 billion USD and a percentage of world stocks of about 45%.[1] Also, the EU's capacity to attract FDI – defined as FDI stocks adjusted with GDP – has increased over time and has overcome the world average since 1990 onwards, thus suggesting that the EU has been able not only to maintain but also to further improve its attractiveness for foreign investments, despite the emergence of new interesting destinations all around the world, such as China, India and Brazil.

While the determinants of these impressive flows of FDI in Europe have been extensively analysed at country level,[2] the literature on location patterns and on the determinants of FDI at regional level is only at its beginning.[3] This study follows this line of empirical research by using original data on the number of foreign investments over the 2005-07 period disaggregated by regions of the EU27 and by sectors. In particular, we perform a detailed analysis of the location determinants of foreign investments in order to demonstrate whether and to what extent variables usually employed to explain the determinant of FDI at country level also influence the location of FDI at regional level, and which locations' characteristics, if any, can be associated with the determinants of FDI in Europe. In so doing, we control for spatial dependence and spatial heterogeneity, as well as for sector and firm heterogeneity by distinguishing between different manufacturing and service sectors and by country of origin of foreign investors.

The paper is organized as follows: Section 2 presents some stylized facts on the FDI trends by sector and by region and describes our unique database. Section 3 reviews the state-of-the art of the literature available at theoretical and empirical levels, and discusses the importance of several potential determinants in attracting FDI at regional level. Section 4 describes the methodology we

[1] See UNCTAD, *World Investment Reports*, various issues for an in-depth analysis of FDI flows and stocks at European and world levels.
[2] See Barba Navaretti and Venables (2004) for a review.
[3] Data constraints largely explain why it has been so difficult to investigate the determinants of FDI at sub-national level.

adopted in the empirical analysis, while section 5 discusses the main results. Section 6 concludes with some policy implications.

2. The spatial distribution of FDI in Europe

2.1. Data source and sample

This paper exploits a database, *FDIRegio*, obtained from Amadeus database.[4] The latter consists of company accounts reported to national statistical offices concerning 11 million public and private companies in 41 European countries. Newly created firms during the 2005-07 period whose percentage of assets owned by non-residents was at least 10% have been considered as FDI in our database. Firms have been aggregated by European NUTS2 region, by sector of activity and by origin within or outside Europe. The overall sample includes around 109,000 foreign firms located in 264 NUTS2 regions and operating in 25 NACE Rev.1 two-digits manufacturing and service sectors.[5]

The peculiarity of our database offers large advantages. First and foremost, the regional distribution of foreign firms is directly observed and not indirectly derived from a "regionalization" of national data. This top-down approach, in fact, implicitly assumes that the sensitivity of FDI to employment or value added – i.e. the variables traditionally used to estimate the distribution of FDI across regions – is constant across foreign firms, regardless the internationalization strategy they pursue (efficiency, market or resource seeking oriented), the country of origin and the role foreign affiliates can play within the group (production vs. research units). Direct observation of the regional location of foreign plants, instead, avoids potential distortions in geographic distribution of FDI. Our approach presents also some limits. In particular, given that data come from firms' balance sheets, they may include either plant or firm level information. Despite that, previous studies based on the same source for FDI data have shown that possible biases deriving from corporate balance sheets do not distort significantly the results (Pusterla and Resmini, 2007; EC, 2006). Moreover, given that we consider the number of foreign affiliates located in a given region instead of the total amount FDI inflows, we are implicitly assuming

[4] Amadeus is a product by the Bureau Van Dijk. For each company Amadeus provides the year of incorporation, the country of origin and destination as well as the ownership structure by nationality. The data also include the region where the firm were founded, as well as the sector of activity. For more information on it, see www.bvdep.com.

[5] We considered as European investors also firms from Norway, Island, Lichtenstein and Switzerland because they have signed agreements with the EU which allow them to participate to the single market without being members of the EU. Malta and Cyprus are not considered because of data limitations. In the Baltic Republics there are no NUTS2 regions; therefore, the regional level coincides with the national one. The list of sectors included in the analysis is provided by Table A.1 in the Annex.

that all FDI have the same size. This hypothesis would probably be a fundamental restriction in the analyses of MNEs' impact on local economies, given that technological spillovers generated by foreign firms are likely to be higher the larger the presence of FDI in a given location, but it does not play any role in the discussion of the factors driving the geographical distribution of foreign firms across regions. According to the theory, foreign plants location decisions depend on MNEs' internationalization strategies and not on foreign firms' size (Barba Navarretti and Venables, 2004).

In order to have an idea of the degree of inclusiveness of our dataset, we compared official (UNCTAD) data on inward FDI flows at the country level with the total number of foreign firms extracted from Amadeus following the criteria described above. Figure A.1 in the Annex plots the two series. It is worth noticing that the correlation coefficient between the two measures of FDI flows is quite high. Thus, by considering the number of foreign firms instead of values of FDI we do not introduce any significant distortion in the patterns of FDI. However, it is worth noting that foreign investments in some destination countries are more relevant in value than in numbers, like in Ireland, and vice-versa, like in Romania and Poland. These results lead to an interesting conclusion: Ireland attracts few, large foreign investments, while Poland and Romania are characterized by the presence of many small foreign firms. Despite that, we will take into account these differences in our empirical analysis by augmenting the regression equation with specific country dummies in order to avoid potential distortions due to sample biases.

2.2. The distribution of FDI by region and sector

Map 1 shows the number of new foreign affiliates established in the EU during the 2005-07 period.[6] Spatial patterns are quite similar to those highlighted by previous similar studies (EC, 2006). In particular, we found that most new foreign affiliates have been established in the EU's core, i.e. the area going from the UK to the North of Italy, including regions on the border between France and Germany, Ireland, Belgium, and the Netherlands. Remarkable exceptions to these traditional patterns are Austria and the Spanish regions of Madrid, Cataluña and Basque country, which have attracted consistent inflows of FDI.

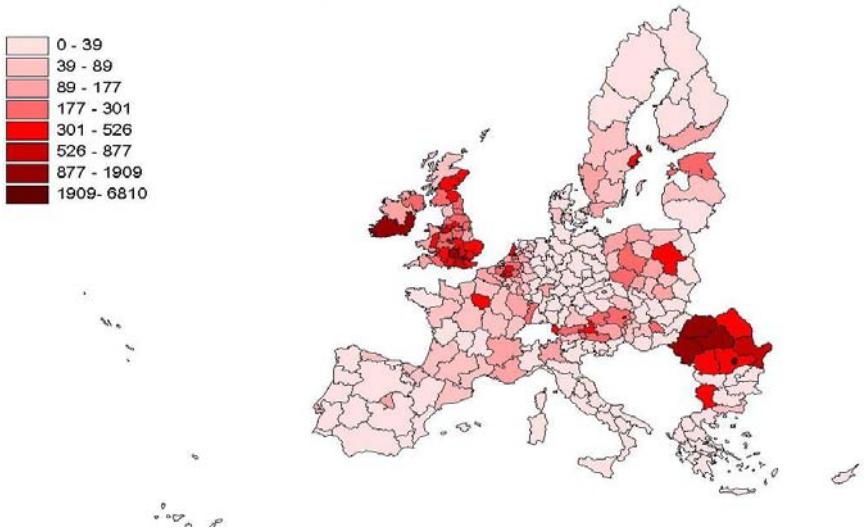
FDI in the new EU member states is largely concentrated in Romania, the Baltic Republics, and also, to some extent, in Poland. As far as other new EU member states are concerned, only the capital regions seem to be able to attract a significant number of new foreign firms. This trend is particularly apparent in the Czech and Slovak Republics, and in Bulgaria, though in all new member

[6] Since larger regions usually attract more FDI than smaller regions, the number of foreign firms has been normalized by population in order to take into account regions' size.

states the concentration of FDI is stronger in capital regions than in other regions.

Most regions, notably in the Southern countries of EU and at the Eastern external borders, have been clearly at the margin of the location patterns of MNEs in Europe. We refer here to Italy, Greece and Portugal, whose regions have attracted a very low number of foreign firms as compared to other Western European countries.

Map no. 1. FDI distribution in Europe
(number of foreign plants, normalized by population, 2005-2007)



Finally, it is worth noticing that foreign firms tend to be spatially clustered, both in Eastern and Western Europe. The two main clusters are United Kingdom and Romania and thus coincide with national borders. This result leads to the conclusion that FDI localization patterns may be influenced by both regional specificities and national factors. The presence of spatial dependence in the location patterns of foreign firms is confirmed by spatial diagnostics (Table 1). [7]

Moreover, they do not seem to be affected by sector specificities, since manufacturing and service foreign firms seem to be attracted by the same regions, as it is shown by Maps 2 and 3.[8] (see Maps 2 and 3), while the presence

[7] For a detailed discussion of spatial dependence see, among others, Anselin (2003).
[8] Note, however, that FDI in the manufacturing concentrates mainly in EU10 regions and FDI in services in EU15 regions.

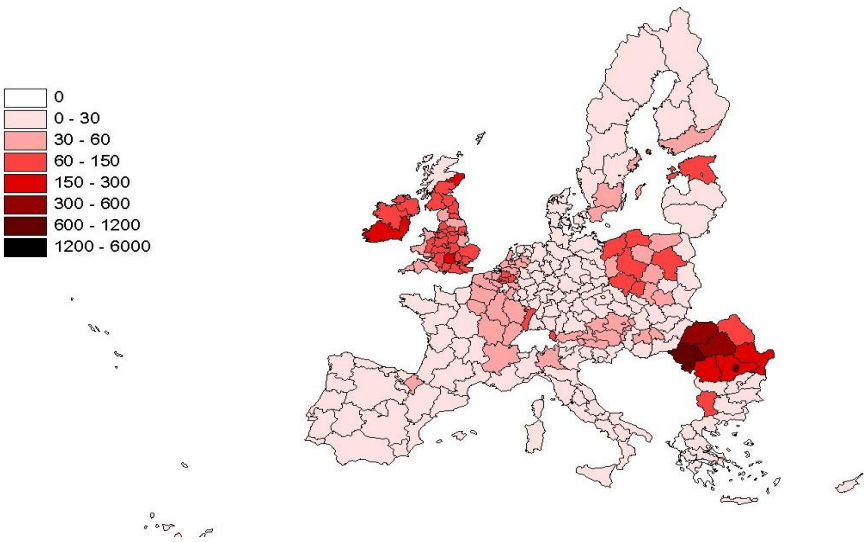
of spatial dependence in the location of foreign firms is confirmed by the Moran's I test reported in Table 1 below.

Table 1. Test for spatial autocorrelation

Variables	Moran's I	z	p-value*
Total FDI	0,048	11,021	0,000
Extra-European FDI	0,037	9,286	0,000
Intra-European FDI	0,056	11,524	0,000
Services FDI	0,043	10,114	0,000
Manufacturing FDI	0,068	14,060	0,000

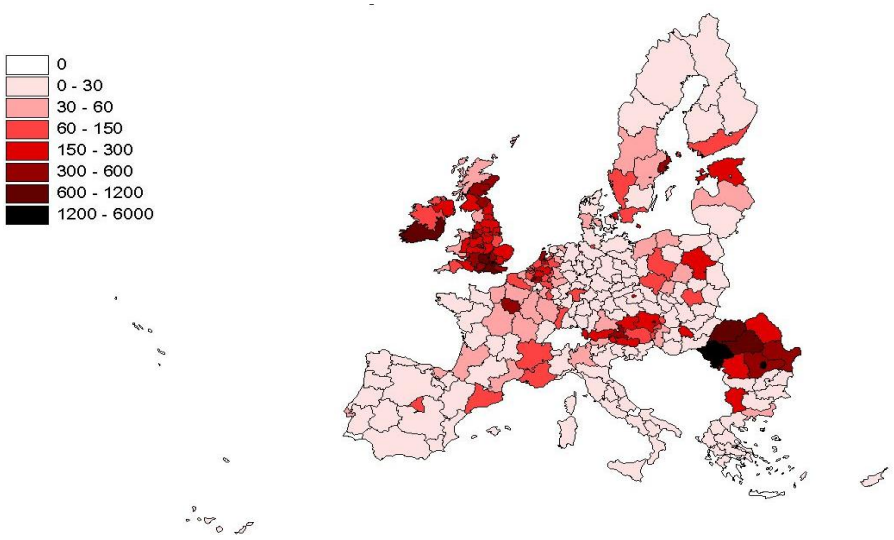
*1-tail test

Map no. 2. FDI distribution in Europe (manufacturing)
(number of foreign plants, normalized by population, 2005-2007)



Map no. 3. FDI distribution in Europe (services)

(number of foreign plants, normalized by population, 2005-2007)



3. Theoretical background

In its beginnings, the theoretical analysis of FDI determinants was mainly focused on necessary and sufficient conditions to enable FDI flows rather than on factors driving their distribution across space (Onida, 2003; Barba Navaretti and Venables, 2004). According to this stream of literature, firms become multinational in order to take advantage of three types of benefits, as indicated by the acronym of the well-known OLI paradigm, i.e. *Ownership*, *Localization* and *Internalization* advantages (Dunning, 2001). FDI, indeed, is an instrument to internalize transaction costs and take advantage of externalities generated by strategic assets , both tangible and intangible ones, that are firm specific.

It is only in more recent times that international economics focused more specifically on FDI determinants *per se*. Following the seminal work by Markusen (1995), FDI can be driven by three main reasons: the needs for larger sales markets (*market seeking* investments), for cheaper source markets (*efficiency seeking* investments) or the willingness to reach the technological frontier (*strategic asset seeking* investments). Given these considerations, FDI determinants can be grouped into two large sets encompassing, respectively, the size and the characteristics of final markets and input costs and the quality of factors of production. The former motivate horizontal FDI, while the latter lead

to vertical FDI characterized by the partial or total spatial segmentation of the production chain (Markusen, 1984; Helpman, 1984; Shatz and Venables, 2000).[9]

A specific focus on the role of agglomeration economies is offered by the New Economic Geography (NEG) literature that tries to explain the concentration of economic activity in geographical space. Fundamental contributions such as Marshall (1920), Krugman (1992), Krugman and Venables (1995) and Venables (1996) introduced the idea that, in a world of imperfect competition, increasing returns to scale and costly trade create different systems of incentives in different geographical areas for firms that endogenously choose location. In this context factor endowments and demand/cost linkages are crucial in determining spatial concentration of firms.

Following these different strains of literature, a number of origin and/or destination country-specific characteristics can been identified as FDI determinants. In this regard the literature usually considers the economic fundamentals, the institutional quality (Bénassy-Quéré et al., 2007), agglomeration forces (Braunerhjelm and Svensson, 1996), and tax and other FDI incentives and promotion policies (Mody and Wheeler, 1992). Needless to say, the relative importance of these factors may vary according to the type of the investment, as suggested by the most recent survey studies, which also highlight a diffuse inconsistency between the theoretical predictions and the results of the empirical evidence (Bloningen, 2005; Barba Navarretti and Venables, 2004).[10]

The empirical evidence is usually based on data collected at the industry or country level and, when available, at the plant level (Bloningen, 2005). Only few studies have appeared recently with a regional focus, but most of them refer to small groups of European regions, often belonging to the same country or to a small group of neighbouring countries, due to lack of data at the sub-national level. Crozet, Mayer and Mucchielli (2004) investigate the determinants of FDI location in the French departments using plant-level data. They show that market size and agglomeration forces as well as low labor costs are the most important determinants of FDI at the regional level. Interestingly, the sign and the magnitude of these effects vary across sectors. Using aggregate FDI data at county level, Boudier-Bensebaa (2005) finds that even in a small country as Hungary both cost and market variables matter in shaping the FDI distribution at

[9] This distinction has been questioned by recent developments in MNEs' internationalization strategies, especially as far as outsourcing and the integration of the production chains are concerned. As Helpmann (2006) pointed out, it is difficult to categorize FDI located in low cost countries and exploiting them as an exporting platform towards the rest of the world into horizontal or vertical. For an empirical investigation on different investment strategies of MNEs see Bloningen et al. (2007).

[10] Inconsistencies refer mainly to the effects of trade barriers, trade openness, labour costs, taxes, and agglomeration forces (Bloningen and Feenstra, 1996; Feenstra and Hanson, 1997; Bloningen, 2005), while the most robust FDI determinant seem to be market size, as suggested by Kravis and Lipsey (1982) and Wheeler and Mody (1992).

sub-national level. Pusterla and Resmini (2007) utilize firm-level data on foreign firm manufacturing plants in Bulgaria, Hungary, Poland and Romania to analyze the determinants of foreign firms' location choice. They find that demand factors are more important than cost factors, and that agglomeration effects are driven by multinational rather than indigenous firms.

More importantly, they confirm the idea that the determinants of FDI vary across manufacturing sectors and that national boundaries do not matter in the foreign firms' location choice, thus further reinforcing the importance of a regional approach to the determinants of FDI. More recently, Basile, Castellani and Zanfei (2004) have introduced the distinction of FDI flows by country of origin. They found that a number of regional characteristics exert a different impact on European and non-European foreign investors. In particular, while the former are attracted towards regions with lower per-capita income, relatively high unemployment and large market potential, the latter seem to prefer regions with higher wage and per-capita income. Agglomeration economies, instead, play an important role in attracting FDI, regardless of their origin inside or outside Europe. Finally, Basile, Castellani and Benfratello (2008) give further support to the idea that FDI determinants may differ between manufacturing and service foreign firms.

Apart from methodological differences, this lack of consensus indicates that the relevance of FDI determinants may depend on locations and that geographic specificities cannot be clearly identified and accounted for at national, sectoral or firm level. To this respect, a regional perspective may be more appropriate than the traditional a-spatial approach, which is usually implicitly assumed in the empirical words. Our work focuses on this neglected aspect.

4. The econometric model and explanatory variables

Our empirical analysis is based on an econometric model that includes as potential determinants of FDI several EU regions' characteristics. The latter have been grouped into conceptually homogeneous groups each of which has been estimated separately from the others. This gradual approach allows us, on the one hand, to select among variables potentially capturing similar effects and, thus avoid potential multicollinearity problems; on the other hand, to test the explanatory power of alternative variables and compare it with that of more traditional determinants of FDI, i.e. usually included in the empirical analysis of FDI determinants at the country level.[11]

[11] Table A.2. in the Annex describes these variables and their proxies.

The model used is a simple log-linear equation of the following form:

$$\ln(FDI_{jt}) = \beta_0 + \sum_k \beta_k * trad\_var_{kjt-1} + \sum_i \beta_i * agglom_{ijt-1} + \sum_h \beta_h * hum\_capital_{hjt-1} + \\ + \sum_d \beta_d * D_d + \varepsilon_{jt} \quad (1)$$

The dependent variable FDI_{jt} is an FDI penetration index calculated as the number of new foreign firms established in region *j* (with *j=1,…,260*) during the 2005-07 period normalized by population.

As for the explanatory variables, the first block (*trad_var*) includes the main traditional location characteristics that have been proven to exert an impact on FDI by previous similar studies (Artige and Nicolini, 2006; Pusterla and Resmini, 2007), i.e. cost advantages, market characteristics and previous inflows of FDI. Factor costs are limited to labour costs because of lack of more exhaustive data. Demand side variables, instead, include both GDP growth and market potential, given that, by definition, the market horizon of any MNE is much larger than the region in which it has established its plants.[12]

According to the theory, the magnitude of the impact these variables may exert on foreign firms depends, on the one hand, on the motive for FDI, and, on the other hand, on the type of foreign investment (manufacturing vs. services). More specifically, we expect that efficiency seeking FDI is more sensitive to labour costs, which are generally considered to be a negative host-specific location determinant, particularly in labour intensive industries.[13] Market size as well as the geographical and economic proximity of the local market to the main economic centres, instead are particularly important for foreign investors looking for new markets for their products. Locations with good market accessibility to the main core markets provide foreign firms to export to and import from the core cheaply. Hence, we expect that regions with a good geographical and economic accessibility to the European economic core are more attractive for foreign firms and therefore, are likely to receive more FDI than other regions.

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[12] Market potential has been computed as follows: $Mkt\_pot_{j,t-1} = \sum_i \frac{GDP_{i,t-1}}{T_{i,j}^2}$, where $GDP_{i,t-1}$ represents the size of the location *i* in 2004 and T_{ij} is the time distance between region *i* and *j*. Note that we consider time distances instead of physical distances. This is to take into account the accessibility to the EU core market from each region. As usual, market accessibility is considered a non linear (and inverse) function of transport costs, proxied by time distances. The traditional formula for market potential (Head and Mayer, 2004), using great circle distances, probably underestimates true distances, while time distance is a good measure of transport/communication costs.

[13] However, in case of highly skilled labour intensive activities – such as financial services – where wages are relatively higher, labour costs may not matter.

Finally, we expect that an existing concentration of foreign firms facilitates the gathering of information via business relationships or because it demonstrates the economic potential of a region. Therefore, the larger the number of foreign firms in a given location, the lower is likely to be the risk (and the cost) for a new foreign firm of locating there.[14]

The role of agglomeration economies in explaining the firms' location choice is explicitly modelled in the second block of explanatory variables (*agglom*). Following a cumulative process, MNE tend to locate in areas where other firms are already present (Markusen and Venables, 1999). Benefits from these externalities are technology and knowledge spillovers, supply of skilled labour force, high quality inputs and availability of business services (Fujita and Thisse, 2002). Given that these benefits are proportional to the size of the economic activity existing in the area, agglomeration economies are usually proxied by the industrial specialization of the region. Following this traditional literature, we consider among the second group of regressors a number of specialization indexes, both in manufacturing activities classified according to their technological content and in the service sectors. In particular, we consider business services, i.e. those service activities that can make foreign firms' activities easier. Therefore, we consider regions' specialization in financial services, transports and telecommunications, real estate and other business services. Indeed, a higher specialization in services acts as a signal of the presence of a large supply of non tradable inputs and thus of the presence of better opportunities to outsource functions and other tasks not directly involved in the production process (OECD, 2007).

The last block of regressors focuses on regional human capital endowment (*hum_cap*). Differently from previous studies, here we consider new and more disaggregated proxies for human capital competencies, which can better capture foreign firms' needs. We believe that easy access to, as well as competition among various local private services – such as professional services and command and control functions – as well as a wide range of cultural diversities – such as the presence of university and scientist professionals – may help foreign firms in overcoming several problems related to inefficient bureaucracies, poor communication infrastructures, unreliable financial institutions, and cultural issues.

[14] We used as a proxy for this variable previous FDI inflows, measured in terms of number of new foreign firms established in the region in the previous period. Since flows are more volatile than stocks, we expect that endogeneity is not a problem, as suggested by the coefficient of correlation between the two series ($r = 0.003$, $p > 0.95$).

As previously stated, we also include in our regression some country dummies to clean out potential distortions due to unobserved effects driven by the capacity of Romania and Poland to attract many small FDI[15].

Of course, all the explanatory variables have been lagged one period in order to avoid potential endogeneity problems.[16]

The estimation method used in this first part of the analysis is a simple OLS technique. Since we are working with data with a spatial structure, we then test for spatial autocorrelation.[17] Following the results of the spatial diagnostics, which highlights the presence of spatial dependence through the error term, we switch to a spatial error model in the second part of our analysis.

Note that all the spatial models used in the empirical analysis that follows are based on an inverse distance matrix. The literature has widely debated the underlying assumption of spatial models consisting in the idea that the structure of spatial dependence present in the data is known, not estimated. The specification of the weighting matrix "is a matter of considerable arbitrariness." (Anselin & Bera, 1998) The main conclusion pointed out is that imposing an a-priori spatial structure is a less strong assumption than forcing spatial independence. In our context we believe the most appropriate spatial structure capturing the underlying reality of FDI inflows patterns can be an inverse distance matrix[18]. On the one hand, indeed, we think that investors entering any region in Europe want ideally to take advantage of the access to the whole European market, thus we don't want to impose boundaries to the possible interdependence of observations. On the other hand, however, the higher the distance between two regions, the more difficult it is for an investor located in the first to have contacts with the second for a variety of reasons that we can broadly define as the costs of doing business at distance.

5. Results

5.1. The basic model

As described in the previous section we tested the relative importance of different regional characteristics through a gradual econometric analysis, not

[15] Note that for Ireland it was not possible to introduce a dummy, though it would be theoretically correct, because that country is composed by two regions only.

[16] "Previous" period cannot be exactly identified, because it depends on data availability.

[17] Spatial correlation exists when locations close to each other exhibit more similar values than those further apart (Anselin, 2003). The presence of spatial correlation either in the distribution of FDI, or in regional characteristics would bias the results because, if not controlled for, it would violate the standard assumption of any OLS analysis, i.e. the independence of the error terms.

[18] More specifically we considered a standardized matrix of inverse physical distances. As a robustness check we substituted it with a time distance matrix where travel distance is measured in terms of minutes. Results remain almost unchanged. They are available upon request to the authors.

only between different blocks but also within blocks of variables. As it is clear form table 2 below, results are in line with theoretical predictions. In column (1) results for traditional determinants of FDI are reported. Market potential and growth prospects enhance FDI inflows, as well as labour costs. Therefore, we can conclude that MNEs are more interested in high productivity and skilled labour force than in low labour costs. Also, the presence of other foreign firms has a positive impact on the ability of a region to attract FDI, being a signal of a good economic and business environment.

Table 2. The choice of explanatory variables

	(1)			(2)			(3)			(4)		
variables	**coef.**		**SE**	**coef.**		**SE**	**coef.**		**SE**	**coef.**		**SE**
GDP growth rate	0.18	***	0.026	0.18	***	0.024	0.18	***	0.022	0.04	*	0.019
Labour cost	0.24	***	0.059	0.26	***	0.058	0.18	***	0.065	0.14	***	0.041
Market potential	0.24	***	0.081	0.23	***	0.080	0.23	***	0.068	0.26	***	0.076
FDI(t-1)	0.59	***	0.048	0.58	***	0.052	0.49	***	0.049	0.35	***	0.047
LT				0.52		0.419						
				-								
MLT				0.41		0.278						
MHT				0.12		0.309						
HT				0.18		0.235						
Transport and Communication services							1.55	***	0.355			
Financial Services							1.03	***	0.268			
Real Estate							1.45	***	0.524			
Corporate Managers										25.57	***	2.251
SMEs managers										-3.81		3.681
Clerks										5.91	***	2.034
Professionals										7.87	***	2.027
Plant and Machines Operators										10.42	***	2.257
Romania	1.82	***	0.291	1.68	***	0.344	2.08	***	0.306	4.89	***	0.451
Poland	1.90	***	0.238	1.90	***	0.240	1.94	***	0.238	1.87	***	0.153
R-squared adjusted	0.62			0.63			0.70			0.82		
Observations	260			260			260			260		

*** significant at 1%; ** significant at 5%; * significant at 10%

In order to gain a comprehensive overview of MNE investment determinants, we introduce more specific agglomeration variables, as described

in the previous section. Note that traditional manufacturing specialization is not an advantage for FDI (column 2), which instead responds positively to the presence of a wide variety of supply of business services (column 3). Highly skilled human capital exerts a positive and significant effect on FDI inflows (column 4). In particular, MNEs seem to look specifically for command and control functions, professional and scientists and skilled workers (blue collars). SME's managers, instead, do not affect FDI inflows, thus suggesting that the opportunity to establish input-output linkages with local small and medium sized firms does not interest foreign investors. Overall, these results suggest that localization patterns of FDI in Europe seem to be driven by a complex set of factors acting both on the demand and on the supply side.

However, these patterns are affected by positive spatial autocorrelation, as indicated by Table 3. In other words, MNEs location choices are also strongly influenced by the spatial distribution of FDI. Consequently, the coefficients estimated with traditional OLS methods may be inefficient or inconsistent because of the presence of spatial autocorrelation in the explanatory variables, in the dependent variable or in the error term. The diagnostic tests reported in column (1) indicate the presence of spatial autocorrelation in the error terms and suggest, therefore, the need to use estimation techniques that take into account the spatial structure of data. The presence of the latter had already emerged during the analysis of the structure of our potential dependent variables, as indicated by the Moran's I coefficients reported in Table 1. However that test alone does not provide insights into suggesting which alternative specification to use. This choice must be driven by more accurate tests that we report in Table 3. Indeed, spatial diagnostics at the bottom of column (1) confirms the presence of spatial autocorrelation and suggests that the best model to control the latter is an error model. Note, indeed, that Lagrange Multipliers test statistics (both traditional and robust) reject the null hypothesis of zero lambda (i.e. error model parameter) but do not reject the hypothesis of zero rho (i.e. lag model parameter). For this reasons we switch to an estimation technique that is able to take into account the spatial structure of data. Column (2) reports the results of this analysis.

The model maintains its explanatory power. The most significant difference concerns the presence of managers of small and medium size enterprises, which now seems to discourage additional FDI flows. This result indicates that MNEs prefer to locate in regions with a low development of local economic activity in order to avoid tougher competition. Moreover, it further reinforces the idea that MNEs are not interested in establishing vertical linkages with local enterprises (Hirschman, 1958). This conclusion, though surprising, is consistent with recent developments in the theory of the internationalization strategies of MNEs, according to which foreign firms tend increasingly to build international networks of production rather than local linkages (Felker, 2003).

The positive and significant estimated coefficients for the lagged FDI term – which captures agglomeration among MNEs – further support this view.

Table 3. The complete model: the role of spatial spillovers

	OLS			Spatial error model		
variables	**coef.**		**SE**	**coef.**		**SE**
GDP growth rate	0.03		0.018	0.03	*	0.017
Labour cost	0.15	***	0.046	0.13	***	0.050
Market potential	0.26	***	0.073	0.29	***	0.065
FDI	0.35	***	0.046	0.38	***	0.038
LT	0.31		0.290	0.34		0.242
MLT	0.18		0.254	0.17		0.215
MHT	-0.15		0.201	-0.17		0.174
HT	-0.23		0.150	-0.23		0.165
Transport and communication	0.82	***	0.250	0.8	***	0.248
Financial services	0.95	***	0.202	0.87	***	0.218
Real estate	-0.48		0.522	-0.42		0.499
Corporate managers	24.93	***	2.190	24.15	***	2.404
SMEs managers	-5.03		3.493	-5.19	**	2.923
Clerks	6.18	***	2.124	5.45	***	2.361
Professionals	5.79	***	1.92	6.04	***	1.674
Plant and machines operators	10.56	***	3.101	9.49	***	2.139
Romania	4.4	***	0.433	4.39	***	0.431
Poland	1.84	***	0.165	1.85	***	0.223
Lambda				0.90	***	0.095
R-squared adjusted	0.85					
Variance ratio				0.87		
Squared corr.				0.85		
Observations	260			260		
Moran I	12.55	***				
LM (error)	27.06	***				
Robust LM (error)	28.103	***				
LM (lag)	1.16					
Robust LM (lag)	2.202					
Wald Test (lambda=0)				90.746	***	
Likelihood ratio test (lambda=0)				15.633	***	
LM test (lambda=0)				27.059	***	

*** significant at 1%; ** significant at 5%; * significant at 10%

5.2. Intra- and extra-European investments

This initial analysis enables us to identify a basic general model, which includes several regional factors that can explain the competitiveness of European regions. This model represents the starting point for a more detailed analysis that seeks to understand whether and to what extent the explanatory power of these variables vary according to different types of FDI or regions.

We start by analysing whether and to what extent the origin of foreign firms within or outside Europe may somehow change previous results, suggesting the existence of different internationalization strategies and, therefore, separate localization patterns for European and non European MNEs. The results are reported in Table 4 and suggest the need for some significant distinctions, though the internationalization strategies of non-European MNEs are difficult to interpret given the exiguous dimension of the phenomenon.

Table 4. Intra and extra European FDI

	Extra-European FDI			**Intra-European FDI**		
variables	**coef.**		**SE**	**coef.**		**SE**
GDP growth rate	0.05	***	0.016	0.03	*	0.018
Labor cost	0.08	*	0.045	0.12	**	0.051
Market potential	0.04		0.054	0.30	***	0.066
Extra-European FDI	0.25	***	0.044	-0.06		0.049
Intra-European FDI	0.11	**	0.043	0.44	***	0.047
LT	-0.31		0.226	0.41	*	0.244
MLT	0.03		0.199	0.10		0.216
MHT	0.00		0.164	-0.22		0.177
HT	0.24		0.151	-0.36	**	0.167
Transport and communication	0.09		0.231	0.85	***	0.254
Financial services	1.03	***	0.206	0.81	***	0.224
Real estate	0.22		0.480	-0.32		0.527
Corporate managers	24.70	***	2.268	23.64	***	2.581
SMEs managers	-2.16		2.709	-6.41	**	3.050
Clerks	2.36		2.118	5.68	**	2.410
Professionals	4.33	***	1.552	4.79	***	1.769
Plant and machines operators	6.44	***	2.005	9.72	***	2.171
Romania	4.45	***	0.389	4.16	***	0.441
Poland	0.70	***	0.203	1.92	***	0.228
Lambda	0.323		0.564	0.90	***	0.098
R-squared adjusted	0.88			0.85		
Variance ratio	0.89			0.83		
Squared corr.	260			260		
Observations						
	0.328			95.81	***	
Moran I	0.274			16.06	***	
LM (error)	0.140			28.20	***	

*** significant at 1%; ** significant at 5%; * significant at 10%

In particular, we found that localization patterns of non-European MNEs are not affected by spatial autocorrelation and do not respond either to changes in market potential or to changes in traditional manufacturing specialization of European regions. However, they are sensitive to the presence of financial services and human capital endowment (command and control functions) and to

the presence of other MNEs, regardless of their origin (intra- or extra-Europe). European MNEs, however, pursue patterns of agglomeration that are more local, since they follow multinational companies of European origin. Furthermore, they seem to be horizontal FDI or aiming to establish export platforms, as indicated by the positive and significant sign of the coefficients of market variables and preferences for regions specialized in transport and communications services. Finally, the localization of European MNEs seems to be discouraged by a strong specialization in technology-intensive manufacturing sectors. This simply indicates that European MNEs tend to locate away from potential competitors in order to minimize knowledge technological spillovers (Alcacer and Chung, 2007).

5.3. Spatial and sector heterogeneity

The results described above could still hide the presence of unobserved heterogeneity at the regional and/or industry level. In order to control for these hypotheses, we need to include into the analysis sector- and/or region-specific fixed effects. Given the limited size of the sample, however, we can include only a small number of such dummies. From a geographical perspective, we therefore decided to introduce a dummy to distinguish between Western and Eastern European regions, while in order to verify the existence of different behaviors at the sectoral level, we separate manufacturing FDI from service ones. The results are interesting because they allow us to draw a more accurate profile of the geography of FDI in Europe.

Table 5 below shows the results when we take into account geographical heterogeneity. Few significant differences characterize MNEs' patterns of location in Western (EU15) and Eastern (EU10) European regions. In particular, in Eastern regions FDI inflows respond positively to increases in specialization in high-tech manufacturing industries and in the endowments of low-level managerial functions (SMEs' managers), and negatively to increases in the endowment of scientific and technical professions and skilled workers.[19] Several explanations, not necessarily mutually exclusive, may help in interpreting these quite surprising results. First of all, the latter might indicate that regions of Central and Eastern Europe attract mainly FDI in manufacturing sectors, which delocalized production activities and not service functions, regardless of their value added. Secondly, we cannot exclude the existence of some multicollinearity, not detected by traditional correlation analysis, between economic and functional specialization of regions. Last but not least, the strong

[19] Coefficients in Table 5 refer to the interaction between the dummy for New Member States (NMS) and the variable of interest. For this reason they can be interpreted as the slope differential in the explanatory power of the independent variables between EU15 (dummy=0) and EU10 (dummy=1) regions.

significance of the variable FDI suggests that the presence of other multinationals could also signal the characteristics of the labour market and the quality of the labour force.[20]

Table 5. The role of geography: regional determinants of FDI attraction in EU15 and EU10 regions

	EU15 regions			EU10 regions		
variables	**coef.**		**SE**	**coef.**		**SE**
GDP growth rate	0.04	*	0.021	0.01		0.036
Labor cost	-0.15		0.154	0.19		0.185
Market potential	0.41	***	0.072	-0.30		0.197
FDI	0.35	***	0.045	-0.01		0.095
LT	0.35		0.256	-0.81		0.713
MLT	-0.03		0.224	0.61		0.605
MHT	-0.08		0.18	-0.44		0.489
HT	-0.28		0.18	1.39	***	0.475
Transport and communication	0.96	***	0.291	0.36		0.931
Financial services	0.76	***	0.226	1.2		0.738
Real estate	-0.59		0.523	0.24		1.790
Corporate managers	25.34	**	2.38	-0.84		11.602
SMEs managers	-5.97	*	3.17	18.26	*	10.900
Clerks	5.80	**	2.456	-7.13		8.090
Professionals	8.35	***	1.81	-11.27	*	6.494
Plant and machines operators	15.79	***	2.593	-20.21	***	5.699
Romania	4.15	***	1.054			
Poland	1.77	*	0.342			
Lambda	0.86	***	0.134			
variance ratio	0.88					
squared corr.	0.87					
n. of observations	260					
Wald Test (lambda=0)	41.44	***				
Likelihood ratio test (lambda=0)	9.76	***				
LM test (lambda=0)	12.758	***				

*** significant at 1%; ** significant at 5%; * significant at 10%

A more disaggregated analysis at the sectoral level provides partial support to this view. In particular, MNEs operating in the manufacturing sector show a high sensitivity to the presence of other foreign manufacturing firms and prefer regions with a high presence of transportation and communication services (see Table 6). The functional specialization of regions is an important

[20] These considerations are supported by data. Indeed, if we exclude from the regression equation all the explanatory variables that refer to industry specialization and previous FDI inflows, the presence of specialized workers become positive and significantly different from zero. Results are available upon request.

FDI driver, with the exception of SMEs' managers. Regional specialization in high-tech manufacturing sectors is another important factor for attracting both manufacturing and service FDI in Eastern regions, as indicated by Table 7. This variable, therefore, may be considered as an indirect proxy for the quality of inputs and intermediate goods produced locally, rather than as an indicator of the potential presence of strategic seeking foreign firms. As a final remark, it is interesting to notice that the patterns of agglomeration of MNEs operating in the service sector are inter-sectoral in nature, given that they also react to location patterns of MNEs operating in the manufacturing sectors.

Table 6. Sector heterogeneity: determinants of FDI in manufacturing

	Total			**EU15**			**EU10**		
variables	**coef.**		**SE**	**coef.**		**SE**	**coef.**[(*)]		**SE**
GDP growth rate	0.00		0.015	0.00		0.017	0.03		0.030
Labor cost	0.12	***	0.043	-0.10		0.132	0.13		0.158
Market potential	0.19	***	0.055	0.25	***	0.061	-0.18		0.171
Services FDI	-0.07		0.553	-0.09	*	0.055	0.12		0.168
Manufacturing FDI	0.38	**	0.071	0.39	***	0.083	-0.17		0.212
LT	0.12		0.260	0.07		0.215	-0.50		0.599
MLT	0.26		0.183	0.15		0.191	0.17		0.508
MHT	-0.11		0.149	-0.05		0.154	-0.34		0.412
HT	-0.04		0.141	-0.12		0.152	1.10	***	0.402
Transport and communication	0.81	***	0.217	0.90	***	0.249	-0.52		0.789
Financial services	0.44	**	0.189	0.28		0.188	1.11		0.690
Real estate	-0.22		0.436	-0.67		0.447	0.77		1.513
Corporate managers	19.86	***	2.110	20.99	***	2.109	-1.37		10.042
SMEs managers	-5.43	**	2.484	-8.34	***	2.706	24.95		1.281
Clerks	5.66	***	2.020	6.70	***	2.074	-11.95	*	6.851
Professionals	2.61	*	1.438	4.11	***	1.558	-7.88		5.530
Plant and machines operators	8.81	***	1.916	12.45	***	2.362	-11.15	**	4.887
Romania	3.97	***	0.371	3.69	***	0.886			
Poland	2.00	***	0.193	1.94	***	0.304			
Lambda	0.90	***	0.099	0.85	***	0.150			
variance ratio	0.83			0.85					
squared corr.	0.83			0.86					
n. of observations	260			260					
Wald Test (lambda=0)	87.62	***		31.872	***				
Likelihood ratio test (lambda=0)	14.27	***		7.944	***				
LM test (lambda=0)	21.53	***		8.856	***				

*** significant at 1%; ** significant at 5%; * significant at 10%

Table 7. Sector heterogeneity: determinants of FDI in services

	Total			EU15			EU10		
variables	**coef.**		**SE**	**coef.**		**SE**	**coef.**		**SE**
GDP growth rate	0.05	***	0.019	0.06	***	0.023	0.00		0.039
Labor cost	0.12	**	0.055	-0.12		0.171	0.17		0.205
Market potential	0.32	***	0.070	0.43	***	0.079	-0.28		0.221
Services FDI	0.28	***	0.071	0.29	***	0.072	0.06		0.217
Manufacturing FDI	0.19	**	0.091	0.16		0.102	-0.08		0.262
LT	0.32		0.026	0.40		0.278	-0.89		0.777
MLT	-0.06		0.023	-0.23		0.247	0.83		0.659
MHT	-0.12		0.190	-0.03		0.2	-0.48		0.534
HT	-0.33	*	0.179	-0.45	**	0.197	1.59	***	0.521
Transport and communication	0.78	***	0.277	0.91	***	0.323	0.90		1.024
Financial services	1.11	***	0.242	0.96	***	0.244	1.23		0.895
Real estate	-0.37		0.552	-0.34		0.579	-1.16		1.962
Corporate managers	23.49	***	2.675	24.42	***	2.724	4.86		13.028
SMEs managers	-4.63		3.167	-5.22		3.511	13.62		11.806
Clerks	4.89	*	2.562	4.90	*	2.682	-2.01		8.886
Professionals	6.03	***	1.832	8.07	***	2.023	-10.39		7.173
Plant and machines operators	7.63	***	2.445	13.66	***	3.066	-21.35	***	6.339
Romania	4.29	***	0.472	4.42	***	1.15			
Poland	1.57	***	0.246	1.62	***	0.395			
Lambda	0.90	***	0.104	0.85	***	0.143			
variance ratio	0.87			0.879					
squared corr.	0.85			0.871					
n. of observations	260			260					
Wald Test (lambda=0)	74.47	***		35.746	***				
Likelihood ratio test (lambda=0)	14.25	***		9.031	***				
LM test (lambda=0)	23.96	***		11.468	***				

*** significant at 1%; ** significant at 5%; * significant at 10%

6. Conclusions

In this paper we have analyzed factors driving the location choices of MNEs in the EU. Our analysis has been carried out on a database containing information about over 100,000 FDI located in 260 regions (NUTS2) in 25 European countries during the 2005-2007 period. Given the richness of the dataset, the study could distinguish, on the one hand, between manufacturing and services FDI, and on the other hand between intra- and extra-EU FDI.

We obtained interesting results that allows us to better understand patterns of FDI across EU regions. First of all, we found that traditional determinants of foreign investments are still important drivers for FDI location patterns. We refer here to market potential and GDP growth rate, and labour costs. Their estimated coefficients were significant in all specifications, thus indicating that foreign firms prefer to locate in dynamic regions, in terms of both GDP and

labor productivity, and with a large market potential. Secondly, we found that FDI flows are more sensitive to the functional rather than the economic specialization of regions, with the exception of financial services and transportation and communication services. This suggests a change in the localization strategies of MNEs in Europe, which must be taken into account when implementing specific policies to attract FDI. Finally, our analysis has shown clearly that MNEs' patterns of localization follow self-sustaining cumulative dynamic processes in both time and space.

A more disaggregated analysis at the firm, geographical and sectoral levels has shown the presence of peculiarities in the patterns of location of MNEs across European regions. Two criteria have been used to identify different types of FDI: the origin of MNEs within or outside Europe, and the sector of activity (manufacturing vs. services). Moreover, we test whether regional potential attractiveness differs between Western and Eastern European regions. Our results are interesting and, once again, demonstrate the need for more targeted policies to promote FDI. In particular, patterns of location of non-European MNEs are affected by temporal autocorrelation, but not by space dependence, while European MNEs seem to follow local patterns of FDI, though sensitive to both forms of autocorrelation. As for specific determinants, we found that European MNEs are more sensitive to local competition, and therefore prefer to locate in regions not specialized in high-tech manufacturing sectors, though well endowed with financial, and transportation and communication services. Finally we have demonstrated that large and diversified human capital endowments remain a major driving factor for both types of MNEs.

The distinction between manufacturing and service foreign firms shows that the former follow intra-industry patterns of agglomeration, while the latter respond to an inter-sectoral logic. This phenomenon, however, is limited to Western European regions. In Eastern Europe, in fact, patterns of location of MNEs are always sensitive to intra-sectoral spillovers. These results indicate that, MNEs operating in the service sectors have delocalized abroad to follow their clients and that this strategy has been made feasible by the recent liberalization processes that have characterized several service sectors. Finally, it is interesting to note that in EU10 FDI prefer to locate in regions specialized in high-tech sectors, but poorly endowed with scientists and / or highly specialized in scientific and business professionals. This result suggests that Eastern European regions may discourage outsourcing of activities not strictly related to the production and the assembly of products.

The analysis of the determinants of FDI can be useful to policy makers, too. In particular, it can help, on the one hand, in predicting the strategies of these new economic agents whose entry into the local market may increase competition pressures; on the other, it allows to better identify the growth

prospects and the development opportunities created by the entry of MNEs in the local economy. In this respect, our results yield to a twofold conclusion: first of all, FDI attraction policies, in order to be effective, should take into consideration the different forms of heterogeneity that characterize multinational firms; secondly, they have to focus on the need to qualify local economies with specific contributions able to maximize high-value, innovative and managerial capacities. We refer here to interventions that can increase human capital endowments and its functional specialization, which must be increasingly geared towards high-level managerial and/or highly specialized technical occupations. An increased availability of services able to support the activities of MNEs, with particular reference to financial intermediation and transport and communication could be the relevant lever not only to attract new FDI, but also to improve the perception of the economic climate of the region, generating through the existence of agglomeration forces, consistent multiplier effects of FDI inflows.

As a conclusive remark, it is important to note that even though targeted FDI promotion policies were at work, it is by no means obvious that the region can take advantage of the potential benefits associated with the presence of MNEs. The latter being the ultimate goal of policy intervention, one must consider it as a part of a more complex problem that requires policies to attract FDI to be consistent with the developmental needs of regions, and with the objectives of regional convergence at both national and European level.

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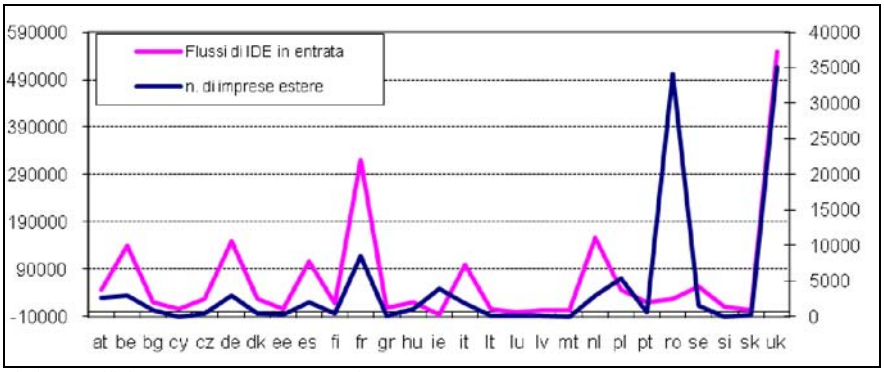
Appendix

Figure A1. Comparison with official data



Correlation coefficient (Pearson): 0.626; p-value>0.000
FDI inflows: figures in millions of USD (left-hand side); number of foreign firms (right hand side).

Table A1. Classes of FDI by sector

sector	Economic activity
AB	agriculture, hunting and forestry + fishing
C	mining and quarrying
DA	manufacture of food products, beverages and tobacco
DBDC	manufacture of textiles, clothing and leather
DD	manufacture of wood and wooden furniture
DE	manufacture of paper, publishing, printing
DFDG	chemical industry
DH	manufacture of rubber and plastic
DI	manufacture of non metal products
DJ	manufacture of metal and metal based products
DK	manufacture of machinery and equipment
DL	manufacture of electrical and electronics, precision instruments
DM	manufacture of automobile and other transport equipment
DN	other manufacturing
E	electricity, gas and water supply
F	Construction
G	wholesale and retail trade
H	hotels and restaurants
I	transport, storage and communication
J	financial intermediation
K	real estate, renting and business activities
L	public administration and defence, compulsory social security
M	education
N	health and social work
OP	Other personal services

Low-Tech (LT): manufacture of food products, beverages and tobacco; textiles, clothing and leather; wood and wooden furniture; paper, publishing, printing; other manufacturing.
Medium-Low Tech (MLT): rubber and plastic; other non metal products; metals and metal based products.
Medium-High Tech (MHT): chemicals; machinery and equipment; automobile and other transport equipment.
High Tech (HT): electrical and electronics, precision instruments.

Table A2. Explanatory variables description

VARIABLES	DESCRIPTION
GDP growth	% change 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 time distances between the respective capitals. Reference year: 2004. Data source: Eurostat and DGRegio
FDI /Lag_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: Eurostat and Amadeus
Low Tech	Specialization Index. 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	Specialization Index. 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	Specialization Index. 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	Specialization Index. 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's 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 (White Collars)	ISCO-88/ 4 employment share on total regional employment (three-year average, 2002-2004). Data provided by DGRegio
Skilled Workers (Blue Collars)	ISCO-88/ 8 employment share on total regional employment (three-year average, 2002-2004). Data provided by DGRegio