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Location choices of multinational firms in Europe: The role of EU cohesion policy

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Abstract

Using data on 5509 foreign subsidiaries established in 50 regions of 8 EU countries over the period 1991–1999, we estimate a mixed logit model of the location choice of multinational firms in Europe. In particular, we focus on the role of EU Cohesion Policy in attracting foreign investors from both within and outside Europe. We find that, after controlling for the role of agglomeration economies as well as a number of other regional and country characteristics and allowing for a very flexible correlation pattern among choices, Structural and Cohesion funds allocated by the EU to laggard regions have indeed contributed to attracting multinationals. These policies as well as other determinants play a different role in the case of European investors as opposed to non-European ones.

Keywords: Europe; Foreign Direct Investments; Location choice; Mixed logit models

JEL classification: F23; O52; R30

1. Introduction

According to a rather established literature, in the presence of increasing returns and local externalities, economic integration leads to the spatial concentration of productive activities (Fujita et al., 1999). In the European Union, this uneven spatial impact of economic integration has provided an important motivation for a set of policy measures, known as the EU Cohesion Policy, aimed to counteract social and economic disparities. In particular, Structural Funds (SF) and the Cohesion Fund (CF) have been allocated to help transform and modernise the structure of relatively poorer regions, and to prepare them for competition within the EU Single Market (European Commission, 1996). As documented by Midelfart-Knarvik and Overman (2002), using sectoral data on regional value added, SF have indeed influenced the location of industry in Europe. In the light of dramatic growth of multinational activity in the EU, which became the largest recipient of Foreign Direct Investments (FDIs) over the nineties, it is timely to investigate whether

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the Cohesion Policy has affected the geographic distribution of FDIs within the EU. Accordingly, this paper quantifies the effects of SF and CF on multinational firms' location choice among European regions.

This paper improves on the existing empirical literature concerning the location choice of multinational firms (MNFs) in at least three ways. First, we address the aforesaid set of issues by exploiting a very large firm-level dataset which enables us both to consider a wide range of recipient countries and to place no limitation on investors' country of origin. Specifically, we use data on the location choice of 5509 affiliates of MNFs between 1991 and 1999 and over a set of 50 NUTS-1 regions in 8 EU countries (France, Germany, Ireland, Italy, Spain, Portugal, Sweden and United Kingdom).[1] Other works have studied location determinants in general and the role of Cohesion Policy in particular, but they have either used very aggregate data at the national level; or have focused on individual recipient countries; or have considered only one country of origin of investors.

Second, we investigate whether the nationality of the parent firm determines a different sensitiveness to location characteristics. In particular, we compare the impact of Cohesion Policy and other location determinants of MNFs from European and non-European countries, investing in the EU.

Third, we provide a methodological contribution by estimating a mixed logit model on MNFs' location choice. This allows us to capture less restrictive substitution patterns between choices than the standard conditional and nested logit models that have been used in this context so far.

Our most fundamental finding is that SF and CF have played a significant role in the attractiveness of peripheral regions, thus contributing to shape FDI patterns in Europe. We also show that agglomeration economies are a major determinant of MNFs' location decisions for all investors. Finally, we demonstrate that European investors have responded differently than non-European investors to market-related variables, to the characteristics of the labor market and to the level of corporate taxation. This result is consistent with the idea that the two groups of investors may have different motivations for setting up foreign plants in the EU.

The paper is organized as follows. Section 2 illustrates the empirical strategy and how this differs from previous works. Section 3 presents the data and variables included in the econometric model. Section 4 illustrates the empirical findings. Section 5 concludes.

2. Empirical strategy

2.1. Modeling location decisions

Following convention (see, for example, Devereux and Griffith 1998 and Head and Mayer 2004), we assume that a firm first chooses whether to serve a foreign market (which, in the context of our empirical analysis, would be the EU market) and then decides whether to do so with exports, licensing, collaborative ventures, FDIs or some combinations. Finally, if it decides to undertake an FDI, the firm chooses where to set up its activity. Herein, we focus on this last step of the decision-making process. Therefore, our analysis is conditional on MNFs having decided to set up production in Europe, assuming that the (simplified) behavioral framework we have illustrated is appropriate. In Section 2.3 we will discuss some caveats in the interpretation of results, whenever this hypothesis would not hold true.

It is worth mentioning that earlier studies have also been limited to particular aspects of investing firms' behavior. Devereux and Griffith (1998) have accounted for the export/FDI decision and, in case of FDI, for the location of US firms in the EU, but they have been constrained by data availability to consider rather aggregated choice sets (countries). On the contrary, most studies addressing the determinants of location choices of foreign firms at a rather disaggregated level have been constrained to focus on location choices within individual countries without taking into account the determinants of the export/FDI decision (Basile, 2004; Crozet et al., 2004; Barrios et al., 2006; Guimaraes et al., 2000; Devereux et al., 2007). Some recent works have analyzed location choices at a Pan-European level using regional data, but they have usually focused on investors from one specific country, such as France (Disdier and Mayer, 2004) or Japan (Head and Mayer, 2004). Similar comments apply to the literature on FDI and SF. Studies based on cross-country data have been constrained to observe correlations between FDI and SF at a very aggregate level. For instance Breuss et al. (2003) have analyzed OECD investments in the EU15 and CEECs over the period 1986–1997, and Hubert and Pain (2002) have examined German FDIs in the EU over the nineties. The former found that SF encouraged FDIs, while the latter found the

[1] NUTS is an acronym for Nomenclature of Units for Territorial Statistics which indicates a hierarchical classification of administrative areas used by the official European statistical office (Eurostat). NUTS levels (1–3) indicate different degrees of aggregation. See the Appendix for more details.

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opposite to be true. Other studies have used more detailed data, but have been compelled to limit their analysis to a single recipient country. For instance, Crozet et al. (2004) have used firm-level data on FDI in 90 French regions and found very little effect of structural policies on foreign investment location decisions.

The present work takes the perspective of the location of MNFs within Europe without any constraint on the investing firms' country of origin. Therefore, while it does not take alternative entry modes into account, it provides a rather good representation of firms' location decisions within Europe and an appropriate framework to test for the role of the Cohesion Policy in this choice.

2.2. Econometric method: mixed logit models

Our empirical model of MNFs' location choice takes the same form as random utility models. Assume that a firm chooses location j if it yields the highest profit among the set of alternatives (i.e. $\pi_{ij}>\pi_{il}\ \forall l\neq j$ and $l=1,\ldots,L$). Further, decompose the profit firm i realizes from location site (region) j (π_{ij}) into a deterministic part (V_{ij}), that depends linearly on observable attributes of the region and of the firm (X), and a stochastic part ε_{ij}:

$$\pi_{ij} = V_{ij} + \varepsilon_{ij} = \beta' X_{ij} + \varepsilon_{ij} \tag{1}$$

Profit maximization then implies that firm i chooses location j if $V_{ij}-V_{il}>\varepsilon_{il}-\varepsilon_{ij}$.

Following Berry (1994) and Train (2003) we write the error term as:

$$\varepsilon_{ij} = v_{ij} + u_{ij} = \mu_i' Y_{ij} + u_{ij} \tag{2}$$

where Y_{ij} is a vector of variables observed for the firm i and the region j, μ_i is a vector of randomly distributed parameters with density $g(\cdot)$over all firms, while μ_{ij} is an iid error term (with type I extreme value distribution). Without any loss of generality, we assume that the μ_i vector has a mean equal to zero, so that we can interpret the term $\mu_i' Y_{ij}$ as an error component which induces heteroskedasticity and correlation over alternatives in the unobserved portion of utility. In fact, the error covariance between any two choices j and l is: $\mathrm{Cov}(\varepsilon_{ij},\varepsilon_{il})=E(\mu_i' Y_{ij}+u_{ij})E(\mu_i' Y_{il}+u_{il})=Y'WY$, where W is the covariance of μ_i. Therefore, substitution patterns between alternatives result both from correlation between Ys and from the covariance matrix of μ_i.

This error component specification is very general and various substitution patterns can be obtained by an appropriate choice of variables (Y) to enter as error components. For example, the standard McFadden's (1974) Conditional Logit (CL) model corresponds to a specification where the vector of variables with random parameters (Y) is identically zero, so that no correlation exists between alternatives. An analogue to the nested logit model (NL) can be obtained by defining Y as a set of dummy variables (d_{jk}) which take value 1 for each alternative j in a nest k and zero elsewhere.

Substituting Eq. (2) into Eq. (1), we express firm i payoff from locating in region j as:

$$\pi_{ij} = \beta' X_{ij} + \mu_i' Y_{ij} + u_{ij} = \beta' X_{ij} + \left(\sum\nolimits_{k=1}^{K} \mu_{ik} d_{jk} + \mu{*}_i' X_{ij}\right) + u_{ij} \tag{3}$$

Here we have broken the error component term ($\mu_i' Y_{ij}$) into two parts. The first part includes K country dummies (d_{jk}) whose coefficients (μ_{ik}) have a normal distribution with mean zero and variance σ_k. The random quantity μ_{ik} will then enter the profit obtained by each alternative in nest k, inducing correlation among these alternatives, so that the variance σ_k would capture the magnitude of correlation between two alternatives in nest k, playing a role analogous to the inclusive value parameter in NL models. In the second part of the error component we introduce the full set of variables which are also used to model location decision (X). The elements of vector $\mu{*}_i'$ are normally distributed random parameters with a mean equal to zero and variance Ω. Note that this specification not only allows for intra-country similarity, mimicking a country-based nested logit structure, but also adds extra sources of correlation across choices, allowing more complex substitution patterns.[2]

[2] A behavioral implication of conditional logit models is that all pairs of alternatives are equally dissimilar (Hensher et al., 2005). Nested logit models maintain this property across nests but not within them. Thus, to use a nested logit model in the present context, we would have to search for a nesting structure that satisfies this property. Both inferential and Bayesian approaches have been developed to identify the nesting structure which would be most supported by the data (Hensher et al., 2005; Poirier, 1996). However, as the number of alternatives rises, the number of possible nests (that is the number of possible non-overlapping combinations of alternatives) increases dramatically, making the search rather cumbersome. Further, even if one were able to find the most appropriate structure of nesting, this would still accommodate rather simple patterns of correlation among alternatives. For example, it would not allow one alternative to belong to more than one nest.

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If the researcher observed μ_i, then the choice probability would be standard logit, since the u_{ij}'s are iid extreme value. That is, the probability that firm i locates in region j *conditional* on μ_i is $L_{ij}(\mu_i)=\exp(\beta' X_{ij}+\mu_i' Y_{ij})/\sum_{l=1}^{L}\exp(\beta' X_{il}+\mu'_i Y_{il})$. However, the researcher does not know μ_i. Therefore, the unconditional choice probability is obtained by integrating $L_{ij}(\mu_i)$ over all possible variables of μ_i along its distribution $g(\cdot)$:

$$P_{ij}^{\mathrm{MXL}} = \int \frac{\exp\left(\beta' X_{ij} + \mu_i' Y_{ij}\right)}{\sum_{l=1}^{L} \exp\left(\beta' X_{il} + \mu_i' Y_i\right)} g(\mu_i) d\mu_i \tag{4}$$

This is called the mixed logit (MXL) probability since it is obtained as a mixture of logit with $g(\cdot)$as the mixing distribution. These choice probabilities cannot be calculated exactly because the mixture of the extreme value and $g(\cdot)$ distributions usually is not known, thus the integral in Eq. (4) does not have a closed form solution. Therefore, they are simulated by drawing values of μ_i from its distribution and included in the likelihood function to obtain the simulated likelihood.

The greater flexibility of MXL has been known to researchers for some time, but the computational burden of simulation techniques has discouraged scholars from applying it to empirical applications on large datasets. With improvements in computer speed, these techniques are becoming increasingly popular in many fields of applied economics such as, for example, the choice of alternative modes of transport, recreational sites and differentiated products (Train, 2003, p. 138). To the best of our knowledge this is the first study that applies MXL to location decisions of MNFs.

2.3. Caveats in the interpretation of results

As mentioned above, we estimate the determinants of foreign firms' location choice, conditioned on having chosen to invest, rather than having opted for other market entry modes, or not serving the market at all. It is worth mentioning some of the implications of different assumptions about the entry-mode strategy for the interpretation of estimated coefficients and probabilities. Let us begin by assuming, in line with previous studies (for example, Devereux and Griffith 1998), that the firms' internationalization process can be described as we have already outlined it in Section 2.1: firms decide whether to serve the EU market and, if so, they decide whether to export and/or carry out local production (FDI). In the FDI case, firms then choose the location for their plants. Under this assumption, the choice model takes a nested structure, where the odds ratio between any two location choices (in the FDI nest) turns out to be independent from a change in the probability of other choices made at the upper level (export vs. FDI), since the error terms are not correlated across nests. An increase in the profitability of internationalization modes different from FDI (say exporting) would simply scale down, proportionally, the probability of each FDI choice, but it would not affect the odd ratios between locations. Thus, neglecting the first decision step does not affect the interpretation of the coefficients associated with the location determinants.

If some unobserved factors influence not only the location choice, but also the probability of exporting, the assumption we have just made would not hold, correlation between alternatives in the FDI nest and in the export nest would occur and bias the predicted probabilities in an unknown way. In fact, under those circumstances, a change in the profitability of the export alternative would affect the probability of locating in some regions more than in others. Given the high dimensionality of the problem (caused by the large number of alternatives in the model) and the lack of any data on non-FDI alternatives, it is not possible to assess the direction of such a bias in the context of this paper. However, as the following example illustrates, the use of mixed logit models should lessen this problem. One rather recurrent type of investment in the EU is the so-called export-platform FDI, which occurs when firms set up production in one region and from there they export to the larger market accessible from that location.[3] An unobserved shock, making, for example, export more profitable (say a drop in tariff barriers or in transport costs) would affect the probability of locating production in regions which can be used as an export-platform, relatively more than the probability of locating in other regions. As noted in Section 2.2, a MXL specification allows us to model the error component in a very rich and flexible way. For example, in our case we can include in the error terms variables, such as host region's market potential and its distance from the investor's headquarters,[4] which may affect both exporting and export-platform FDI. This allows us to control for correlation in profits among regions which would be more affected by the unobserved shock described above. In general

[3] This appeared to be a strategy followed by US firms investing in Ireland and some regions of the UK and by French and German MNFs investing in Spain and Portugal in the aftermath of the creation of the EU Single Market (Neary, 2002; Rhys, 2004).

[4] See Section 3 for a comprehensive discussion of the variables used in estimation.

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terms, we believe that using MXL, and introducing in the error component a large set of variables which may affect both location in a particular region and other modes of internationalization, reduces the extent of potential biases arising from the sample selection we have just illustrated. In fact, this specification will allow us to control for patterns of correlation in error terms in a flexible and non-predetermined way.

A different source of bias arises from not including all possible locations in the choice set of MNFs. In particular, we do not consider Central and Eastern European Countries (CEECs) as alternative locations. This determines a lower range of variability in some location determinants, such as tax rates, labor costs, unemployment rates, agglomeration economies and infrastructures, which are substantially lower/worse in those countries. This limited variability may reduce the generalization of our results. However, it is worth mentioning that FDI to CEECs were relatively low in the early and mid nineties and received a boost from the late nineties onwards. Thus, it is not unreasonable to assume that they were not in the choice set of MNFs investing in Europe in the period considered in this paper (1991–1999).

3. Data and variables

The analysis makes use of the Elios dataset (European Linkages and Ownership Structure), assembled at the University of Urbino and based on Dun & Bradstreet's Who Owns Whom, which provides information on the location choice of 5509 affiliates of MNFs between 1991 and 1999 over a set of 50 NUTS-1 regions in 8 EU countries (France, Germany, Ireland, Italy, Spain, Portugal, Sweden and United Kingdom). Parent companies are of different nationalities: the single largest home country is the US (25%), but the majority of investors are from EU countries (60%). Thus, each firm faces 50 possible choices and the dependent variable is equal to 1 if firm i is set in region j and zero for all regions different from j.[5] Independent variables have been selected according to the existing literature on location choices of MNFs. In particular, we control for market size and distance, agglomeration economies, characteristics of the local input market, national fiscal policy and EU Cohesion Policy. Below is a brief illustration of the variables used (further summarized in Table 1) and the main theoretical justifications for their use as location determinants.

Market size, measured by the regional GDP, should make MNFs' location relatively more profitable, as larger sales would allow investors to recover the fixed set-up cost of foreign production. Following Head and Mayer (2004) and the theory of export-platform FDI (Neary, 2002), we also include *market potential* for region i, measured by the distance-weighted market size of all regions different from i. Per-capita GDP is also introduced to capture the purchasing power in the region. The *distance* of each region's main city from the investor headquarters, is included as a proxy for trade costs. On the one hand, a higher distance should increase the probability of market-seeking FDI, as opposed to export and, thus, increase the likelihood of location in a given region. On the other hand, firms engaging in vertical FDI would seek closer locations, due to the large flow of trade in intermediate goods associated with the vertical fragmentation of production.

Agglomeration economies have been found to be a key determinant of location in virtually every recent empirical work, suggesting that industrial firms tend to locate where other firms of the same industry are present. The reasons for this result are well known: agglomeration determines technological and pecuniary externalities, such as access to a more stable labor market, availability of intermediate goods, production services, skilled manpower and knowledge spillover between adjacent firms (see Devereux et al., 2007 for a recent discussion of the role of agglomeration economies in attracting FDI decisions). In the case of foreign-owned firms, agglomeration economies derive not only from the generic number of local incumbents, but also from the number of other foreign firms operating in the same geographical area. As suggested by Head et al. (1999), foreign investors may have less initial knowledge about regional characteristics than their domestic counterparts and interpret the presence of other foreign firms in a given region as a signal of profitability of a given location. We capture these effects by introducing the log of the number of (domestic and foreign) firms in the same region and in the same sector where firm i operates. We also control for the fact that agglomeration economies may reach limit values and that agglomeration diseconomies eventually emerge,[6] by introducing spatial lags[7] for these variables. A measure of firm-specific agglomeration, obtained as the number of affiliates of the same multinational group in each region, which we call

[5] Since the unit of our analysis is the foreign affiliate and not its headquarter, each individual affiliate enters the sample only once and, thus, our dataset constitutes a cross-section, even though the period of the analysis covers a decade.

[6] Firms operating in markets with relatively large numbers of firms face stronger competition in product and labor markets. This acts as a centrifugal force and favours the location of activities away from, but still in the neighborhood of, highly agglomerated areas.

[7] Spatial lags are defined as the distance-weighted sum of the values of agglomeration variables in all other regions and are expected to capture spatial correlation and any congestion effect, which will discourage location in highly agglomerated regions and favour establishment in regions nearby.

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t1.1 Table 1
t1.2 Variable List and Description

	Variables	Description	Source	Type
t1.3	Variables	Description	Source	Type
t1.4	Market size	Log of value added in region *j*	Eurostat	Region
t1.5	Market potential	Log of the sum of value added in all regions $r \neq j$ weighted by the inverse Euclidean distance between the major cities in *r* and *j*	Eurostat	Region
t1.6	Per-capita GDP	Log of (regional GDP/population)	Eurostat	Region
t1.7	Overall agglomeration	Log of the number of establishments in region *j* (and sector *s*). Also spatial lags are considered	Elios	Region-sector
t1.8	Foreign-firms agglomeration	Log of the cumulative number of foreign-owned firms within region *j* (and sector *s*). Also spatial lags are considered	Elios	Region-sector
t1.9	MNF Experience	Log of the number of firms in region *j* controlled by the same parent of firm *i*	Elios	Firm-region
t1.10	Wages	Log of (wages/total employment)	Eurostat	Region
t1.11	Population density	Log (regional population/total area in km^2 of the region)	Eurostat	Region
t1.12	R&D intensity	Log (regional R&D expenditures at 1995/regional value added)	Eurostat	Region
t1.13	Secondary school enrolment ratio	Log (students enrolled in sec. school at 1995/total pop. aged 10–19)	Eurostat	Region
t1.14	Unemployment rate	Log of unemployment rate	Eurostat	Region
t1.15	Tax wedge on employment	Log of (sum of social contributions, income taxes and consumption duties over total employment)	Martinez-Mongay, C. (2000)	Country
t1.16	Structural Funds	Log of European Structural Funds expenditure allocated to the region over the period 1989–1993	European Commission	Region
t1.17	Objective 1 region	1 if the region is within Obj.1, 0 otherwise		Region
t1.18	Cohesion country	1 if the country of region *j* is eligible for the Cohesion Fund, 0 otherwise		Country
t1.19	Public infrastructure	Index of infrastructure stock in region j at 1985	Confindustria	Region
t1.20	Corporate tax rate	Log of national effective average corporate tax rate	Institute for Fiscal Studies	Country
t1.21	Distance from home country	Log of the geodesic distance between the main city in the host region and in the home country of the MNF	ArcView	Firm-Region

MNF experience, is introduced to capture agglomeration economies generated among firms belonging to the same business entity. The idea is that, to the extent that firms gain experience and get acquainted with a given context, uncertainty is likely to decrease and MNFs will perceive lower risks from further investments (Castellani and Zanfei, 2004). As a result, MNFs' experience will determine persistence in firms' location choices.[8]

A number of *characteristics of the local input market* are also controlled for. As for the labor market, we use a measure of the average regional wage, the secondary school enrolment ratio and the unemployment rate. The expected impact of schooling on location choices is positive, since, *ceteris paribus*, a better educated workforce should increase the productivity, and thus the profitability, of activities in a given region. By contrast the impact of wages and unemployment is not univocal. In fact, lower wages may attract firms seeking for lower labor costs, but high wages may signal highly skilled workers which may in turn attract location of higher value added activities. As for unemployment, firms may interpret it both as a measure of a large supply of labor, which would attract firms, and as an indicator of a relatively rigid labor market, which would discourage them. Population density is used to proxy for the cost of land, which should make regions less attractive. However, this measure may also pick up the effect of the agglomeration of consumers, which would instead increase attractiveness. A measure of the regional stock of infrastructure is also introduced to capture the cost of setting up a plant and of accessing the market from a given location. Finally, the share of R&D expenditures in regional GDP is introduced to account for the technological knowledge produced in the region. Regions with better infrastructures and higher R&D intensities should be more attractive to foreign investors.

National fiscal policy, measured by the national effective average corporate tax rate (as developed by Devereux et al., 2002) and the tax wedge on labor, should reduce profits and thus discourage MNFs location. However, empirical evidence is mixed, as fiscal policy may be ineffective in the presence of agglomeration economies and firms may be willing to pay higher taxes in exchange for more public goods (Benassy-Quèrè et al., 2000).

[8] All agglomeration variables refer to the beginning of the period (1991), in order to mitigate possible endogeneity problems.

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With regards to *EU Cohesion Policy*, it is important to remark that the EU has no specific policy instrument 'dedicated' to the attraction of FDI, so that foreign firms benefit from 'generic' public incentives, such as those co-financed as a part of EU Cohesion Policy.

The EU Cohesion Policy, which accounts for about one-third of the EU budget, aims at achieving social and economic cohesion, by helping transform and modernise the structure of relatively poor economies in order to prepare them for competition within the EU Single Market and, thus, reducing regional imbalances. The main instruments of the EU Cohesion Policy are the Structural Funds (SF) and the Cohesion Fund (CF), which represent about 80% and 8% of the budget, respectively. These funds are granted mainly for the provision of public goods, such as building economic and social infrastructures and, from this perspective, should be negatively correlated with plant set-up costs, thus increasing the attractiveness of each location (Kellenberg 2007).[9]

SF are allocated over a 5–7 years programming period (so far the periods have been 1989–1993, 1994–1999, 2000–2006, 2007–2013) and have two priority objectives: Objective 1 and Objective 2. The former accounts for about two-thirds of total SF and is aimed at supporting the development and structural adjustment of regions whose development is lagging behind, by providing them with the basic infrastructure or encouraging investments in business economic activity (also through direct subsidies). Regions eligible for Objective 1 funds are those NUTS-2 regions with a per-capita GDP lower than the 75% of the EU average, with a very low population density and/or ultra-peripheral regions. Objective 2 aims to revitalise all areas facing structural difficulties, whether industrial, rural, urban or dependent on fisheries. Though situated in areas whose development level is close to the Community average, Objective 2 regions are faced with different types of socio-economic difficulties that are often the source of high unemployment. For each programming period, the European Commission allocates the SF by Member States, taking into account a set of criteria: eligible population, regional and national prosperity (in terms of per-capita income, infrastructure endowment and education attainment) and the relative severity of the structural problems, especially the unemployment rate. Member States are then responsible for the allocation of these Funds to the regions. While the final distribution of Funds largely reflects the criteria defined by the Commission, there is some political discretion, which may create a mismatch between the structural backwardness of regions and the amount of funds actually received.[10]

The CF was established in 1992 to complement the SF and was intended to help countries which had a GDP per capita lower than the 90% of the EU average in 1992 (Greece, Ireland, Portugal and Spain). In the nineties, the main beneficiary of this Fund was Spain (where more than 50% of the budget has been allocated), followed by Portugal (22%), Greece (16%) and Ireland (10%).

We control for the role played by the different instruments of the EU Cohesion Policy by introducing the log of the amount of SF allocated to each region in the period 1989–1993, a dummy variable taking value 1 if a region is eligible for Objective 1[11] and a CF dummy equal value 1 if a region belongs to Ireland, Portugal or Spain (Greek regions are not included in our sample).

4. Location determinants of foreign firms in Europe: results

As we discussed in Section 2, we exploit the flexibility of MXL models to estimate the location determinants of MNFs in the EU regions over the nineties. The MXL has been specified so that we exploit as much information as

[9] Some 30% of the Structural Funds are spent on infrastructure investment, mainly transport infrastructure as well as telecommunications and energy. The emphasis put on infrastructure is justified in part on the grounds that disparities in infrastructures in the EU are greater than those existing between incomes. A further 30% of the Structural Funds are devoted to strengthening education and training systems and supporting labor market policies. The remaining 40% are subsidies to industries.

[10] We have tested for this event by regressing the amount of SF received by each region during the programming period 1989–1993 on a number of structural characteristics, such as being an Objective 1 region, per-capita GDP, unemployment rate, infrastructure, human capital and population density. The coefficients of these variables have the expected sign and are statistically significant. The adjusted R-squared is rather high (0.60), but the portion of interregional variability in the amount of SF that is not explained by this set of structural variables is still high. Results are available from the authors upon request.

[11] Since our analysis is at the NUTS-1 level, we set equal to one the Objective 1 dummy for all the NUTS-1 which includes at least one NUTS-2 region eligible for Objective 1. Table A.2 shows the list of Objective 1 regions, as well as the distribution of SF allocated over the 1989–1993 period to all 50 regions. To avoid that the dummy variable "Objective 1" picked up nonlinearities in the effect of income, we also include per capita income squared in our location equation.

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Table 2 Q1

The determinants of MNFs location decisions in Europe — Mixed logit regressions

	All firms			European firms			Non-European firms		
	Coefficients	Standard error		Coefficients	Standard error		Coefficients	Standard error	
Location determinants									
Structural funds	0.036	(0.017)	**	0.025	(0.021)		0.104	(0.034)	***
Objective 1 region (dummy)	−0.057	(0.143)		−0.110	(0.153)		0.104	(0.237)	
Cohesion country (dummy)	0.508	(0.195)	***	1.008	(0.263)	***	−2.351	(0.984)	**
Market size	0.134	(0.068)	**	0.094	(0.083)		0.128	(0.143)	
Market potential	0.358	(0.180)	**	0.480	(0.216)	**	−0.544	(0.372)	
Per-capita GDP	−0.914	(1.324)		−2.718	(1.615)	*	4.648	(2.808)	*
Per-capita GDP (squared)	0.152	(0.230)		0.396	(0.279)		−0.638	(0.486)	
Tax wedge on employment	−1.397	(0.435)	***	0.423	(0.524)		−5.033	(1.061)	***
Effective average tax rate	0.190	(0.149)		0.375	(0.186)	**	−1.065	(0.495)	**
Infrastructure index	−0.140	(0.148)		−0.246	(0.190)		0.048	(0.283)	
MNF experience	1.900	(0.074)	***	1.735	(0.085)	***	2.269	(0.164)	***
Overall aggl.	0.336	(0.054)	***	0.275	(0.062)	***	0.467	(0.112)	***
Foreign firms aggl.	0.484	(0.057)	***	0.480	(0.067)	***	0.442	(0.112)	***
Overall aggl. (spatial lag)	−0.425	(0.313)		−0.433	(0.369)		0.094	(0.629)	
Foreign firms aggl. (spatial lag)	0.384	(0.335)		0.252	(0.399)		0.579	(0.661)	
Wage	−0.037	(0.125)		−0.232	(0.155)		0.550	(0.256)	**
Secondary schooling rate	0.302	(0.198)		0.194	(0.239)		0.441	(0.413)	
Unemployment rate	−0.069	(0.077)		−0.200	(0.100)	**	0.132	(0.163)	
Population density	0.088	(0.083)		0.201	(0.104)	*	−0.059	(0.183)	
R&D intensity	0.118	(0.050)	**	0.185	(0.061)	***	−0.047	(0.096)	
Distance from home country	−0.779	(0.060)	***	−0.966	(0.058)	***	1.082	(0.543)	**
Error component (standard deviation) [a]									
MNF experience	2.091	(0.140)	***	1.880	(0.157)	***	2.620	(0.290)	***
Population density	0.414	(0.115)	***	0.335	(0.144)	**	0.580	(0.211)	***
Distance from home country	1.405	(0.121)	***	0.696	(0.165)	***	1.796	(0.993)	*
Market size	0.063	(0.112)		0.041	(0.120)		0.294	(0.168)	*
Per-capita GDP	0.368	(0.233)		0.152	(0.298)		0.983	(0.462)	**
Foreign firms aggl.	0.038	(0.069)		0.131	(0.063)	**	0.060	(0.099)	
Number of firms	5509			3676			1833		
Simulated Log-L MXL	−16,585.2			−11,126.3			−5283.1		

Notes: The dependent variable is equal to 1 if firm i is set in region j and zero for all regions different from j. Asterisks denote confidence levels: $*p<10$ and $**p<05$. MXL models have been estimated through the GAUSS routine available on Kenneth Train's website (http://elsa.berkeley.edu/Software/abstracts/train0196.html), using 100 Halton draws.

[a] In each regression the error component includes all the 21 variables used also as location determinants, as well as 8 host country dummies. For all these variables we have an estimated standard deviation. To save space, we do not report estimates associated with the country dummies and those that are not significant in any of the samples used. Standard deviations for all the variables are available from the authors upon request.

possible to capture correlation among the unobserved portions of profit stemming from location in different regions, as illustrated by Eq. (3). In Table 2 we report the results from the estimation of such a MXL model. In particular, in column (1) we present the results for the whole sample, while in columns (2) and (3) we split the sample into investors originating in Europe and elsewhere.[12]

Before commenting on the determinants of MNFs location choices, let us briefly discuss the patterns of substitution between choices which emerge from the standard deviations estimated for the random parameters associated with the variables introduced in the error component (μ_i).[13] In all the samples, a significant standard deviation has been estimated for previous experience of the MNF in each region, for population density and distance from the home

[12] MXL models have been estimated through the GAUSS routine available on Kenneth Train's website (http://elsa.berkeley.edu/Software/abstracts/train0196.html), using 100 Halton draws.

[13] Recall, from Section 2.2, that the error covariance between any two choices j and l (i.e. the substitution pattern) is: $\mathrm{Cov}(\varepsilon_{ij}, \varepsilon_{ij}) = Y'WY$, where W is the covariance matrix of μ_i. This is why we are interested in the standard deviations of the elements of μ_i.

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country.[14] This suggests that if a region becomes less attractive (due to a change in some of its observable or unobservable attributes), MNFs seem more likely to locate where they already had some plants, in other regions sharing similar population densities and at similar distance from the home country. To appreciate this result, it is worth noting that it is not a single characteristic which affects substitution, but it is a combination of different attributes which shapes the degree of perceived similarity among the regions and which would hardly be captured by any combination of nests, grouping mutually exclusive alternatives.[15]

Let us now discuss the results on the estimated mean of the parameters associated with the various location determinants in Table 2. As expected, in the whole sample the probability of an MNF locating in one region increases with the regional market size and potential, with the extent of agglomeration economies, with the R&D intensity of the region and with a lower taxation on labor. Location seems also more likely in regions closer to an MNF's home country. However, this result needs to be interpreted with caution, since in the whole sample it may pick up the fact that the majority of investors are from the EU and, thus, are closer to the host regions.

As regards the EU Cohesion Policy, we find that, after controlling for nonlinearity in the effect of per-capita income, being eligible for Objective 1 funds does not affect a region's attractiveness. It is rather the amount of SF allocated to a region that seems to be a significant determinant of the profits MNFs expect to extract from locating production in that region. Furthermore, regions within countries that were eligible for the CF are significantly more attractive than other regions.

In columns (2) and (3) of Table 2 we show the results of separate regressions for the sample of European and non-European investors. Findings are broadly consistent with those of the whole sample, but some differences also emerge. In particular, location decisions of non-European firms are substantially more responsive to increases in the amount of SF, while CF seems to play a positive and significant role for European MNFs. This may reflect a higher propensity of the latter to set up a plant in Southern Europe and in Spain and Portugal (which were the largest recipients of CF) in particular.[16]

Interesting differences exist between European and non-European MNFs with respect to some of the market-related variables, the labor market and the role of taxation. First, while the former place significant weight on market potential, the latter are more attracted towards richer markets (with higher per-capita income). Second, while high unemployment seems to attract European investors, non-European MNFs are attracted by a high wage, which we interpret as a search for more skilled workers. Both sets of results describe different patterns of investment followed by the two groups of firms. On the one hand, the European pattern is consistent with a process of re-organization of production to serve the EU Single Market, in search for a combination of relatively low production cost and good market access. On the other hand, the non-European pattern is consistent with a search for rich markets and possibly skilled workers and strategic assets.[17] A third difference between the two groups of firms concerns the effect of taxation. In fact, both the tax wedge on labor and the corporate tax rate have a negative and significant effect on the location of non-European firms, but not in the European sample. One may speculate that this difference has to do with the different role of the welfare state, which, especially in Continental and Nordic Europe places a relatively higher burden on taxpayers, in exchange for more public goods. In this perspective, European MNFs may not have such a strong preference towards lower taxes, if this comes at expense of a lower amount of public goods.

5. Concluding remarks

This paper analyzes the determinants of location choices of MNFs in Europe, by estimating a mixed logit model on a sample of 5509 foreign plants located in 50 European regions over the 1991–1999 period. Our results have

[14] To save space, Table 2 does not report either the standard deviations associated with the country dummies, or those which did not turn significant in any of the sample used.

[15] For example, in a companion paper using the same data-set used here (Basile et al., 2007), we estimate a nested logit model where regions are grouped into country nests and find that this would not adequately capture the pattern of correlation between choices (as the inclusive value parameters fall outside the 0–1 interval for most nests). This result, while revealing that national boundaries do not matter in most location choices, highlights that nested structures may not be able to fully capture substitution patterns among location alternatives.

[16] The motor vehicle industry in Spain is an interesting example of such a process. In fact, Spanish production and export of cars have more than doubled from the mid '80s to the end of the '90s and Spain is now the third largest European manufacturer of cars, hosting production plants of GM, Ford, PSA and Volkswagen, and exporting more than 80% of its production (Rhys, 2004).

[17] In this perspective, one would expect a positive impact of R&D intensity on the location of non-European plants, while the coefficient with R&D is significant only in the European sample. This may reveal the fact that in the sample of non-European firms the effect of R&D intensity may be picked up by the positive and significant effect of per-capita income.

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interesting implications both as concerns methodology and MNF location determinants. In methodological terms, we support the idea that using a MXL represents a significant improvement. Especially when addressing a problem with many alternatives in the choice set, conditional and nested logit models (widely used in empirical studies on firms' location decisions) may impose too restrictive substitution patterns among choices and lead to biased estimation. In our case, we find that the degree of similarity (correlation) in the unobserved portion of profits stemming from different regions is not fully captured by relatively simple groupings of regions such as in a nested logit framework. Rather, it is a combination of factors such as population density, distance from the investors' headquarters and the degree of MNFs previous experience in each location, which shape substitution patterns among regions.

As concerns MNF location determinants, we support the well established result that agglomeration economies play a key role in determining location choices, both for European and non-European MNFs, but we also find that a number of determinants play a different role for the two groups of firms. 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 regions and countries with lower taxes on labor and corporate income.

Finally, we find that the EU Cohesion Policy, creating more favourable conditions for investments in Peripheral regions through funding training, infrastructure and R&D activities, have succeeded in attracting MNFs, counteracting agglomeration forces which lead to a concentration of economic activities in Core regions. In particular, our results suggest that regions receiving a larger overall amount of Structural Funds and those belonging to countries eligible for the Cohesion Fund have been more attractive to foreign investors. While this is an interesting result, which adds to a growing literature on the impact of structural policy on growth and cohesion in the European Union, further work is required along these lines. First, an extension to the more recent years is necessary, in order to capture the impact of EU Enlargement, which has resulted both into a larger choice set for MNFs locating in the EU, and in new challenges for EU cohesion policies. Second, one would like to control for more direct measures of EU policies, such as the actual amount of funds transferred to the various regions for different activities, for example training, infrastructures and R&D. Careful measurement of national and regional policies specifically targeted to FDI is also required, in order to correctly assess the differential impact of EU vs. national and regional policies. Third, further investigation should be devoted to assessing whether and to what extent the EU Cohesion Policy has distorted the efficient allocation of multinational activity in Europe and eventually affected the long run growth of Europe.

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Appendix A. The NUTS classification

The *Nomenclature of Units for Territorial Statistics* (NUTS) is a hierarchical classification of administrative areas, used across the EU for statistical purposes, i.e. for the collection, development and harmonization of Community regional statistics. At the top of the hierarchy (NUTS-0) are the individual Member States, below that are levels 1 to 3.[18] Generally speaking, territorial units are defined in terms of the existing administrative units in the Member States. The

[18] Here, we refer to the nomenclature operating during the period of our analysis. Classification criteria changed in July 2003.

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Table A.1— The NUTS classification for EU countries

Country	NUTS-1	NUTS-2	NUTS-3
Countries non-eligible for the Cohesion Fund			
DE (Germany)	**Länder:** DE1 Baden-Wuerttemberg; DE2 Bayern; DE3 Berlin; DE5 Bremen; DE6 Hamburg; DE7 Hessen; DE9 Niedersachsen; DEA Nordrhein-Westfalen; DEB Rheinland-Pfalz; DEC Saarland; DEF Schleswig-Holstein; *The following regions have been excluded due to the lack of data on Structural Funds DE4 Brandenburg; DE8 Mecklenburg-Vorpommern; DED Sachsen; DEE Sachsen-Anhalt; DEG Thueringen*	Regierungsbezirke	Kreise
FR (France)	**Z.E.A.T + DOM:** FR1 Ile-de-France; FR2 Bassin Parisien; FR3 Nord-Pas-de-Calais; FR4 EST; FR5 Ouest; FR6 Sud-Ouest; FR7 Centre-Est; FR8 Mediterranee; *The following region has been excluded due to the lack of data on foreign plant location FR9 Departements d'outre-mer*	Régions + DOM	Départements + DOM
IT (Italy)	**Gruppi di regioni:** IT1 Nord Ovest; IT2 Lombardia; IT3 Nord Est; IT4 EMILIA-Romagna; IT5 Centro; IT6 Lazio; IT7 Abruzzo-Molise; IT8 Campania; IT9 Sud; Ita Sicilia; ITB Sardegna	Regioni	Provincie
SE (Sweden)	SE Sverige (NUTS-1)	Riksområden	Län
UK (United Kingdom)	**Standard regions** UK1 North; UK2 Yorkshire and Humberside; UK3 East Midlands; UK4 East Anglia; UK5 South East (UK); UK6 South West (UK); UK7 West Midlands; UK8 North West (UK); UK9 Wales; UKA Scotland; UKB Northern Ireland	Group of counties	Counties/Local authority regions
Countries eligible for the Cohesion Fund			
ES (Spain)	Agrupacion de comunidades autonomas: ES1 Noroeste; ES2 Noreste; ES3 Comunidad de Madrid; ES4 Centro; ES5 ESTE; ES6 Sur; *The following region has been excluded due to the lack of data on foreign plant location ES7 Canarias*	Comunidades autonomas + Ceuta y Melilla	Provincias + Ceuta y Melilla
IE (Ireland)	IE Ireland (NUTS-1, NUTS-2		Regional Authority, Regions
PT (Portugal)	**Continente + Regiones autonomas:** PT1 Continente; The following regions have been excluded due to the lack of data on foreign plant location *PT2 Acores; PT3 Madeira*	Comissaoes de coordenaçao regional + Regioes autonomas	Grupos de Concelhos

NUTS level to which an administrative unit belongs is determined on the basis of population thresholds. Where the population of a Member State as a whole is below the minimum threshold for a NUTS level, that Member State itself constitutes a NUTS territorial unit of that level (thus, Ireland consists of only one NUTS-2 region, while Sweden consists of only one NUTS-1 region).

The NUTS classification serves as a reference for the framing of EU regional policies: for the purposes of appraisal of eligibility for aid from the Structural Funds, regions whose development is lagging behind (regions concerned by Objective 1) have been classified at the NUTS-2 level. For the present work, we utilized NUTS-1 as the elemental location choice, as it represents (in the context of our econometric analysis) the best solution to the trade off between complexity and exhaustiveness. In fact, NUTS-0 (countries) represent overly large geographical units to study MNF location behavior, as significant heterogeneity is present within countries. The use of NUTS-2 or NUTS-3 levels would imply the inclusion of a too large number of alternatives, which would make estimation unfeasible. In Table A.1 we summarize the NUTS classification for the 8 countries in our sample and indicate the list of regions used in the analysis.

Table A.2 — Distribution of new foreign affiliates of European and non-European MNFs in the period 1991–1999, and of SF allocated in the period 1989–1993, by NUTS-1 region

Country/ region	Objective 1 region	Subsidiaries of European MNFs 1991–1999	Subsidiaries of non-European MNFs 1991–1999	Structural Funds 1989–1993	Country/ region	Objective 1 region	Subsidiaries of European MNFs 1991–1999	Subsidiaries of non-European MNFs 1991–1999	Structural Funds 1989–1993
Germany		16.2	12.2	4.7	Ireland	Yes	0.7	1.0	6.0
– Baden-Wuerttemberg	No	3.0	1.8	0.4	Italy		3.8	2.1	11.0
– Bayern	No	2.6	2.3	0.8	– Nord Ovest	No	0.3	0.3	1.0
– Berlin	No	0.5	0.3	0.5	– Lombardia	No	1.9	1.3	0.3
– Bremen	No	0.1	0.1	0.2	– Nord Est	No	0.5	0.0	0.8
– Hamburg	No	0.5	0.6	0.0	– Emilia Romagna	No	0.3	0.2	0.3
– Hessen	No	2.3	2.2	0.2	– Centro	No	0.3	0.1	1.0
– Niedersachsen	No	1.2	0.8	0.6	– Lazio	No	0.1	0.1	0.4
– Nordrhein-Westfalen	No	4.5	3.3	1.4	– Abruzzo Molise	Yes	0.1	0.1	0.6
– Rheinland-Pfalz	No	0.8	0.4	0.2	– Campania	Yes	0.1	0.0	1.5
– Saarland	No	0.1	0.1	0.2	– Sud	Yes	0.1	0.0	2.7
– Schleswig-Holstein	No	0.6	0.4	0.2	– Sicilia	Yes	0.1	0.0	1.4
Spain		6.4	3.0	18.1	– Sardegna	Yes	0.0	0.0	1.0
– Noroeste	Yes	0.3	0.1	3.6	Portugal	Yes	2.6	0.7	1.8
– Noreste	No	0.8	0.5	0.9	Sweden	No	2.1	0.8	0.0
– Com. de Madrid	No	1.9	1.4	0.3	United Kingdom		17.7	31.8	8.4
– Centro	Yes	0.4	0.0	5.0	– North	No	0.5	1.2	0.9
– Este	No	2.7	0.8	3.2	– Yorkshire-Humberside	No	1.3	1.5	0.8
– Sur	Yes	0.3	0.2	5.1	– East Midlands	No	1.5	1.8	0.3
France		11.3	5.7	6.3	– East Anglia	No	0.5	1.0	0.1
– Ile de France	No	2.8	1.7	0.0	– South East (UK)	No	7.8	15.6	0.2
– Bassin Parisien	No	1.9	1.0	1.5	– South West (UK)	No	0.9	1.6	0.3
– Nord Pas de Calais	No	0.8	0.4	0.5	– West Midlands	No	2.1	3.5	0.9
– Est	No	1.8	0.4	0.7	– North West (UK)	No	1.6	2.5	1.6
– Ouest	No	0.8	0.6	1.0	– Wales	No	0.5	0.9	0.7
– Sud Ouest	No	1.0	0.4	0.9	– Scotland	Yes	0.7	1.9	1.4
– Centre Est	No	1.6	1.0	0.7	– Northern Ireland	Yes	0.2	0.2	1.3
– Mediterranee	No	0.6	0.2	0.9	Total		100.0	100.0	100.0

Percentage values

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