National boundaries and the location of multinational firms in Europe[♣]

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Abstract

Using data on 5,102 subsidiaries established in the period 1991-1999, we examine the location choice of multinational firms of different nationalities in 47 regions of 5 EU countries. In particular, we estimate a nested logit model and find that European multinationals consider regions across different countries as relatively closer substitutes than regions within national borders. This is consistent with the hypothesis that European regions compete to attract FDIs relatively more across than within countries. However, in line with previous studies, we also find that national boundaries still play some role in choices made by non-European multinationals.

JEL Classification: F23, O52, R30
Key words: Europe; Multinational Firms; Location; Discrete Choice Models.

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1. Introduction

Over the last two decades, the European Union has attracted more than 40% of total world flows of foreign direct investments (FDIs), becoming the largest recipient of multinational activity (Unctad, 2006). Accelerating economic integration played an important role in this process (Barrel and Pain, 1999; Neven and Siotis, 1996). In particular, falling trade barriers increased the gains from concentrating manufacturing activity in few locations to use as export-platforms or from re-organizing production through international vertical fragmentation (Motta and Norman, 1996, Neary, 2002, 2006). With respect to investment decisions, national boundaries might have lost some of their importance and locations across countries might have become relatively closer substitutes.[1] From this perspective, one may wonder whether (and to what extent) regions belonging to different countries are actually competing to attract foreign investors. For instance, one may ask whether an Italian region, such as Emilia Romagna, competes for attracting multinationals more with Lombardia than with regions having similar characteristics but belonging to other countries, such as Bayern or Catalunya.

This paper addresses this question by analyzing the location choices of 5,102 affiliates of multinational firms (MNFs) between 1991 and 1999 over a set of 47 NUTS-1 regions in 5 EU countries (France, Germany, Italy, Spain and United Kingdom)[2]. In

[1] However, actual or perceived national specificities might still matter in different respects, hindering competition across borders. For example, studies on international trade patterns tend to find that border effects are still significant and the home bias in consumption is rather high (Head and Mayer, 2000; Chen, 2004).

[2] 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). In particular, NUTS-0 units correspond to countries, while NUTS-1 regions are socio-economic areas

particular, we estimate a nested logit model of MNFs' location choices and test whether foreign investors consider regions within national boundaries closer substitutes than regions across borders. This is done by grouping regions into country-nests and by testing whether the inclusive value parameter of the nested logit model falls in the 0-1 interval. From this specific point of view, this paper extends and generalizes the results obtained by Head and Mayer (2004), who estimate a nested logit model of the location choice of 452 Japanese-owned affiliates in 57 EU regions during the period 1984-1995. For this sample of foreign investors, which is smaller than ours and focused on firms originating from Japan only, their analysis supports a country-region nesting structure, thus suggesting that the degree of substitution between profitability from different locations is larger within than across national borders[3]. In this paper, we analyse investors from different nationalities, including European MNFs locating their activities in foreign countries within the EU, as well as non-European investors (originating mainly from the US and Japan) and we relax some restrictions imposed on the estimation of the nested logit model (namely, allowing for different magnitudes of the inclusive value parameters for the different nests). Our results broadly confirm the patterns of substitution found in Head and Mayer (2004) for Japanese investors, but suggest that this may be a special case. Indeed, our analysis shows that for the whole sample of investors from all nationalities, regions within national borders are not

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grouping together so-called basic areas (NUTS-2 regions) and, in the context of our analysis, represent the best solution to the trade-off between complexity and exhaustiveness.

[3] It is worth noting that this result is not emphasised in Head and Mayer's work, as it is not at central stage in their analysis. In fact, the issue of the country-region nesting structure is more of an a-priory assumption, which is eventually confirmed by the data, in a study focused on the determinants of location decisions of Japanese multinationals, and of the role of market potential as an attractor of FDIs in particular.

considered as closer substitutes than regions belonging to different countries. This holds especially for intra-Europe investments (which accounts for about 60% of all inward FDIs in Europe), while the border effect plays some role in choices made by non-European MNFs, particularly when considering Italian locations. This result has implications both in terms of policy and of specification of location choice models. On the one hand, it supports the idea that within an integrated Europe, regions compete significantly across borders to attract foreign investors. On the other hand, it implies that empirical models of the location choice of MNFs in Europe based on a country-region nesting structure would produce biased results due to the incorrect specification of substitution patterns.[4]

The rest of the paper is organized as follows. Section 2 describes the empirical model, Section 3 illustrates data and econometric results. Section 4 concludes.

2. Econometric model

Location choices can be modelled in the random utility maximization (RUM) setting, where it is assumed that firm *i* chooses location *j* if it yields the highest utility (or profit) among the set of available alternatives, that is $\pi_{ij} > \pi_{il} \quad \forall l \neq j \quad (l = 1,...,L)$. As we illustrate in the Appendix, different assumptions on the unobserved portion of profits yield different discrete choice models. The literature on firms' location choice has mainly estimated conditional logit (CL) and nested logit (NL) models[5].

[4] In Basile *et al*. (2007) we address this issue, by estimating a mixed-logit model, which allows a more flexible pattern of substitution between the profit stemming from different regions, and helps reduce this specification error.

[5] Carlton (1983) first estimated a discrete choice model to analyze the location of new industrial branch plants in the United States. A number of applications of CL and NL models on the location choice of new

In this study, we estimate a nested logit model, where 50 elemental choices (regions) are grouped into 5 nests. We refer to the Appendix for a more detailed discussion of NL models. Suffice here to recall that a key quantity in NL is the inclusive value (IV), which measures the profit that a firm can expect to obtain from locating in any region within nest *k.* It turns out that the estimated parameter associated with the *IV* ($\lambda_{k,}$) reflects the degree of dissimilarity among unobserved portions of utility within a nest, with lower λ_k indicating more similarity, (or in other words, closer substitution in location decisions) (Train, 2003). In fact, 1-λ_k is a measure of correlation of the error components from different choices within the same nest. As long as $\lambda_k \to 1$, the correlation within a nest approaches zero, while $\lambda_k \to 0$ indicates substantial correlation within a nest. An estimated *IV* parameter in the 0-1 interval implies that alternatives within the same nest are closer substitutes than alternatives outside the nest. We will use this condition to assess whether national boundaries matter, by grouping regions into country nests and testing whether the corresponding parameter λ_k is significantly lower than 1. A λ_k parameter greater than 1 suggests that correlation within

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foreign-owned plants have been proposed thereafter. Many empirical works analyze location within the United States (see, for example, Coughlin *et al*., 1991; Head *et al*., 1995, 1999; Friedman *et al*., 1996), but a number of recent applications address investments in Europe. Most of these studies analyze location within individual European countries (see, for example, Basile, 2004; Crozet *et al*., 2004; Barrios *et al.*, 2006; Guimaraes *et al*., 2000; Devereux *et al*., 2007; Bekes, 2007), but others address it in a multi-country framework. For example, Devereux and Griffith (1998) analyze the choice between FDI and export as a means to serve the European market and the location of FDI among different European countries, while Disdier and Mayer (2004) analyze French investments in Eastern and Western European Countries. Instead, Head and Mayer (2004) study location choices at the NUTS-1 level for 9 countries, but their analysis is confined to Japanese investors, while Pusterla and Resmini (2005) focus on location choices within Transition Countries.

a nest is negative, so that alternatives are more similar across than within nests. Daly and Zachary (1979) and McFadden (1979) demonstrate that if λ_k is between zero and one for all *k*, the model is consistent with profit maximizing behaviour (Train, 2003, p. 85).[6] Furthermore, as shown in a Monte Carlo experiment by Herriges and Kling (1997), λ_k greater than one determine also a significant bias in the coefficients estimated for th**e** location determinants.

The parameter λ_k can differ across nests, reflecting different correlation among unobserved factors within each nest, but many empirical works have constrained λ_k to be the same for all the nests (see, for example, Head and Mayer, 2004), indicating that the correlation is the same within each nest. In this paper we estimate both a restricted and an unrestricted NL and test, using a likelihood ratio statistics, whether these constraints are reasonable.

3. Data and results

Our analysis exploits a dataset (named Elios), built at the University of Urbino, which collects information from Dun & Bradstreet's Who Owns Whom on a large sample of firms active in Europe. In particular, we have data on firms establishing affiliates in the 5 largest EU countries (France, Germany, Italy, Spain and the United Kingdom), which *inter alia* accounted for about 60% of total inward FDI flows in the EU15 over the

[6] For λ_k greater than one, the model is consistent with profit maximization only for some range of the explanatory variables. Herriges and Kling (1996) provide tests of consistency of nested logit with profit maximization when λ_k>1, but they argue that for applications with several alternative groups, the acceptable range for the λ_ks does not extend much beyond the unit interval. Given the relatively high number of choices (47) and nests (5), in our application we will maintain the unit interval as the acceptable range for the λ_ks.

nineties. Since three-quarters of the remaining 40% go to Belgium and the Netherlands, which attract mainly financial and service activities, we are rather confident that our sample picks up a very important share of foreign manufacturing activities established in Europe over the nineties.

For each firm we have information on the name and country of the ultimate owner, the sector of activity (2-digit SIC), location and year of establishment. Exploiting the information on the country of the ultimate owner, we identify foreign-owned firms and we restrict our analysis to those which were established over the 1991 to 1999 period. We end up with a sample of 5,102 foreign-owned firms located in 47 NUTS1 regions of the countries considered[7]. The cross-country distribution of foreign investments in our dataset is largely consistent with inward FDI flows registered by Eurostat over the same period (see Table A.1), though investments in France are slightly underrepresented, while the share of new affiliates which, according to our sample, were established in the UK is slightly larger than the actual flow of inward FDI. As concerns the area of origin of investors, Table A.2 reveals that 57.5% are from EU15, while 26.4 and 4% of affiliates in our sample have parent companies in the US and Japan, respectively. As one would expect, US and Japanese MNFs tend to invest more intensively in the UK. The comparison with the origin of inward FDIs recorded by Eurostat suggests that our sample is well balanced also in this respect. Finally, it is worth commenting on the regional distribution of investments. Although we cannot benchmark it with any official statistics, the distribution of our sample of subsidiaries of non-European multinationals

[7] Unfortunately, Who Owns Whom does not provide any information on the share of ownership, nor on the type of the investment, so that we cannot identify different location patterns for wholly owned vs. shared ownership ventures, nor for greenfields vs. acquisitions.

is remarkably similar to the one reported in Head and Mayer (2004) (see Table A.3 in this paper and Table A.1 in Head and Mayer) and reveals a concentration of new foreign affiliates in the economic core of each country[8].

For the econometric analysis of the location choice, we integrate data from the Elios dataset with information gathered from other sources. For each of the 5,102 affiliates in our sample, the response variable takes value 1 for the region where the firm has actually established and zero for all the other possible locations. The choice set is as large as 47 regions, but is smaller in the case of affiliates whose parent company is located in one of the 5 EU countries, since we exclude locations in the home country (namely, in the case of German, Italian and UK MNFs the choice set reduces to 36 regions, in the case of French MNFs is 39, while for Spanish MNFS is 41). A large set of explanatory variables has been selected following the vast empirical literature on foreign firms' location choices (see Table A.4 for the variable list and detailed description). In particular, we include measures of regional market size (total value-added and per-capita GDP) and market potential (distance-weighted sum of the size of GDP of all other regions in our sample), agglomeration economies (stock of all firms and foreign firms in the same sector-region of each firm in our sample)[9], MNF experience (number of affiliates established in a region belonging to the same parent of

[8] In particular, the major regions of destination of foreign investors are: South East (with London as the major city), West Midlands (Birmingham) and North West (Manchester) in the UK; Nordrhein-Westfalen (Bonn, Dusseldorf, Koln), Baden-Wurttemberg (Stuttgart), Bayern (Munich), Hessen (Frankfurt) in Germany; Comunidad de Madrid (Madrid) and Este (Barcelona) in Spain; Ile de France (Paris) in France; Lombardia (Milan) in Italy.

[9] We include also spatial lags of agglomeration economies, by computing a distance-weighted measure of agglomeration in other regions.

each firm in our sample), labour market characteristics (average regional wages, schooling and unemployment rates), R&D intensity and population density. We also consider indicators of EU regional policy (namely the amount of Structural Funds allocated to the region in the period 1989-1993 and an indicator taking value one for regions eligible of Objective 1 Funds) as well as a proxy of the level of public infrastructure in the region.

We estimate three different specifications of the NL model (A, B and C), each imposing the same country-region nesting structure. Thus, we have 5 nests (one for each country), each including a different number of regions (see Table A.3 for the list of regions in each country). In table 1 we report the *IV* parameters resulting from each regression. As illustrated in section 2, these parameters reflect the substitution patterns (or correlation) between profits stemming from different regions as emerging from the residuals of the model. We do not show all the estimated coefficients associated with the variables in the model, both to save space and because, as we will see, the nesting structure that we have imposed is not always consistent with profit maximization and, thus (as argued in section 2), coefficient estimates may be biased. Regressions results will be presented for the whole sample of investors, as well as for the sub-sample of European and non-European MNFs. For the latter group, we will also provide detailed results for US and Japanese-owned firms, to improve comparability with Head and Mayer (2004). Likelihood ratio (LR) statistics will also be reported, in order to test two restricted versions of the NL model. The first (NLr) imposes a common IV parameter for all nests, while the second is the conditional logit model (CL) where all IV parameters are set to one.

Specification A) includes only regional variables, thus leaving the maximum unobserved heterogeneity in profitability stemming from each nest. In this case, the correlation between profits from locating in regions within the same country is determined by both national and regional unobserved factors. Examples of the first are national institutional quality and national policies, which affect the attractiveness of each region within a country. An example of unobserved regional factor is the promotion activity carried out by a Regional Development Agency (RDA) to attract FDIs within a specific area. Let us illustrate the difference between the two effects. On the one hand, the probability of locating in region *j* of country *k* may go up if the institutional context in country *k* is more conducive to FDI than in any other country. On the other hand, the substitution pattern would tell us how much the probability of locating in region *j* would be affected by a change in attractiveness of other regions. For example, if territorial marketing in Catalunya is improved, does the probability of locating in Emilia Romagna decrease? What if RDA activity is improved in Bayern or in Lombardia? The region-country NL specification would impose the same cross-elasticity (that is the same substitution pattern) for all regions outside the nest (Catalunya and Bayern) and a common (although different from the previous one) substitution between regions within the same country[10]. The country-specific effect on the attractiveness of each region is accounted for in specifications B) and C). The former mimics Head and Mayer (2004), including two measures of national policy (such as the average effective corporate tax rate and the tax wedge on labor compensations), while the latter introduces also three proxies of the effectiveness of

[10] In the CL model these two elasticities would collapse, so that a change in the attractiveness of any region *l* would have the same effect on the probability of locating in region *j*.

national institutions (namely measures of the efficiency of public administration, the degree of labor market regulation and the effectiveness of the legal system).

Results reported in Table 1 suggest the following. First, the unrestricted NL performs better than both CL and the NLr. In fact, the LR statistics rejects the restrictions imposed by both models, in all specification and sub-samples. A partial exception to this rule occurs in the case of Japanese firms, but it should be noted that this sample is rather small and estimates may not be as precise as in larger samples. Second, in the whole sample, IV parameters tend to be above one. This is particularly true in specification A), where in four out of five IVs the λ_k is significantly higher than one, so that the country-specific nesting structure is rejected by our data. When controlling for country characteristics - in specifications B) and C) - the parameters drop, so that only in the case of Germany it remains significantly higher than one. However, in no case the IV parameters fall significantly within the unit interval. Third, this pattern appears to be driven by European MNFs, for which the IV parameters are generally larger, while in the case of non-European investors we find some evidence of λ_k significantly below one (for Italy in all specifications and for Spain and France only in specification B and C). Among non-European investors, IV parameters are consistently lower than one for Japanese-owned firms (in particular when we control for country characteristics), a result which largely corresponds to the one obtained by Head and Mayer (2004). In the case of US MNFs IV parameters are not statistically different from one, except for the case of Italy.

In sum, our results suggest that, in the whole sample, the substitution pattern imposed by the country-region nesting structure is wrong and MNFs investing in Europe would consider regions belonging to different countries as closer substitutes

than regions within national boundaries. Thus, everything else equal, regions would compete relatively more with other locations across borders to attract foreign investors. This is particularly the case for investments made by European MNFs, while for non-European firms there is some evidence that national boundaries shape the degree of substitution among regions. Consistently with Head and Mayer (2004), we find that Japanese investors consider regions within national boundaries as closer substitutes than regions across boundaries. This corresponds to a decision process where Japanese firms first choose the country where they want to set-up production activities in Europe, then decide in which region, within the country, they establish their affiliates. In the case of US MNFs, the evidence of border effect is less straightforward and seems to be particularly relevant only in the case of Italy. This would support a view about the peculiarity of Italy that is not new to US observers and could be summarized by a quote from an article appeared in *The New York Times* ("Italian Puzzle: The Land That Doesn't Seem To Fit", August 20, 2003)*:* "Italy has occupied an odd place in Europe, too potent to be ignored, but too peculiar to be embraced". This finding is also consistent with Basile *et al*. (2005), where it is clearly documented that Italian regions attract significantly less than their observable potential because of a common (adverse) country effect.

It is important to stress that the country-region nesting structure appears to be consistent with profit maximizing behavior only in the case of non-European MNFs and, in particular, in the case of Japanese firms. This nesting structure is not able to capture the true pattern of substitution in the case of European MNFs, since the IV parameters are never significantly lower than one. Under these conditions, one could not rely on estimated coefficients (which, as shown by Herriges and Kling, 1997, would be

biased) for the analysis of the determinants of the location choice. Therefore, the researcher might need to look for different groupings of regions (that is: alternative nesting structures, different from the one obtained by aggregating regions according to national boundaries) which satisfy the condition that all *IV* parameters are below one. Finding the most appropriate nesting structure is beyond the scope of this paper, which focuses on the role of national specificities in location decisions of MNFs. Suffice here to note that 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 increases dramatically, making the implementation of such a search rather cumbersome (Verlinda, 2005). Furthermore, even if one were able to find the most appropriate nesting structure (like in the case of non-European MNFs), 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. A more general approach to capturing substitution patterns in the discrete choice problems is represented by mixed logit models, which are considered the frontier techniques to estimate discrete choice models (Train, 2003). In a companion paper, we estimate a mixed logit model on the same dataset used here and investigate the determinants of location choices of MNFs investing in Europe (Basile *et al.*, 2007).

4. Concluding remarks

This paper analyzes the location choice of MNFs in Europe. Most previous studies focused on location decisions within single countries, often analyzing locations at a rather geographically disaggregated level, but making the hypothesis that firms choose regions within and not across countries. In other words, firms are usually assumed to

choose countries first and then decide in which region within that country they locate their activities. The process of European integration is making this perspective rather narrow, since regions can be expected to compete with other regions both within and across national boundaries for the attraction of FDIs. This study provides empirical support to this latter view by showing that in most circumstances, country boundaries do not matter for location choices of MNFs. In fact, estimating a nested logit model on a sample of 5,102 firms locating foreign plants in 47 European regions over the 1991-1999 period, we find that MNFs tend to consider regions across countries in Europe as closer substitutes than regions within national boundaries. This suggests that, when taking location decisions, MNFs perceive the EU as a relatively (albeit not completely) integrated area, rather than a collection of independent countries and EU regions compete with other locations across national boundaries (within the EU) to attract foreign plants. This holds particularly true for European MNFs, which account for more than 60% of all foreign investments in the EU, while we find some evidence of a country effect in the case of location choices of non-European firms, and of Japanese firms in particular, thus confirming a previous result obtained by Head and Mayer (2004). By providing evidence on location decisions of a large number of MNFs regardless of their nationality, this paper provides a considerable extension of previous research efforts and helps provide a more general view of foreign investment patterns in Europe.

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Table 1 – The role of country boundaries in MNFs location decisions in Europe– Nested logit regressions

Specification A: Only regional characteristics (see Table A.4 for the variable list and description)

Sample	All firms		European firms		non-European firms		US firms		Japanese firms	
N. firms	5,102		3,349		1,753		1,347		203	
	Coeff.	**Std.Err.**	**Coeff.**	**Std.Err.**	**Coeff.**	**Std.Err.**	**Coeff.**	**Std.Err.**	**Coeff.**	**Std.Err.**
Unrestricted NL										
IV parameters										
GERMANY	1.154	(0.051) °°°	1.228	(0.066) °°°	0.978	(0.078)	0.950	(0.085)	0.632	(0.203)
SPAIN	1.159	(0.082) °	1.271	(0.107) °°	0.847	(0.121)	0.840	(0.139)	0.680	(0.312)
FRANCE	1.089	(0.054) °	1.164	(0.071) °°	0.876	(0.080)	0.872	(0.091)	0.607	(0.191) °°
ITALY	0.895	(0.053) °°	0.925	(0.066)	0.720	(0.093) °°°	0.652	(0.098) °°°	0.614	(0.259)
UK	1.124	(0.055) °°	1.112	(0.071)	1.043	(0.082)	0.994	(0.089)	0.698	(0.197)
Restricted NL										
IVk = IV	1.107	(0.006) °°°	1.132	(0.029) °°°	1.021	(0.071)	1.000	(0.080)	0.643	(0.158) °
Log-likelihood										
NL	-15187.7		-10118.7		-4944.5		-3815.8		-598.6	
CL	-15213.7		-10145.5		-4953.9		-3823.6		-600.8	
NLr	-15211.0		-10143.0		-4953.8		-3823.6		-598.8	
LR Tests:										
NL vs. CL	52.08	[0.000]	53.56	[0.000]	18.93	[0.002]	15.54	[0.008]	4.43	[0.488]
NL vs. NLr	46.62	[0.000]	48.56	[0.000]	18.85	[0.001]	15.54	[0.008]	0.52	[0.971]
NLr vsCL	46.62	[0.019]	5.00	[0.025]	0.09	[0.769]	0.00	[1.000]	3.91	[0.048]

Specification B: Regional characteristics and national tax policy variables (see Table A.4)

Sample	All firms		European firms		non-European firms		US firms		Japanese firms	
	Coeff.	Std.Err.	Coeff.	Std.Err.	Coeff.	Std.Err.	Coeff.	Std.Err.	Coeff.	Std.Err.
Unrestricted NL										
IV parameters										
GERMANY	1.257	(0.057) °°°	1.307	(0.073) °°°	1.011	(0.086)	1.010	(0.095)	0.518	(0.164) °°
SPAIN	1.168	(0.083) °°	1.305	(0.109) °°°	0.791	(0.114) °	0.827	(0.138)	0.538	(0.265) °
FRANCE	1.002	(0.054)	1.024	(0.069)	0.839	(0.082) °	0.817	(0.091) °°	0.709	(0.217)
ITALY	0.926	(0.055)	0.949	(0.068)	0.704	(0.092) °°°	0.660	(0.100) °°°	0.510	(0.212) °°
UK	1.155	(0.057) °°°	1.166	(0.075) °°	0.986	(0.080)	0.994	(0.091)	0.515	(0.161) °°°
Restricted NL										
IVk = IV	1.132	(0.032) °°°	1.138	(0.058) °°	0.988	(0.070)	0.995	(0.080)	0.591	(0.148) °°
Log-likelihood										
NL	-15167.2		-10101.0		-4939.7		-3812.4		-595.9	
CL	-15204.9		-10135.8		-4949.8		-3822.0		-599.3	
NLr	-15201.0		-10133.2		-4949.8		-3822.0		-596.6	
LR Tests:										
NL vs. CL	75.34	[0.000]	69.72	[0.000]	20.16	[0.001]	19.15	[0.002]	6.85	[0.232]
NL vs. NLr	67.56	[0.000]	64.46	[0.000]	20.14	[0.000]	19.14	[0.001]	1.52	[0.910]
NLr vs. CL	7.78	[0.005]	5.26	[0.022]	0.03	[0.872]	0.00	[0.950]	5.33	[0.021]

Specification C: Regional characteristics, national tax policy variables and national institutional variables (see Table A.4)

Sample	**All firms**		**European firms**		**non-European firms**		**US firms**		**Japanese firms**	
	Coeff.	Std.Err.	Coeff.	Std.Err.	Coeff.	Std.Err.	Coeff.	Std.Err.	Coeff.	Std.Err.
Unrestricted NL										
IV parameters										
GERMANY	1.154	(0.057) °°°	1.168	(0.071) °°	0.955	(0.089)	1.003	(0.102)	0.230	(0.131) °°
SPAIN	1.089	(0.080)	1.178	(0.105) °	0.768	(0.113) °°	0.815	(0.138)	0.336	(0.221) °°°
FRANCE	0.967	(0.054)	0.960	(0.067)	0.833	(0.085) °	0.842	(0.097)	0.423	(0.208) °°°
ITALY	0.970	(0.062)	0.977	(0.074)	0.736	(0.104) °°	0.706	(0.111) °°°	0.311	(0.196) °°°
UK	1.082	(0.056)	1.060	(0.071)	0.949	(0.084)	1.008	(0.099)	0.237	(0.129) °°°
Restricted NL										
IVk = IV	1.047	(0.046)	1.029	(0.057)	0.895	(0.073)	0.942	(0.086)	0.339	(0.144) °°
Log-likelihood										
NL	-15150.7		-10089.5		-4933.3		-3804.5		-591.1	
CL	-15159.5		-10098.3		-4938.1		-3809.5		-598.4	
NLr	-15159.1		-10098.2		-4937.4		-3809.3		-593.1	
LR Tests:										
NL vs. CL	75.34	[0.003]	17.52	[0.004]	9.61	[0.087]	9.91	[0.078]	14.7	[0.012]
NL vs. NLr	67.56	[0.002]	17.34	[0.002]	8.07	[0.089]	9.54	[0.049]	4.00	[0.406]
NLr vs. CL	7.78	[0.365]	0.18	[0.671]	1.53	[0.215]	0.37	[0.543]	10.71	[0.001]

Notes:

The dependent variable is equal to 1 if firm *i* is set in region *j* and zero for all regions different from *j*. CL refers to a conditional logit model, where all *IV* parameters are constrained to 1. NLr refers to a specification where $IV_l=IV_k$ for all countries l and *k*. The symbol (°) denotes confidence levels for the hypothesis that *IV* parameters are different from 1: ° p<.10 and °° p<.05, °°° p<.01. P-values for LR statistics are reported in squared brackets.

Appendix – Random Utility Maximization and Discrete Choice Models

Location choices can be modelled in the random utility maximization (RUM) setting, where it is assumed that firm *i* chooses location *j* if it yields the highest utility (or profit) among the set of available alternatives, that is $\pi_{ij} > \pi_{il} \quad \forall l \neq j \quad (l = 1,...,L)$. Decomposing 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 (***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

$$V_{ij} - V_{il} > \varepsilon_{il} - \varepsilon_{ij} \tag{2}$$

Under the assumption of independently and identically distributed (*iid*) error terms, with type I extreme-value distribution, the probability of choosing location *j* is

$$P_{ij}^{CL} = \exp(V_{ij}) \Big/ \sum_{l=1}^{L} \exp(V_{il}) \quad \forall l \neq j \quad (l = 1,...,L) \tag{3}$$

This is known as the conditional logit (CL) model (McFadden, 1974). A major drawback of this model is the assumption of Independence of Irrelevant Alternatives (IIA), according to which the odds of choosing between any pair of alternatives are independent of the characteristics of any other alternative in the choice set. A behavioural implication of IIA is that all pairs of alternatives share the same degree of substitution (i.e. they are symmetric) which amounts to assuming that all the information in the random component is equal in quantity and relationship between pairs of alternatives, and that the cross-alternatives covariance in the error term is equal to zero (Hensher *et al.*, 2005). This assumption would be violated if, for example, different groups of regions had similar unobservable characteristics, so that the error

terms would be positively correlated across choices. For example, in this work we test whether some (unobserved) country effect occurs. If this is the case, the choice would not be made among symmetric substitutes, as the degree of substitution between regions within national boundaries might be higher than across countries. More generally, the IIA assumption may be implausible in location choice analysis, as adjacent locations may have similar unobservable characteristics, which make them interdependent. Failing to account for this correlation would lead to biased estimates.

The Nested Logit (NL) model partially solves this problem by allowing for some correlation between errors within mutually exclusive groups (nests), while maintaining the hypothesis of no correlation across nests. The IIA assumption, thus, holds across nests but not within them. In other words, a change in the attractiveness of region *j* would increase the probability of locating in other regions within the same nest relatively more than the probability of locating outside the nest. Alternatives within the same nest are then closer substitutes than choices placed in different nests. More formally,

$$E(\varepsilon_{ij}, \varepsilon_{il}) = \sigma_k \quad \text{if} \quad l \text{ and } j \in k \qquad (4)$$
$$E(\varepsilon_{ij}, \varepsilon_{il}) = 0 \quad \text{otherwise}$$

To illustrate, let us assume that the *J* alternatives are grouped into *K* country-nests, that is each alternative belongs to a nest *k*. Thus, the probability that a firm chooses region *j* is the product of two logit probabilities: the conditional probability of choosing *j* (known as the *lower* model), given that nest *k* has been selected ($P_{ij|k}$), times the marginal probability of choosing nest *k* (P_{ik}, known as the *upper* model):

$$P_{ij}^{NL} = P_{ij|k} \times P_{ik} = \frac{\exp[(V_{ij})/\lambda_k]}{\sum_{j \in N_k}[(V_{ij})/\lambda_k]} \times \frac{\exp(\lambda_k IV_k)}{\sum_k \exp(\lambda_k IV_k)} \quad (5)$$

A key quantity in NL is the inclusive value ($IV_k = \ln \sum_{j \in k} \exp[(V_{ij})/\lambda_k]$), which measures the profit that a firm can expect to obtain from locating in any region within nest k and links the upper and the lower model by bringing in the former information from the latter. Additional nest-specific regressors *Z* can also be included in the upper model. In this case, the probability of choosing nest *k* would be $P_{ik} = \exp(\gamma' Z_k + \lambda_k IV_k) \Big/ \sum_k \exp(\gamma' Z_k + \lambda_k IV_k)$. It turns out that the estimated parameter associated with the IV (λ_k,) reflects the degree of dissimilarity among unobserved portions of utility within a nest, with lower λ_k indicating more similarity, hence closer substitution (Train, 2003).

Table A.1 – FDI flows by country of destination in the period 1991-1999

Source	Elios		Eurostat
	N. of new affiliates of foreign MNFs	%	Inward FDI flows
France	867	17.0%	30.0%
Germany	1368	26.8%	28.3%
Italy	295	5.8%	4.6%
Spain	484	9.5%	11.5%
United Kingdom	2088	40.9%	25.6%
Total	5102	100.0%	100.0%

Table A.2 – FDI flows by area of origin and country of destination in the period 1991-1999 (percentage values)

Source	**Elios**					**Eurostat**				
Variable	**Number of new affiliates of foreign MNF**					**FDI flows**				
Area of origin	**World**	**EU15**	**US**	**JPN**	**Other**	**World**	**EU15**	**US**	**JPN**	**Other**
France-Germany-Italy-Spain-UK	100	57.5	26.4	4.0	12.1	100	63.7	24.4	0.5	11.5
EU15						100	64.0	19.1	2.2	14.8
by country of destination										
France	100	69.0	16.5	3.0	11.5	100	67.5	17.7	0.8	13.9
Germany	100	57.9	23.6	2.8	15.7	100	50.6	27.3	0.1	22.0
Italy	100	68.5	18.0	4.1	9.5	100	77.9	7.8	0.9	13.4
Spain	100	76.0	14.0	3.9	6.0	100	69.7	17.3	2.4	10.7
United Kingdom	100	46.6	36.4	5.2	11.8	100	55.7	35.3	0.1	8.9

Table A.3 – Distribution of new foreign investments of European and non-European MNFs in the period 1991-1999, by NUTS1 region. Percentage values

Country/Region	European MNFs 1991-1999	non-European MNFs 1991-1999	Country/Region	European MNFs 1991-1999	non-European MNFs 1991-1999
Germany			**Italy**		
– Baden-Wuerttemberg	3.0	1.8	– Nord Ovest	0.3	0.3
– Bayern	2.6	2.3	– Lombardia	1.9	1.3
– Berlin	0.5	0.3	– Nord Est	0.5	0.0
– Bremen	0.1	0.1	– Emilia Romagna	0.3	0.2
– Hamburg	0.5	0.6	– Centro	0.3	0.1
– Hessen	2.3	2.2	– Lazio	0.1	0.1
– Niedersachsen	1.2	0.8	– Abruzzo Molise	0.1	0.1
– Nordrhein-Westfalen	4.5	3.3	– Campania	0.1	0.0
– Rheinland-Pfalz	0.8	0.4	– Sud	0.1	0.0
– Saarland	0.1	0.1	– Sicilia	0.1	0.0
– Schleswig-Holstein	0.6	0.4	– Sardegna	0.0	0.0
Spain			**United Kingdom**		
– Noroeste	0.3	0.1	– North	0.5	1.2
– Noreste	0.8	0.5	– Yorkshire-Humberside	1.3	1.5
– Com. de Madrid	1.9	1.4	– East Midlands	1.5	1.8
– Centro	0.4	0.0	– East Anglia	0.5	1.0
– Este	2.7	0.8	– South East (Uk)	7.8	15.6
– Sur	0.3	0.2	– South West (Uk)	0.9	1.6
France			– West Midlands	2.1	3.5
– Ile de France	2.8	1.7	– North West (Uk)	1.6	2.5
– Bassin Parisien	1.9	1.0	– Wales	0.5	0.9
– Nord Pas de Calais	0.8	0.4	– Scotland	0.7	1.9
– Est	1.8	0.4	– Northern Ireland	0.2	0.2
– Ouest	0.8	0.6	**Total**	**100.0**	**100.0**
– Sud Ouest	1.0	0.4			
– Centre Est	1.6	1.0			
– Mediterranee	0.6	0.2			

Source: Elios (University of Urbino)

Table A.4 - Variable List and Description

Regional characteristics

Variable	***Description***	***Source***
Market Size	Log of Value Added in region *j*	Cambridge Econometrics
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*	Elaborations on Cambridge Econometrics
Per-capita GDP	Log of (regional GDP/population)	Cambridge Econometrics and Eurostat
Overall agglomeration	Log of the number of establishments in region *j* (and sector *s*). Also spatial lags are considered	Elios
Foreign-firms agglomeration	Log of the cumulative number of foreign-owned firms within region *j* (and sector *s*). Also spatial lags are considered	Elios
MNF Experience	Log of the number of firms in region *j* controlled by the same parent of firm *n*	Elios
Wages	Log of (wages/total employment)	Eurostat
Population density	Log (Regional Population / Total area in Km^2 of the region)	Eurostat
R&D intensity	Log (Regional R&D expenditures at 1995 / Regional Value added)	Eurostat
Secondary school enrolment ratio	Log (Students enrolled in sec. school at 1995 / Total pop. aged 10-19)	Eurostat
Unemployment Rate	Log of unemployment rate	Eurostat
Structural Funds	Log of European Structural Funds expenditure allocated to the region over the period 1989-1993	European Commission
Objective 1 region	1 if the region is within Obj.1, 0 otherwise	
Public Infrastructure	Index of infrastructure stock in region j at 1985	Confindustria

National policy and institutional variables

Corporate tax rate	Log of national effective average corporate tax rate	Institute for Fiscal Studies
Tax wedge on employment	Log of (sum of social contributions, income taxes and consumption duties over total employment)	Martinez-Mongay C. (2000)
Bureaucracy	Log of (Bureaucracy does not hinder business activity; ; 0=less efficient; 10=more efficient)	IMD
Labour regulations	Log of (Labour regulations (hiring and firing practices, minimum wages,..) do not hinder business activity; 0=more restrictive; 10=less restrictive)	IMD
Legal system and intellectual property right	Log of (Patents and copyright protection is adequately enforced in your country; 0=less effective; 10=more effective)	Frazer Institute