LOCATION AND AGGLOMERATION OF FRENCH FDI IN EUROPEAN COUNTRIES AND REGIONS:

A PROBABILISTIC APPROACH

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ABSTRACT

After having emphasized the geographic concentration of French foreign direct investments (FDI) in Europe, we analyze the location determinants of French multinationals in seven European countries (Belgium, Germany, Italy, The Netherlands, Portugal, Spain and the United Kingdom) and forty seven administrative European regions between 1987 and 1994. Our sample is composed of 614 individual location decisions in industrial sectors.

To understand the main factors which may influence the location of French FDI at both geographic levels, we retain a nested logit model in the econometric analysis. This model is based on a hierarchical structure of the location process of firms: nation – region. We find that, depending on the geographic level considered, the probability to locate a French subsidiary in a particular site is significantly influenced by demand or cost variables and also by the presence of local and French firms.

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Keywords: FDI Location, Agglomeration, Conditional Logit Model, Nested Logit Model.

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I. INTRODUCTION

With the renewal of interest of spatial economic geography, there is an increasing amount of articles in economic literature which are devoted to multinational firms location. An important part of these recent studies emphasizes the phenomenon of agglomeration of FDI and spatial externalities generated by the geographic proximity (see Ferrer (1998) for French firms in European countries and regions, Ford and Strange (1999) on the location of Japanese firms in some European countries or the study of Mayer and Mucchielli (1999) considering Japanese FDI in Europe at national and regional levels).

This study investigates the main determinants of the geographic concentration phenomenon of French manufacturing firms in Europe. The originality of our empirical approach relies on the assumption of the location process of French FDI in the European area. We assess whether the location of French multinationals could result from a sequential process where firms choose at first a country and then a region inside the chosen country to settle a subsidiary. We try to test the idea that French firms do not "directly" choose a city in Europe where they are going to locate but the choice of the production site results from a decision process: country-region. Consequently, thanks to a qualitative approach, we try to understand spatial patterns of French manufacturing investors considering demand, cost and agglomeration variables (i.e. the influence of the presence of other local firms or French plants in the same location). The study focuses on seven European countries: Belgium, Germany, Italy, The Netherlands, Portugal, Spain and the United Kingdom and forty seven administrative European regions during the period 1987-1994.

The paper is organized as follows: the first section briefly underlines some stylized facts on the French FDI location in Europe according to a perusal of our data. The second part of the article outlines the econometric methodology (conditional logit model and nested logit model). In the third part, we present the database and we explain the chosen variables. Finally, we discuss the empirical results.

II. STYLIZED FACTS

Even though French firms started to invest abroad lately (French FDI flows were almost insignificant before the second part of the eighties), nowadays France plays an important role in the world concerning its international investments.
Reaching a historic record of $172 billion in 2000, France became the second most important investor behind the United Kingdom ($250 billion) and before the United States ($139 billion) (UNCTAD, 2001).

With the European construction: the Single Market, the European Monetary Union and the free circulation of capital, firms started to realize opportunities which are offered in Europe and began to internationalize their strategies.

A brief descriptive analysis based on a database of the French Directory of Economic and Foreign Relationships (*Enquêtes-Filiales DREE 2000*) of the French Ministry of Economics, Finance and Industry underlines that nowadays the main part of the French FDI (more than 36%) is located in European countries.

Nevertheless, we show in an recent article that the distribution of FDI is not homogenous from a country to another or across European regions and an increasing French outflows does not mean that French FDI settled "randomly" (Mucchielli and Puech, 2001).

Analyzing the geographic distribution of French international investments highlights some strong geographic disparities at international and intra-national levels. The most attractive countries (in terms of subsidiaries located in the country) are the United Kingdom, Germany, Spain, Belgium and Italy. Those nations regroup more than 75% of French FDI located in Europe. Moreover, at a regional scale, several European regions attract a large part of French FDI, on the contrary, others are unattractive for French international investments.
French FDI are located in industrialized regions or regions which include the capital of the country. For instance, considering the most attractive European regions in terms of the number of French FDI, the respective shares of the Eastern region in Spain, the Lombardy in Italy or South East in the United Kingdom are 8.1%, 5.1% and 3.9% and the ones of Madrid, Brussels and London are respectively equal to 7.1%, 7% and 6.5% (those estimations are calculated from the *Enquêtes-Filiales DREE 2000*)[3].

[3] In the descriptive analysis, the new version of the NUTS classification is retained (NUTS 1 level for all countries except for Finland, Ireland, Portugal and Sweden, NUTS 2 level).

In order to describe the geographic concentration of French FDI in European regions, we calculate in 2000 for each region denoted i a ratio R_i equal to:

$$R_i = \frac{\dfrac{Stock\ of\ French\ FDI\ in\ region\ i}{Stock\ of\ French\ FDI\ in\ Europe}}{\dfrac{GDP\ of\ the\ region\ i}{Sum\ of\ the\ GDP\ of\ all\ European\ regions}}$$

This allows to eliminate the regional "size effect": all things being equal, larger regions attract more FDI than smaller regions. To gauge the geographical concentration by counting the number of FDI located in each region does not take into account any difference in regions size.

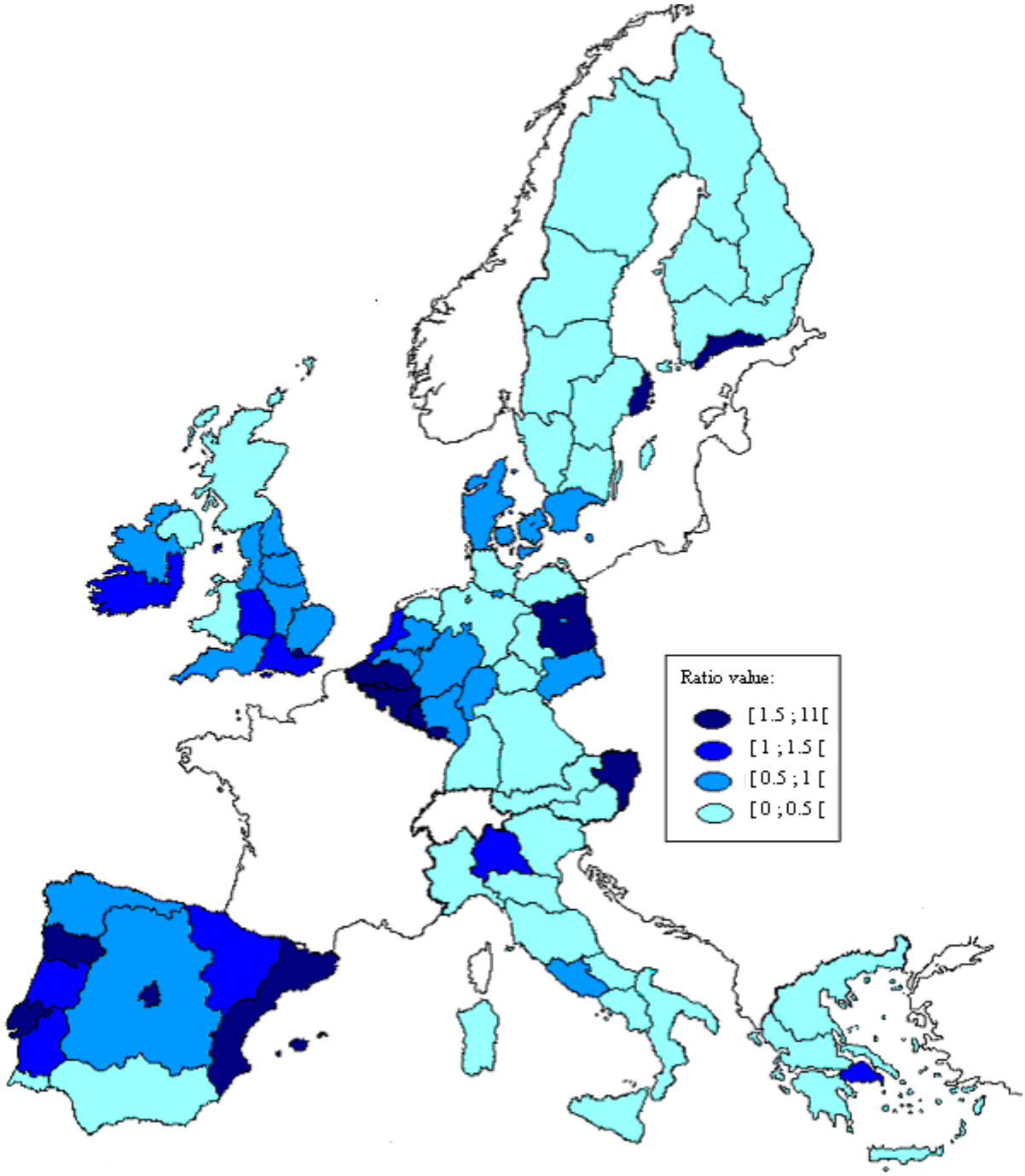
The proposed ratio is an indicator of the regions attractiveness which includes differences in regions size. The numerator denotes the proportion of French FDI in the region i and the denominator represents the share of the region i in the European Gross Domestic Product (GDP).

The benchmark is one. Ratio values greater (respectively smaller) than one indicate that the considered regions have a more important (respectively less important) share of French FDI than their representative economic shares in Europe should have been expected to.

Using the proposed ratio, Figure 1 depicts the attractiveness of European regions for French FDI.

Two main conclusions can be drawn. Firstly, as we previously underlined, industrialized regions or regions which contain the capital are particularly attractive for French FDI. For instance on Figure 1, one can see the attractiveness of the Lombardy or the Eastern region in Spain which are some well-known industrialized European regions. Secondly, two main areas in Europe capture the majority of French FDI. The core European regions receives a large part of French FDI: regions which belong to the area defined by the South of the United-Kingdom, Belgium, The Netherlands and the Western regions in Germany attract proportionally more French investments in comparison with their economic size. The second geographical area particularly attractive for French FDI are the Northern regions in Portugal or in Spain. Conversely, all other peripheral regions are less attractive. It is the case for the most important part of regions in Greece, Italy, Finland or Sweden.

Figure 1: Distribution of the stock of French FDI in European regions in 2000



Source : Estimations calculated from the Enquêtes-Filiales DREE 2000.

III. METHODOLOGY

We want to highlight the location decisions of French firms in the European area and the available database registers individually French subsidiaries located in Europe. Consequently, discrete choice models are particularly well adapted to our target. Our empirical estimations made on qualitative econometric models will allow to understand and also quantify the importance of the main determinants which influence the choice of a specific site.

1. Models *without* a hierarchical structure

In this section, determinants of French firms' location are *separately* studied: by evaluating independently the influence of location variables at national and regional levels.

By assumption, we consider that when a firm wants to locate a subsidiary abroad, the multinational makes a discrete choice considering all of the possible alternatives (which are unranked choices).

Following McFadden (1974), a lot of recent researches study the firms location determinants using a conditional logit model. Table 1 lists some empirical works concerning the location determinants of FDI in manufacturing sectors.

This discrete qualitative choice model is based on the maximization of firms' profit functions. All investors will choose a particular site if and only if this specific location leads the highest profits among all possible alternatives.

In this theoretical framework, each firm can choose between N possible areas for its future location ($j = 1, 2, \ldots, N$; the indexing is of course arbitrary) and profits of each firm associated to the location j can be described as $\Pi_j = V_j + \varepsilon_j$ where V_j is a function of all characteristics and ε_j is an unobservable random error term. We retain the expression: $V_j = \beta X_j$ where X_j is the vector of observable characteristics of the location j and β is the vector of the parameters (which are going to be estimated).

Table 1: Recent articles on manufacturing firms location choice using a conditional logit estimation

Authors	Home Country	Host Country	Period	Geographic Agglomeration	Demand	Labor Costs
Bartik (1985)	The United States	American States	1972-1978	+	Not included	-
Carlton (1983)	The United States	Standard Metropolitan Statistical Areas (only in 3 industries)	1967-1971	+	Not included	NS
Chen (1996)	Foreign Countries	Provinces in China grouped in three regions	1987-1991	Not included	+	NS
Coughlin, Terza and Arromdee (1991)	Foreign Countries	American States	1981-1983	+	+	-
Crozet, Mayer and Mucchielli (2000)	Belgium, Germany, Italy, Japan, The Netherlands, Switzerland, the United Kingdom and the United States	France, 92 Départements	1985-1995	+	+	+/-
Ford and Strange (1999)	Japan	Belgium, France, Germany, Italy, Netherlands, Spain and the United Kingdom	1980-1995	+	+	-
Friedman, Gerlowski and Silberman (1992)	Foreign Countries	American States	1977-1988	Not included	+	-
Guimarães, Figueiredo and Woodward (2000)	Foreign Countries	275 Concelhos in Portugal	1985-1992	+	Not included	+
Head and Ries (1996)	Australia, Canada, Europe, Japan and the United States	54 Cities in China	1984-1991	+	Not included	NS
Head, Ries and Swenson (1995)	Japan	American States	1980-1992	+	Not included	Not included
Head, Ries and Swenson (1999)	Japan	American States	1980-1992	+	+	+/-
Jianping (1999)	China, Japan and the United States	30 Chinese Provinces	1981-1996	+	Not included	-
Luker (1998)	Foreign Countries	American States: South and Midwest	1974-1986	+/-	Not included	-
Mayer and Mucchielli (1998)	Japan	France, Germany, Italy, Spain and the United Kingdom	1984-1994	+	Not included	+
Woodward (1992)	Japan	American States and Counties	1980-1989	+ (County)	+ (State)	-

Note: *NS = variable is not significant,* **+** *(respectively* **-***) means that the variable has a significant positive (respectively negative) impact on firms location choice.*

In those conditions, assuming that random error terms are independently and identically distributed according to a Weibull distribution, McFadden (1974) proved that the probability for a firm to choose the location *j* is given by the conditional logit model: $P_j = \exp(\beta X_j) \Big/ \sum_{k=1}^{N} \exp(\beta X_k)$

Note that each firm will choose the location *j* if the expected profits noted Π_j are superior to all of the expected profits of other locations: $\Pi_j = \max\{\Pi_k\}$ where $k = 1, 2, \ldots, N$ that is to say: $P_j = P(\Pi_j > \Pi_k)$ for all k (and $k \neq j$).

Finally, coefficients which constitutes the vector β are estimated by the maximum likelihood technique.

2. Models *with* a hierarchical structure

An important restriction of the conditional logit model is the hypothesis on the random error terms. We assume that they are not correlated across alternatives. This implies a powerful property called the *"Independence of Irrelevant Alternatives"* (IIA). This well-known IIA hypothesis implies that the ratio of probabilities of any two alternatives is unaffected from the choice set. In other words, it means that adding another alternative in the sample will not change the odds ratio between two other alternatives (for more details, see for instance McFadden 1974, Ben-Akiva and Lerman 1985).

As McFadden (1974) underlined, this assumption is restrictive in many applications. For example, this property is unlikely be respected if two alternatives are closed substitutes.

One way to relax the IIA property is to use a nested logit model. Such econometric model allows the statistician to partition it sample in mutually exclusive groups which seem to have similar attributes. Consequently, the nested logit model describes the location process where individual choices can be interpreted as a multi-stage dynamic process (hierarchical decision structure). In our case, we create a two stages tree structure: nests are constituted by countries (first level) and each nest regroups its respective regions (bottom level). This structure seems *a priori* correct if we consider that two regions which belong to the same country are closer substitutes than two regions from two different countries.

Several articles retain this approach considering the location of firms for instance Hansen (1987), Guimarães *et al.* (1998) or Mayer and Mucchielli (1999). Note that several

authors include some dummies in their model in order to absorb the correlation across choices (Bartik 1985, Woodward 1992, Head *et al.* 1995, 1999).

Basically, let's denote regions $r = 1, 2, \ldots, R$ and countries $c = 1, 2, \ldots, C$. Each firm will choose the alternative which maximizes its profits: $\Pi_{cr} = V_{cr} + \varepsilon_{cr}$. Here, the function of the observed characteristics V_{cr} depends at the same time on characteristics of the nest Y_c (the country) *and* on attributes which vary across regions X_{cr}. We obtain : $V_{cr} = \beta X_{cr} + \alpha Y_c$ where β and α are vectors of parameters which are going to be estimated.

The probability to choose a country depends at the same time on its attributes and also on characteristics of alternatives which composed the nest. We defined an expected maximum utility associated to the nest called *inclusive value* (I_c) which is equal to: $I_c = \log\left(\sum_{i=1}^{R_c} \exp^{\beta X_{ic}}\right)$.

Consequently:

- The probability P_c to choose a country *c* is: $P_c = \exp^{\sigma I_c + \alpha Y_c} \Big/ \sum_{j=1}^{C} \exp^{\sigma I_j + \alpha Y_j}$
- The probability P_{cr} to choose a region *r* is: $P_{cr} = P_{r|c} \times P_c$ where $P_{r|c} = \exp^{\beta X_{cr}} \Big/ \sum_{i=1}^{R_c} \exp^{\beta X_{ci}}$ that is to say : $P_{cr} = \left(\exp^{\beta X_{ic}} \times \exp^{\sigma I_c + \alpha Y_c} \right) \Big/ \left(\sum_{j=1}^{C} \exp^{\sigma I_j + \alpha Y_j} \times \exp^{I_c} \right)$

The σ coefficient of the inclusive value determines the pertinence of the tree structure. As underlined McFadden (see for instance McFadden 1984), $0 < \sigma < 1$ is a sufficient condition for a sequential model. On contrary, if $\sigma = 1$ or $\sigma = 0$, the model is equivalent to a conditional logit model. At last, the value $(1 - \sigma)$ gives the degree of similarity across alternatives.

IV. DATA AND VARIABLES AT NATIONAL AND REGIONAL LEVELS

1. Model and Data

The aim of this study is twofold: to know what are the location and agglomeration determinants of French multinationals in Europe and at which geographic level those variables affect the location choices of French investors.

We use a database of the French Directory of Economic and Foreign Relationships (*Enquêtes-Filiales DREE 2000*) of the French Ministry of Economics, Finance and Industry.

This survey registers French multinationals or multinational firms with a French participation in the world.

This study is the first made on the *Enquête filiales DREE 2000* which lists international French establishments created until 2001. We only retained multinational firms whose subsidiaries belonged to manufacturing sectors. Our sample is composed of 614 individual location choices of French multinationals settled between 1987 and 1994 in seven European countries and forty seven regions (NUTS 1 classification)[4].

The *Enquête filiales DREE 2000* database classifies all sectors of activity according to the NAF 60 which is a French nomenclature of activities. We then ranked those industries according to the NACE European nomenclature at a two digit level and we only kept sectors for which national and regional data were available (described in the appendix).

2. Variables and expected signs

The decision of the optimal site is based on the comparison of attributes of each potential location. The relevant attributes which may influence the location choice are discussed below.

National level

The explained variable is the country chosen by each firm. In our study each multinational has the choice between seven alternatives: Belgium, Germany, Italy, The Netherlands, Portugal, Spain and the United Kingdom.

To understand the location patterns of new plants, we use the well-known distinction of firms location determinants as market seeking, cost seeking and strategic seeking (the last one in order to understand the agglomeration behavior). Hence, three main groups of explicative variables are retained: demand, cost and agglomeration variables.

Market seeking:

To test whether the probability to settle a French firm is significantly influenced by the national market size, we include a variable called $\mathbf{GDP_n}$ in the econometric model. This variable is the Gross Domestic Product of the country the year of the settlement. If we consider that the GDP is a good proxy of the national demand, the expected sign of GDP_n is positive because firms seem to have a greater intensive to settle an affiliate in areas where there are a high market potential.

[4] At the NUTS 1 geographical level, Portugal is at the same time a country and a region.

Cost seeking:

The second main location determinant represents some cost variables.

The average of the annually wage cost per capita in the manufacturing sector (**$WAGECAP_n$**) is retained. Even if high wages could indicate a high level of qualification and skilled workers, it is generally acknowledged that high wages would tend to deter and discourage FDI in the country. The most important part of empirical studies on FDI location underline that multinationals are attracted in areas where there are low labor costs (see for instance Coughlin 1991, Friedman *et al.* 1992, Luker 1998, Jianping 1999, Ford and Strange 1999, Crozet *et al*. 2000). The coefficient of this variable is therefore presumed to be negative. We also add the **$SOCIAL\ CHARGES_n$** variable which represents the social charges per capita in each sector of activity the year of the affiliate settlement. The expected sign of this coefficient is negative.

Another variable included in the model is **$UNEMPLOYMENT_n$** which is the long-term unemployment rate in the country. The expected sign of this variable is unclear because firms may interpret a high unemployment rate as a result of rigidities on the labor market (negative impact) or on the opposite, they can understand it as good signal of a potential availability of workers (positive impact). In the European area, empirical results of the unemployment rate on FDI are ambiguous: Ferrer (1998) found a positive significant impact and Mayer and Mucchielli (1998) a negative significant effect.

Finally, the productivity (**$PRODCAP_n$**) is taken into account in the model. The expected sign of the variable is unclear. For instance Ford and Strange (1999) found a significant negative impact of the productivity on the location choice of FDI and, on the opposite, Friedman *et al.* (1992) or Woodward (1992) conclusions support the fact that a higher productivity would attract international investments.

Strategic seeking:

The third type of determinants measures the agglomeration effects. Here, the strategic behavior is analyzed towards the propensity to agglomerate activities. The idea of the benefits generated by the geographic proximity of firms is not recent. As Marshall (1920) underlined industrial concentration may provide a potential pool of skilled workers, a more easier access to suppliers and a potentiality to beneficiate of knowledge spillovers. Furthermore, it is obvious that multinationals have an imperfect information of foreign potential sites (Johanson and Wiedersheim-Paul 1975, Hirsh 1976). Consequently, to know that other French or local firms are located in a particular area in the foreign market may constitute a key-determinant of

the location strategy. However, some theoretical debates subsist regarding the importance of forces which tend to produce an agglomeration phenomenon and those which bring a spatial dispersion of firms on a given territory (see for instance Krugman 1991, Fujita *et al.* 1999). As an example, on the one hand, the proximity to other firms could constitute a source of geographic agglomeration. For instance, after the location of one firm in a given area, all of the other firms would rather like to follow the former in order to beneficiate of positive effects of intra-industry or inter-industry externalities. On the other hand, numerous firms in the same area can create some centrifugal forces: in this case, firms want to avoid their competitors generating a dispersion effect on the territory.

However, empirical studies of FDI location generally support the fact that the number of local firms has a positive impact on multinationals location (Ford and Strange 1999, Head and Ries 1996, Head *et al.* 1995, 1999, Crozet *et al.* 2000).

The distinction between several agglomeration/dispersion forces has to be done to analyze the agglomeration patterns more precisely. Firstly, we create a variable labeled **STOCK FRENCH SECTOR$_n$** which is the sum of French affiliates of *the same sector of activity* located in the country the year before the settlement. It was necessary to add one to the stock of French FDI because for some sectors the first French investment was made during the period 1987-1994. Consequently, we use the technique proposed by Head *et al.* (1995) to avoid any problem by taking the logarithm form. The predicted sign of the STOCK FRENCH SECTOR$_n$ coefficient is unclear because it seems that there is not a main location trend of the French firms location in Europe according to their sector of activity (Mucchielli and Puech, 2001).

Secondly, we create a variable called **STOCK FRENCH INDUSTRY$_n$** which corresponds to one plus the stock of French manufacturing FDI located in the country the year before the settlement. We expect a positive sign of STOCK FRENCH INDUSTRY$_n$ because the more the cumulated count of French affiliates settled in a country, the more attractive the potential host country is. To know that other French multinationals had already settled in a country could be understood as a positive signal to invest in the host country. Finally, we have to distinguish whether French firms have a typical behavior when they choose a geographical site for their subsidiaries or, for example, if they simply follow the location patterns of local firms. The variable **SHARE HOST$_n$** tries to capture a "host country agglomeration effect". It represents the number of local employees which belong to the same sector of the affiliate in comparison with the whole manufacturing employment in the host country. We consequently expect a positive sign associated to SHARE HOST$_n$.

We summarize sources and definitions of explanatory variables in Table 2.

Regional level

The dependant variable is the region chosen by each firm across forty seven administrative European regions (for the complete list of regions see Figure 4 in the appendix).

Firstly, we retain the Gross Domestic Product of the region the year of the settlement as a proxy of the regional demand. We called this variable $\mathbf{GDP_r}$. Secondly, to capture labor cost, we add a regional cost variable which is represented by the average of the annually wage cost per capita in the sector ($\mathbf{WAGECAP_r}$). Moreover, we include the variable $\mathbf{UNEMPLOYMENT_r}$ which is the long-term unemployment rate in the region. Thirdly, concerning agglomeration variables, we also keep the same name variables $\mathbf{SHARE\ HOST_r}$, $\mathbf{STOCK\ FRENCH\ INDUSTRY_r}$ and $\mathbf{STOCK\ FRENCH\ SECTOR_r}$ but all of those variables are of course defined at regional level.

We expect the same signs for regional variables as those previously described at national level. Nevertheless, the interest of differentiating national and regional levels is to show *at which geographic scale* determinants affect the location choice. For instance, we can assume that some variables like agglomeration variables would have a more important impact on the location choice at a thin economic level.

All regional variables are described in Table 3.

Table 2: Description of independent variables at national level

Variable	Definition	Source
GDP_n	GDP of the country the year of the settlement.	CHELEM
$WAGECAP_n$	Annual average wage per capita in each sector of activity the year of the affiliate creation.	OECD
$SOCIAL\ CHARGES_n$	Social charges per capita in each industry the year of the settlement.	EUROSTAT: Structure and activity of industry
$UNEMPLOYMENT_n$	Long-term unemployment rate in the country the year of the settlement.	EUROSTAT
$STOCK\ FRENCH\ INDUSTRY_n$	One plus the stock of French affiliates in manufacturing sectors the year before the settlement in the country.	DREE 2000
$STOCK\ FRENCH\ SECTOR_n$	One plus the stock of French multinationals which belong to *the same sector* the year before the settlement in the country.	DREE 2000
$SHARE\ HOST_n$	Number of employees which belong to *the same sector* compared to the whole manufacturing industry employment in the country.	OECD
$PRODCAP_n$	Annual average production per capita in each sector of activity the year of the affiliate creation.	OECD

Table 3: Description of independent variables at regional level

Variable	Definition	Source
GDP_r	GDP of the region the year of the settlement.	EUROSTAT: Regio
$WAGECAP_r$	Annual average wage per capita in each sector of activity the year of the affiliate creation in the region.	EUROSTAT: Structure and activity of industry
$UNEMPLOYMENT_r$	Long-term unemployment rate in the region the year of the settlement.	EUROSTAT: Regio
$STOCK\ FRENCH\ INDUSTRY_r$	One plus stock of French affiliates in manufacturing sectors the year before the settlement in the region.	DREE 2000
$STOCK\ FRENCH\ SECTOR_r$	One plus stock of French affiliates in manufacturing sectors which belong to *the same sector of activity* before the settlement in the region.	DREE 2000
$SHARE\ HOST_r$	Number of employees which belong to *the same sector* compared to the whole manufacturing industry employment in the region.	EUROSTAT: Structure and activity of industry

V. RESULTS

Empirical results are depicted in Tables 4 and 5. The estimated coefficients of explanatory variables are discussed at first considering independently the two geographic levels and in a second part considering the hierarchical structure: countries/regions.

1. Empirical results *without* a sequential structure

The econometric model 1 and 2 are estimated without an eventual tree structure: investors consider separately the two geographical levels.

Firstly, it is noteworthy that all significant variables have the expected sign. Considering demand and cost variables, we can emphasized that the probability to locate a new subsidiary in a particular region or country is all the more important that local demand is high and the level of wages is low.

If we consider the GDP as a good proxy of demand we show that this determinant constitutes at national and regional levels a relevant factor to locate new plants. The probability for a firm to invest in one of the seven European countries or in the forty seven European regions will increase if the local expected demand (or the size of the local market) is important. Moreover, empirical results at both geographic levels suggest that the wages per capita variables have a strong impact on the location choice of French affiliates. Their high negative coefficients prove that firms are very sensitive to the level of wages they would have to pay if they create a subsidiary in Europe. In the economic literature on FDI location, some studies find a significant negative impact of labor cost variables (see Table 1) in particular, Mayer and Mucchielli (1999) put the stress on the wages variable which represents a key determinant at regional level for Japanese FDI location in Europe.

Secondly, the three agglomeration variables are significant and the coefficient associated is always positive. French firms detect a positive signal from areas where some country partners (which belong to the same industry or not) or some local manufacturing activities are located. In other words, existing local manufacturing activity is estimated to have a positive effect on new multinationals location. To sum up, it seems that agglomeration forces tend to be stronger than dispersion forces and French FDI copy the location behavior of local firms or the one of their country partners. Ferrer (1998) who studies the location of

French FDI in Europe also finds that agglomeration variables have a significant positive impact.

Table 4: Maximum likelihood estimation results of the conditional logit models

Model *without* a hierarchical structure			
National level		**Regional level**	
Variables	**Model 1**	**Variables**	**Model 2**
GDP_n	0.20 ***	**GDP_r**	0.21 **
	(0.07)		(0.08)
$WAGECAP_n$	- 0.80 ***	**$WAGECAP_r$**	- 0.73 ***
	(0.27)		(0.13)
STOCK FRENCH INDUSTRY$_n$	0.33 *	**STOCK FRENCH INDUSTRY$_r$**	0.50 ***
	(0.19)		(0.07)
STOCK FRENCH SECTOR$_n$	0.54 ***	**STOCK FRENCH SECTOR$_r$**	0.44 ***
	(0.11)		(0.08)
SHARE HOST$_n$	0.22 *	**SHARE HOST$_r$**	0.32 ***
	(0.12)		(0.06)
UNEMPLOYMENT$_n$	0.10	**UNEMPLOYMENT$_r$**	- 0.01
	(0.10)		(0.07)
$PRODCAP_n$	0.02		
	(0.23)		
SOCIAL CHARGES$_n$	0.05		
	(0.14)		
Log – Likelihood	- 1049.20	**Log – Likelihood**	- 1992.33

Note: All variables are taken in logarithm. Standard errors are in parentheses. *, ** and *** denote significance levels at 10%, 5% and 1% respectively.

Besides, coefficients associated to agglomeration variables: STOCK FRENCH INDUSTRY, STOCK FRENCH SECTOR and SHARE HOST are quite similar at national and regional levels. This means that agglomeration variables have the same influence at both geographic levels. Nevertheless, we could have been expected that regional coefficients values of agglomeration variables would have been stronger than national ones.

Finally, we can note that regional and national unemployment rates, the productivity and the social charges variables are not significant.

2. Empirical results *with* a hierarchical structure

Considering empirical results of nested logit models (model 3 and 4), the tree structure is relevant and several variables are only significant at national level, conversely others are only significant at regional level and at last one variable is pertinent at both geographical scales. However, all significant variables have the correct expected sign.

Relevance of the tree structure

The proposed tree structure is validated (models 3 and 4). Nesting regions inside countries seems to be a good specification of the tree structure according to the inclusive

value coefficient (all coefficients of inclusive values belong to the unit interval]0;1[) and to the variable significances (at a 10% or 1% threshold).

Table 5: Maximum likelihood estimation results of the nested logit models

	Variables	Model *with* a hierarchical structure	
		Model 3	**Model 4**
Regional level	**GDP_r**	0.30 ***	0.28 ***
		(0.11)	(0.11)
	$WAGECAP_r$	0.39	
		(0.44)	
	STOCK FRENCH $INDUSTRY_r$	0.44 ***	0.47 ***
		(0.10)	(0.09)
	STOCK FRENCH $SECTOR_r$	0.33 ***	0.32 ***
		(0.10)	(0.10)
	$SHARE\ HOST_r$	0.29 ***	0.30 ***
		(0.08)	(0.08)
	$UNEMPLOYMENT_r$	- 0.13	- 0.14
		(0.12)	(0.12)
National level	**GDP_n**	0.00	
		(0.13)	
	$WAGECAP_n$	- 1.03 ***	- 0.92 ***
		(0.30)	(0.27)
	$SOCIAL\ CHARGES_n$	0.16	0.18
		(0.16)	(0.15)
	STOCK FRENCH $INDUSTRY_n$	0.28	0.17
		(0.19)	(0.20)
	STOCK FRENCH $SECTOR_n$	0.41 ***	0.38 ***
		(0.13)	(0.11)
	$SHARE\ HOST_n$	0.07	0.03
		(0.14)	(0.13)
	$UNEMPLOYMENT_n$	0.09	0.12
		(0.10)	(0.10)
	$PRODCAP_n$	- 0.02	0.01
		(0.23)	(0.23)
	Inclusive Value	0.54 *	0.70 ***
		(0.30)	(0.18)
Log – Likelihood			
	regional level	- 931.60	- 932.00
	national level	- 1047.56	- 1046.48

Note: All variables are taken in logarithm. Standard errors are in parentheses. * and *** denote significance levels at 10% and 1% respectively.

As we underlined, the inclusive value coefficient is essential because it indicates the degree of choices substitutability. If the inclusive value coefficient is equal to zero or one, this implies that we can model separately both geographical levels (two conditional logit models) without the proposed hierarchical structure. However, if the coefficient of the inclusive value belongs to the unit interval]0;1[this proves that nested regions inside countries is relevant and the value of the coefficient $(1 - \sigma)$ gives the degree of similarity across alternatives. For instance, $(1 - \sigma)$ closed to one attests that regions which belong to the same nest are very

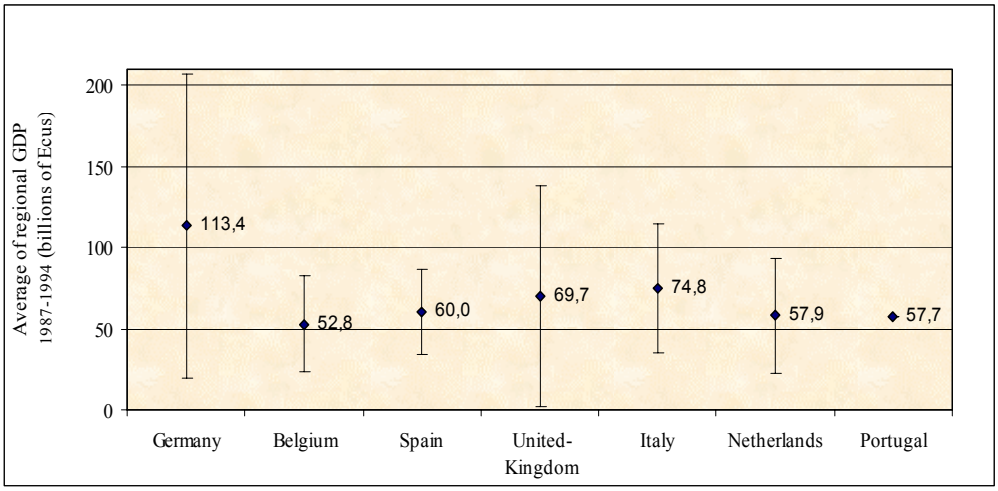
similar on the opposite, (1 - σ) closed to zero indicates that two regions which belong to the same country are quite different. We can easily show that considering the complete econometric model 3, the tree structure is particularly relevant because this models a situation where national and regional characteristics matter (coefficient of the inclusive value is equal to 0.54). As a result, in our econometric models, the significance of the inclusive value coefficient demonstrates that modeling independently the location choice of French multinational firms in countries and then regions constitutes an inappropriate approach and the correct econometric method is the nested logit model.

Demand and cost variables

Demand and wages variables have a significant impact on the location choice decisions but their significant influence occurs at different geographic scales.

The demand variable is only significant at regional level. This underlines that investors consider the regional GDP in their strategies and a higher regional market size will increase the probability to choose a particular region. If we analyze more precisely regional GDP per country we can show that there are important differences between regions which belong to the same country. Figure 2 depicts the average regional GDP on the period 1987-1994 per country and standard deviations associated. The variability of regional GDP inside the same country is high. This could explain why the demand variable has an impact on firms location strategies at a regional level.

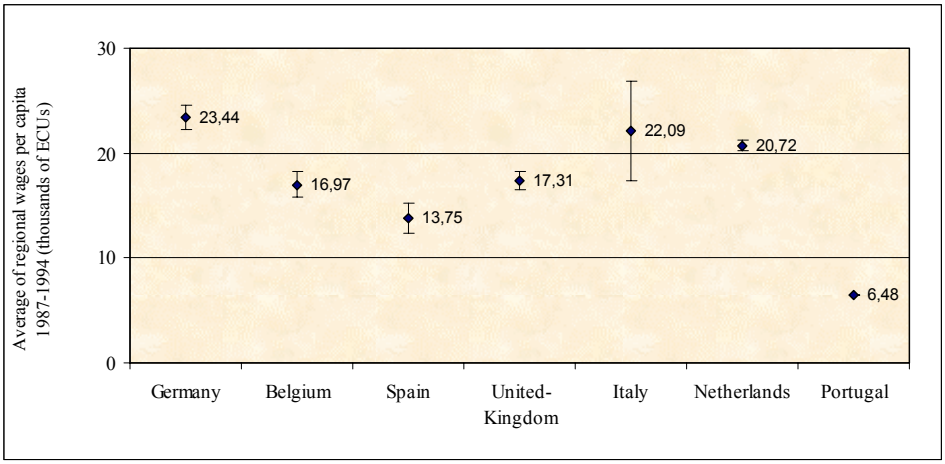
Figure 2: Average of regional GDP (1987-1994)



Conversely, if we analyze the regional annual value of wages per capita per country on the same period (Figure 3), we can show that the mean of the annual regional wages per

capita is quite different from a country to another and standard deviations associated are small. Consequently, wages per capita is likely to be a national determinant of location choice if we use a nested approach. As we find in model 3, the wages variable is only significant at national level and the level of this labor cost constitutes a key determinant in FDI location strategies: coefficient associated to national wages is the most important (–1.03).

Figure 3: Average of regional wages per capita (1987-1994)



Nevertheless, we have to make additional comments. Firstly, Figure 3 points out that Belgium and the United-Kingdom have approximately the same average regional level of wages per capita in industrial sectors on this period and in Italy, there are some notable regional differences for this variable. Secondly, in our econometric model, we use two different sources of wages per capita for the two geographic levels consequently the national average level of wages per capita is not exactly the same as the average of regional wages per head.

Finally, in the model 4, we remove the wages per capita at regional level and the GDP at national level. All coefficients of explicative variables remain stable and the one of the inclusive value is greater (0.7) but significant at a 1% threshold.
Moreover, in both econometric models, the unemployment, social charges and productivity variables are not significant.

Agglomeration variables

Empirical results of the nested model underline the existence of agglomeration economies which occur at the same time at national of regional levels. We can show that there is only one agglomeration variable which is significant at national level whereas all of the

three variables are significant at regional level. Here, with a well-specified econometric model, empirical results show that agglomeration effects take place at short distances (for instance spatial externalities generated by the geographic proximity like externalities of technology, knowledge etc. occur in a close environment).

Moreover, regional results demonstrate the existence at the same time of intra-industry geographic concentration (from their own country partners or from local competitors) and inter-industry concentration (French firms are attracted in regions where there are other French firms). As a result, French firms are attracted in industrial areas.

VI. CONCLUSION

Thanks to a qualitative approach, we prove in this article that studying location and agglomeration determinants of French firms at both geographical levels is relevant because the influence of those factors differs according to the considered geographic scale. Moreover, the multi-stage process is validated consequently we have to model the location patterns of French FDI with a nested structure if we want to analyze the location determinants in European countries and European regions.

Finally, econometric results indicate that demand and labor cost variables constitute an important element in the French firms location strategies but also the presence of other French firms (which belong to the same activity sector or not) or local competitors represents a key determinant for the location choice of a future affiliate.

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VIII. APPENDIX

Figure 4 : The tree structure of the location set : 7 countries and 47 regions
(46 regions NUTS 1 + Portugal NUTS 0)

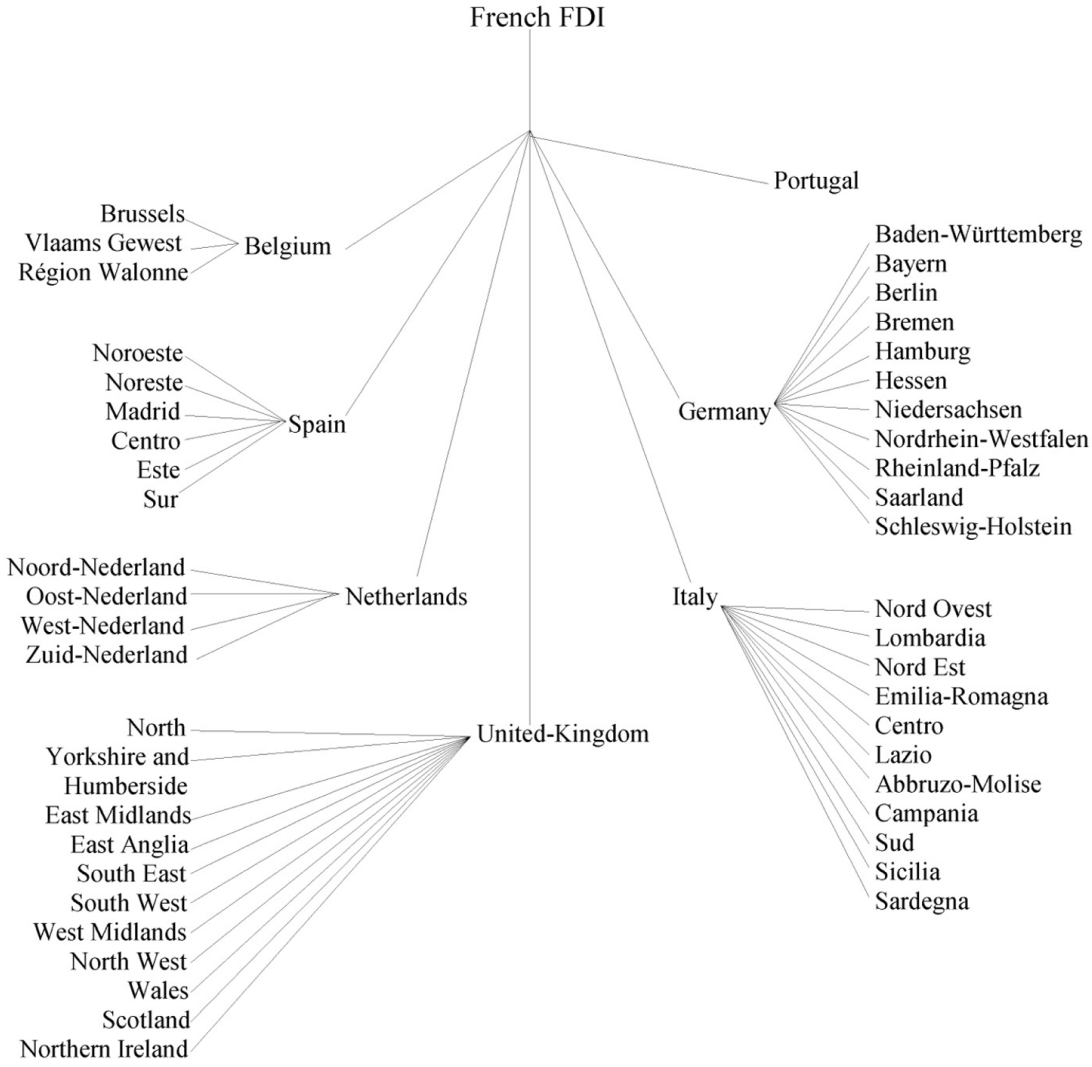

Table 6: The sixteen industrial sectors of activity (NACE 2 digit)

22: Production and preliminary processing of metals
24: Manufacture of non-metallic mineral products
25: Chemical products
32: Mechanical engineering
33: Manufacture of office machinery and data processing machinery
34: Electrical engineering
35: Manufacture of motor vehicles and of motor vehicle parts and accessories
36: Manufacture of other means of transports
37: Instrument engineering
41 and **42:** Food, Drink and Tobacco industry
43: Textile industry
45: Footwear and clothing industry
47: Manufacture of paper and paper products; printings and publishing
48: Processing of rubber and plastics
49: Other manufacturing industries