Do U.S. Multinationals Engage In Sequential Choice? Evidence from New Manufacturing Operations in Europe

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Abstract

Despite an extensive literature on the determinants of the foreign location choices by multinational companies, researchers have only recently begun to systematically examine how these companies form their location consideration sets. When considering new foreign locations, do firms evaluate the attributes of the alternatives at the national level, the sub-national regional level, at some other level of geographical aggregation, or using some combination of these? This paper employs discrete choice models to examine how U.S. multinational companies form their location consideration sets and to identify some of the relevant location attributes. The results indicate that U.S. firms tend to employ a sequential, or hierarchical, decision-making process in which a host country is first chosen based on one set of attributes and then a region within that country is chosen based on another set of attributes. The relevant location attributes include industrial agglomeration and labor market conditions.

1 Introduction

There is an extensive literature on the determinants of the foreign location choices of multinational companies. Most of these studies model location choice using *discrete* choice methods, which pertain to the case in which a firm has already decided to invest a certain amount of its resources abroad but needs to deliberate over exactly where to invest those resources. In addition to choosing between discrete choice methods and alternative methods, it is also important to consider how firms compose their location consideration sets. Do firms evaluate broad geographic areas (such as Europe or Asia), countries, regions within those countries, some other geographical unit, or some combination of these? Thill (1992) (page 364)

notes that the correct specification of consideration sets is essential to ensuring meaningful empirical results when analyzing discrete choices such as location choice.

> [C]orrect estimation of model parameters and correct prediction of choices by discrete choice models is conditional on correct information about consideration sets. Whenever information is deficient, discrete choice modelling usually results in erroneous estimations.

Nevertheless, many location choice studies provide little or no discussion of this important point and provide no evidence of having tested alternative specifications of consideration sets.

Researchers who have examined the composition of location consideration sets have generally found that firms employ a sequential choice process when choosing new business locations [Hansen (1987), Guimaraes et al. (1998), Mayer and Mucchielli (1999), Mucchielli and Puech (2004), Schmenner (1994)]. That is, firms tend to first select a large geographic area (such as a country) based on one set of attributes and then select a smaller geographic area within that larger area (such as a city or region) based on another set of attributes. Such behavior accords with the psychology and marketing literature that suggests that groups and individuals engage in sequential choice in order to limit the number of alternatives and the number of criteria they must simultaneously consider [Tversky (1972), Grether and Wilde (1984), Roberts and Lattin (1991)]. Individuals might engage in this sort of behavior for reasons such as natural limitations on human cognitive ability. Firms might be even more inclined to narrow their field of choice—particularly toward traditional locations—because of the additional constraints, such as organizational

inertia, which can exist at the group level.[1]

The notion of restricted location consideration sets also tends to be supported by the case-study literature. Based on a detailed analysis of the foreign location choices of 38 U.S. multinational companies, Aharoni (1966) (p. 54) observed:

> [O]nly a handful of companies in [the United States] resolved to look for foreign investment opportunities, and even in these few cases, the resolution was generally restricted to investments in European Common Market countries.

This seminal contribution has been supported by more recent case-study analysis such as Haigh (Fall 1990), Jayet and Wins (1993), and Bingham and Eisenhardt (2005). This literature also supports the notion of a sequential choice process. Blackbourn (1974) (pp. 249-50) notes that one large U.S. multinational, International Business Machines, developed a routine for evaluating new foreign business locations in which a country would first be selected and then regions within that country would be evaluated.

This paper will examine how firms form their location consideration sets and which location attributes they consider using data on U.S. multinational companies' new manufacturing investments in seven European countries over the period 1989-2003. Like the aforementioned studies, the paper will employ discrete choice models of location choice but, unlike all the papers except Mayer and Mucchielli (1999), it will consider some alternative specifications of the choice process. It will examine whether firms appear to evaluate location attributes at the national level,

[1] Rumelt (1995) discusses five major sources of organizational inertia: Distorted perception, dulled motivation, failed creative response, political deadlocks, and action disconnects.

the sub-national regional level, or whether they evaluate some attributes at different levels. The dependent variable used in this study is based on confidential data from mandatory surveys conducted annually by the U.S. Bureau of Economic Analysis. These data have been augmented with information on the regional location of the investments within a country based on Bureau Van Dijk's *Amadeus* database and other private data sources.

The measures of location attributes are national and regional data on gross domestic product, employment, wage rates, average education levels, and unemployment rates produced by Eurostat and on national-tax-rate data from the University of Michigan's World Tax Database. To aid comparison with the preceding studies, this empirical analysis in this paper begins with a baseline model that closely follows the scope and methods employed in Mayer and Mucchielli (1999).

This paper has three major findings:

1. **U.S. multinationals tend to employ a sequential choice process when choosing new manufacturing operations in Europe.**The statistical results are consisent with a decision-making process in which a country is selected based on national attributes that include industrial agglomeration, and then a region within that country is selected based on regional attributes that include worker skill levels, industrial agglomeration and transportation infrastructure.

2. **The importance of industrial agglomeration, found in the aforementioned studies of the locations of multinational companies, is confirmed.** This result, combined with the result that candidate locations are not penalized by high local wage rates, suggests that location attributes related to industrial agglomeration (such as proximity to customers and the availability of workers with

the necessary skills) dominate location attributes related to factor prices (such as the availability of cheap land or low-wage labor).

3. **Firms appear to evaluate greenfield investments in at least roughly the same way as they evaluate targets for acquisition.** Although the factors that must be considered in these two types of investment are not identical, the location attributes studied in this paper appear to be considered in both cases.

The remainder of the paper is organized as follows. The first section presents summary statistics for new manufacturing investments of U.S. multinational companies during the period considered. The second section presents the empirical models used to examine the location choices of U.S. multinationals. The third section discusses the data used in estimation. The fourth section presents the empirical results, and the fifth section concludes and offers suggestions for further research.

2 New Manufacturing Investments in Europe by U.S. Multinationals

The relevance of regional attributes in location choice is suggested by the regional distribution of new manufacturing investments by U.S. multinational companies.[2] During 1989-2003, the new investments in the 51

[2]The regions considered in this paper are from Eurostat's 1999 Nomenclature of Territorial Units for Statistics (NUTS) classification system. Each one-digit NUTS category represents either an administrative region (such as Wales in the United Kingdom or the 16 *Länder* in Germany) or a major geographic zone (such as Eastern France or Southern Spain). These regions are generally delineated in an economically meaningful way: They are of roughly comparable size (with a population of between 3 and 7 million) and they are sometimes under unified legislative, fiscal, and executive oversight.

European regions considered tended to be concentrated in particular zones within the individual countries such as Eastern Spain, Northern Italy, and Western Germany (Figure A-1). In Spain, two out of the six statistical regions (*Este* and *Noreste*) accounted for three-quarters of the new investments (Table A-1). This geographic concentration partly reflects the overall pattern of industrial concentration in Western Europe.

The relevance of national attributes in location choice can by illustrated by national patterns in the residuals (i.e. differences between the actual and predicted values) from a simple linear econometric regression. The attractiveness of the individual European regions should primarily be a function of the attributes of those regions which affect the return on investment. By regressing the number of investments received by the 51 European regions on the location attributes, the model should absorb the effects of those attributes leaving a normally-distributed, mean zero, regression residual.[3] For this exercise, four location attributes are considered: (1) market size, (2) wage rate, (3) worker education level, and (4) extent of transportation infrastructure.[4]

The set of location attributes considered in this exercise is intentionally parsimonious. While the four specified attributes are among those that are found to have the strongest predictive power in the more extensive statistical analysis in section 5 of this paper, the list is not exhaustive. There are other unspecified attributes—both quantifiable (such as industrial agglomeration) and unquantifiable (such as employees' attitudes toward work)—that undoubtedly affect location choice. To the extent that

[3]The regressand data for this regression is a 51 row column vector in which each row represents the total number of investments that a particular region received in the 1989-2003 period.

[4]The vector of regressors for this regression is a fifty-one-by-four matrix in which each row describes the average value, in 1989-2003, of the four considered attributes for each of the 51 European regions.

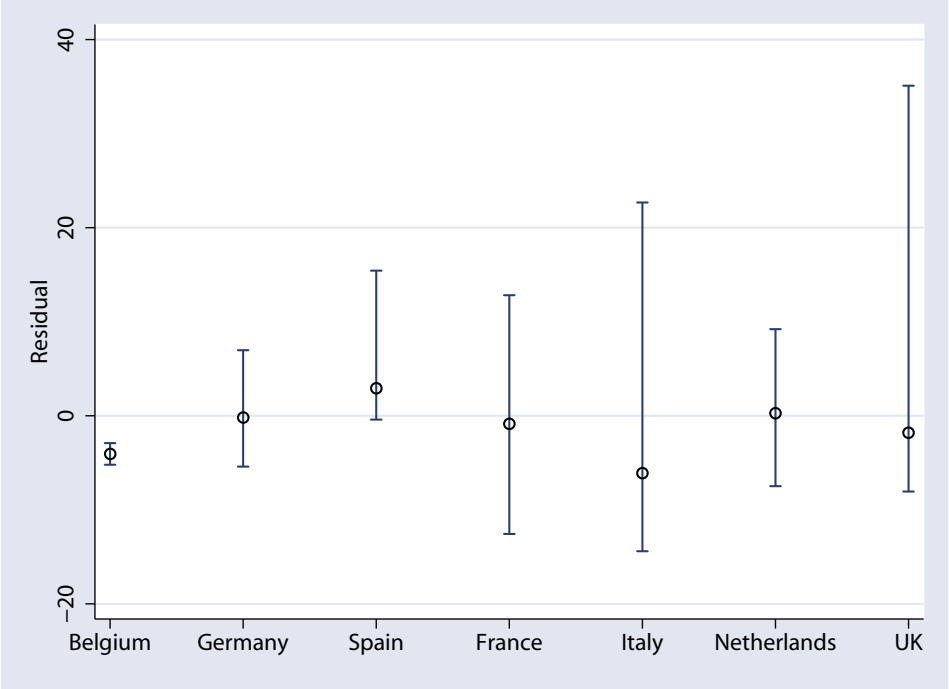

Figure 1: Range (|–|) and Median Values (o) of Regression Residuals (Actual values less predicted values)

the regions of a country possess common unspecified attributes that are uniformly attractive or unattractive to investors, the regression residuals for the regions of an individual country will biased in either a positive or negative direction.

Figure 1 presents summary statistics of the regression residuals, organized by country. For most countries, the median residual—across the regions of that country—is close to zero, suggesting that the regions of those countries do not share any common distinguishing attributes (other than the four specified attributes) that affect location choice. However, for a few countries, such as Belgium, Spain, and Italy, the residuals appear to be systematically above or below zero, suggesting that the regions of these

countries do share common distinguishing attributes that affect location choice. Further evidence of the national significance of location attributes is presented in section 5.3.

In summary, the regional and national patterns of the new manufacturing investments by U.S. multinational companies presented in this section suggest that these companies evaluate location attributes at more than one geographic scale. The importance of regional attributes is suggested by the strong regional concentration of the investments within a particular country and the importance of national attributes is suggested by patterns in the regression residuals.

3 Empirical Models

Most empirical models of location choice use a discrete dependent variable. The behavioral interpretation of these models, which distinguishes them from models using a continuous dependent variable, is that firms consider every new location choice to be a significant commitment of resources and that the choice of *where* to invest dominates the choice of *how much* to invest. These models can be classified as either compensatory or non-compensatory choice models. In a compensatory choice model, all attributes of all alternatives are evaluated at once so that alternatives that do not score well on any particular attribute may still have a chance of being selected by scoring especially well on some other attribute. In a noncompensatory choice model, such as the sequential choice model, choice occurs in stages and alternatives that do not score well on attributes that are considered in the first stage are eliminated from further consideration, no matter how well they might score on attributes to be considered in later stages.

The statistical analysis to follow will present three models of firms' location

choice process: (1) A choice of country based on strictly national location attributes, (2) a choice of region based on strictly regional attributes, and (3) a two-tier choice over country and region within country based on national and regional attributes. In the first two models, the representative firm simultaneously deliberates over all candidate countries or regions based on all relevant national or regional attributes. In the third model, the sequential choice model, the representative firm first deliberates over the candidate countries based on certain national attributes and, once a country is selected, then deliberates over regions within that country based on certain regional attributes. The first two models simulate a compensatory decision-making process and the third model simulates a non-compensatory decision-making process. The appendix provides a technical description of these models.

4 Data

The dependent variable in this paper is the incidence of newly acquired or established manufacturing operations by U.S. multinational companies in seven European countries: Belgium, France, Germany, Italy, the Netherlands, Spain, and the United Kingdom. The sample consists of 641 of these operations that were newly acquired or established over the period 1989-2003 based on mandatory surveys conducted annually by the U.S. Bureau of Economic Analysis (BEA). Within the dependent variable data, newly acquired operations and newly established ("greenfield") operations can be separately identified. Because BEA surveys do not collect information on the location of these operations below the national level, it was necessary to link the BEA records to external information on the regional location of these businesses. In some cases, this information was derived from Bureau Van Dijk's *Amadeus* database of information on

European companies. In other cases, it was derived from various sources on the Internet.

The independent variables measure host country attributes that are most commonly found in studies of firms' location choice: market size, wage rate, education unemployment rate, tax rate, industrial agglomeration, infrastructure and familiarity.[5] All of the independent variables have been lagged one year to acknowledge the time required for search and other activities related to establishing a new business location.[6]

To ensure that the measured attributes of the candidate locations are as relevant as possible to the investing firms, some of the independent variables are specific to the industry of the newly acquired or established firms. Eurostat produces both national and regional data disaggregated by its own industrial classification system, *Nomenclature générale des Activités économiques dans les Communautés Européennes* (NACE).[7] Table 1 presents the 11 NACE industry subsectors that were used in this paper. These subsectors comprise all of the NACE subsectors for manufacturing industries except for leather products (NACE code dc), wood products (NACE code dd), and petroleum products (NACE code df), all of which were excluded because there were only a few observations for the dependent variable in these industries. To associate these data with the observed investments, it was necessary to assign a NACE code to the dependent variable data. This was done using the detailed verbal description of these businesses' activities that was found using the same sources that were used

[5]For a tabular summary of empirical findings of earlier studies, see table 2.1 in Mucchielli and Puech (2004).

[6]Jayet and Wins (1993) found, for example, that the median location time for a multinational company investing in France was 12 months.

[7]The NACE classification system used for this study (Rev. 1.1) is fully consistent with the United Nations' International Standard Classification of All Economic Activities (ISIC) Rev. 3.1.

to determine the regional locations of these businesses.

Table 1: 11 NACE Manufacturing Industry Subsections

NACE code	Description
da	Food Products, Beverages, and Tobacco
db	Textiles and Textile Products
de	Pulp, Paper and Paper Products Publishing and Printing
dg	Chemicals, Chemical Products and Man-made Fibers
dh	Rubber and Plastic Products
di	Other Non-metallic Mineral Products
dj	Basic Metals and Fabricated Metal Products
dk	Machinery and Equipment Not Elsewhere Classified
dl	Electrical and Optical Equipment
dm	Transport Equipment
dn	Manufacturing Not Elsewhere Classified

4.1 Agglomeration Variables

Certain geographical locations within a country clearly attract a disproportional share of firms, especially in particular industries. There are a number of possible explanations for this "industrial agglomeration." The most fundamental explanations, put forth by Marshall (1920), relate to cost-reducing and productivity-enhancing effects of agglomeration. The potential benefits include proximity to supplying firms, the availability of a pool of workers possessing industry-specific skills, and knowledge spillovers. Others, such as Knickerbocker (1973), have considered an industrial organization perspective in which firms in oligopolistic industries tend to mimic the location patterns of their rivals in an effort to "fare no worse" than their competitors. Still others, such as Johanson and Widersheim-Paul

(1975), offer a behavioral interpretation of mimicry, in which firms interpret the success or failure of their competitors in an unfamiliar location as a signal of the expected future profitability of investing in that location.
The measure of industrial agglomeration used in this paper is known as a "location quotient" (see Barber (1988)). The location quotient measures the industrial specialization of a geographic region by comparing the weight of a specific industry in a region to the weight of that industry in a larger geographic area. This paper considers both a national measure (LQ_n) and a regional measure (LQ_r) of industrial agglomeration. The regional index is calculated using Eurostat data on national and regional employment data based on the following formula:

$$\frac{EMP_{ir}}{EMP_r} / \frac{EMP_{ie}}{EMP_e} \tag{1}$$

where EMP refers to average annual employment, i refers to industry, r refers to region, and e refers to the total for the seven European countries covered by this paper. An index significantly greater than one would indicate the presence of industrial agglomeration. The expression for the national index of industrial agglomeration is derived by substituting the r subscripts in the numerator of the index with n subscripts. The location quotients are calculated using median annual values for the entire 1988-2002 period in order to accommodate missing values and outliers. The employment data used to calculate the location quotients are from Eurostat.

4.2 Market Size Variable

An important determinant of location choice is market size. In fact, access to local markets may be the most common explanation that multinationals offer for choosing to operate in a foreign country. Having a local presence allows these firms to avoid transportation costs and tariffs that they might

face if they were to serve the foreign market through exports. It can also help the firms tailor their products to the tastes of local consumers, and it can reduce the possibility of a political backlash if sales of their products encroach on sales by indigenous firms. Because larger markets can offer a higher absolute level of profits as well as economies of scale in production, market size is expected to be positively related to industrial location. The most relevant geographic dimension for market size is somewhat ambiguous and will probably vary according to factors such as the industry and the export orientation of the firm. Gross product originating in the host nation (GP_n) and region (GP_r) were chosen as the measure of market size because, for the period under consideration, most sales by the European manufacturing affiliates of U.S. companies were to customers in the host country. The gross product data are from Eurostat.

Table 2: Definitions and Expected Effect of Location Determinants

Market size (GP)	Gross domestic product (+)
Wage rate (W)	Average hourly wage rate (-)
Education (EDU)	Percent of workforce with at least a secondary education (+)
Unemployment rate (U)	Unemployment rate (+/-)
Tax rate (TAX)	Maximum statutory income tax rate (+/-)
Industrial agglomeration (LQ)	Location quotient based on industry employment (+)
Infrastructure ($INFR$)	Ratio of length of roads to total surface area (+)
Familiarity (FAM)	Dummy variable for a prior investment in host country (+)

Tax rates are from the University of Michigan's World Tax Database.
Familiarity variable derived from U.S. Bureau of Economic Analysis data.
All other data items are from Eurostat.

4.3 Labor Market Variables

Three perspectives on local labor market conditions that might be important to manufacturing firms are average wage rates, average worker

skill levels, and the rate of unemployment. All else equal, one would expect wage rates to be negatively related to industrial location because firms are expected to be cost minimizers. However, there is ample empirical evidence to show that labor is not a homogeneous resource and that average wage rates are an imperfect measure of effective labor cost because they do not take account of differences in worker skill levels. One way to control for differences in average worker skill levels is to include a variable for average education levels. The effect of average wage rates was estimated in this paper based on average hourly wage data at the national level (W_n) and the regional level (W_r), by industry, from Eurostat. To partially account for spatial differences in the average level of worker skill, control variables measuring the percentage of the workforce with a secondary level of education were included at the national level (EDU_n) and the regional level (EDU_r); these data are from Eurostat.[8]

The influence of the unemployment rate on industrial location is theoretically indeterminate. On the one hand, a high unemployment rate might reflect idle labor resources, which could give employers bargaining power over potential employees; in this case, one would expect a positive relationship between the unemployment rate and the incidence of new industrial enterprises. On the other hand, a high unemployment rate might reflect unfavorable labor market conditions, such as deficiencies in the average skill level of local workers, that make those workers less productive; in this case, one would expect a negative relationship between the unemployment rate and the incidence of new industrial enterprises.[9] The measure of unemployment used in this paper is the ratio of long-term

[8] A median percentage in 1999-2002 was used for all years because these data were available from the Eurostat Web site only for those years.

[9] A related explanation could be structural rigidities, such as restrictive labor laws, that reduce the employer's discretion over labor policies within the firm.

unemployed workers to the total economically active population. The national estimates (U_n) and regional estimates (U_r) of this ratio are based on population data from Eurostat.

4.4 Familiarity Variable

The influence of familiarity with alternatives on choice sets has been explored in the literature on consumer choices. These studies generally tend to find that decision makers are more likely to choose an alternative with which they are already familiar (such Park and Lessig (1981)). Likewise in the direct investment literature, some (such as Rangan (2000)) have suggested that multinational companies are more likely to identify profitable investment opportunities in the regions in which they already operate because of the information linkages created between their affiliates in the region and the domestic parent company. The measure of familiarity used in this paper is an indicator variable for whether or not the investing firm had an existing foreign affiliate in the chosen host country prior to investing there. This variable is based on the BEA data.

4.5 Tax Rate Variable

Many empirical studies have encountered difficulties in measuring a relationship between industrial location and tax rates. All else equal, one would expect a cost-minimizing firm to seek locations with low tax rates, but there are other considerations. First, U.S. multinationals are taxed on their worldwide income, so that low foreign income tax rates do not necessarily reduce the total taxes on those companies' worldwide profits. Roughly speaking, U.S. corporations are taxed on income generated by their foreign affiliates, but they receive credits for the income taxes paid by the affiliates to host governments, leaving them with U.S. income taxes on

that income only to the extent, if any, to which the foreign tax rate is below the tax rate in the United States. Furthermore, in the case of foreign subsidiaries (foreign-incorporated affiliates), any U.S. taxes are deferred until the income is repatriated to the United States, which can create incentives for U.S. companies to seek out low-tax foreign locations.[10] On the other hand, high corporate income taxes can also imply high public expenditures, which could be directed toward activities that enhance the business environment, such as public education or building infrastructure. The net impact of corporate tax rates is an empirical question. The tax rate data used in this paper are the maximum statutory corporate income tax rates from the University of Michigan's World Tax Database.[11]

4.6 Infrastructure

Manufacturers rely heavily on supporting infrastructure (such as roads, airports, and telecommunications) to support their trade with suppliers and customers. These interactions are an integral part of the firms' activities. For example, inputs from suppliers accounted for two-thirds of the value of goods and services sold or added to inventory by U.S. manufacturers in 2005.[12] In this study, the extent of transportation infrastructure serves as a proxy for the various components of business support infrastructure. Of the various aspects of infrastructure funded by public expenditure, Fisher (1997) noted that expenditure on highways is most commonly found to be positively related to economic development. Therefore one would expect

[10]See, for example, Desai and James R. Hines (1999).

[11]Although some foreign affiliates may effectively pay a rate that differs from the maximum statutory rate, the effective tax rates are likely to be correlated with the maximum statutory rates.

[12]Based on data for manufacturing in table 1 "value added by industry" and table 8 "gross output by industry" in Thomas F. Howells III and Lindberg (2006).

new investments to be positively related to the extent of transportation infrastructure. The measure of transportation infrastructure used in this study is the ratio of the distance of roads to the total surface area of the host region or country.

5 Results

Several alternative specifications of a basic logit model are tested in the first two parts of this section to determine whether or not the location consideration sets of multinational companies are comprised, respectively, of only countries *or* only regions within countries. In the last part, a nested logit model is tested to examine whether or not decision makers construct their consideration sets in a sequential way in which both countries *and* regions are considered, rather than considering all alternatives at once as suggested by the basic logit models. The tests in this section closely follow the approach taken by Mayer and Mucchielli (1999) in their study of the European location choices of Japanese multinational companies. Their results are presented alongside those of this paper.[13]

5.1 National Choice Model

The first empirical model considers the case in which firms evaluate candidate locations only at the national level. Although this characterization may be unrealistic, the results will serve as a benchmark against which to compare the models of less cursory choice. The coefficients are estimated using the conditional logit model using data that are measured at the national level.

[13]In order for the estimated coefficients to be comparable to those of Mayer and Mucchielli, the data for the independent variables have been converted to natural logs prior to the estimation of the models.

Table 3: Conditional Logit Results at the National Level

Attribute	Baseline Model	Mayer & Mucchielli	Expanded Model
GP_n	0.81***	0.36***	0.63***
	(0.07)	(0.08)	(0.10)
W_n	-0.40*	-0.41	-0.58**
	(0.23)	(0.30)	(0.26)
U_n	-0.44***	-0.14	-0.21
	(0.10)	(0.18)	(0.16)
LQ_n	0.14	0.67***	0.19
	(0.13)	(0.10)	(0.13)
TAX_n			-0.17
			(0.37)
EDU_n			0.78***
			(0.27)
$INFR_n$			-0.10
			(0.09)
FAM_n			0.15
			(0.14)
Number of observations	n=617	n=446	n=617
Likelihood ratio index	0.09		0.10

*** 1-percent significance level

** 5-percent significance level

* 10-percent significance level

Standard errors are shown in parentheses.

The results are presented in table 3. The first column ("Baseline Model") presents the baseline results, which use a set of dependent variables that is similar to that used in Mayer and Mucchielli (1999). The second column ("Mayer & Mucchielli") presents Mayer and Mucchielli's results for comparison. The third column ("Expanded Model") presents the baseline model with four additional explanatory variables: The maximum statutory corporate income tax rate (TAX_n), the average education level of the workforce (EDU_n), the extent of transportation infrastructure ($INFR_n$), and the measure of the investing firm's familiarity with the host country (FAM_n).

Market size (GP_n) is found to have a significant positive impact on location choice. In terms of marginal effects, a one-billion-euro increase in host-country market size would be associated with a 0.4-percent increase in the odds of being selected, holding all other variables constant.

Average host-country wage rates in the investing firm's industry (W_n) and host-county unemployment rates (U_n) were found to have a significant negative impact on location choice. The model suggests that a one-euro decrease in average hourly host-country wages results in a 3 percent increase in the odds of being selected, and a one percentage-point decrease in the host-country unemployment rate results in a 13 percent increase in the odds of being selected. The wage effect is consistent with the elementary theory of the firm, and the effect of the unemployment rate suggests that this measure may be indicative of unfavorable labor market conditions.

Of the variables in the expanded model, the percentage of the national labor force with at least a secondary education (EDU_n) was found to have a significant positive impact on location choice. A one percentage-point increase in the percentage of the workforce having at least a high school education results in a 1 percent increase in the odds of being selected. The extent of transportation infrastructure ($INFR_n$), the corporate income tax

rate (TAX_n), and familiarity with the host country (FAM_n) are not found to be significant.
Mayer and Mucchielli found two national attributes to have a significant and positive effect on location choice: market size and industrial agglomeration. These results confirm the positive effect of market size but do not confirm the positive effect of industrial agglomeration.

5.2 Regional Choice Model

The second empirical model considers the case in which firms evaluate candidate locations only at the regional level. This specification may be referred to as the "full deliberation" model, in which firms simultaneously evaluate the attributes of all 51 European regions without regard to national borders. The coefficients are estimated using the conditional logit model and data that are measured at the regional level.
The results are presented in table 4. Market size (GP_r) and industrial agglomeration (LQ_r) are found to have a significant positive impact on location choice. In terms of marginal effects, a one-billion-euro increase in host-region market size would be associated with a 0.4 percent increase in the odds of being selected, holding all other variables constant, and a 1-unit increase in the location quotient (base=100) results in a 0.7 percent increase in a region's odds of being selected.
The regional unemployment rate (U_r) is found to have a significant negative impact on location choice. A one percentage point decrease in the unemployment rate results in a 12 percent increase in the odds of being selected. The percentage of the regional labor force with at least a secondary education (EDU_r) is found to have a significant positive impact. A one percentage-point increase in this measure results in a 1.2 percent increase in the odds of being selected.

Table 4: Conditional Logit Results at the Regional Level for Europe

Attribute	Baseline Model	Mayer & Mucchielli	Expanded model
GP_r	0.60***	0.15*	0.73***
	(0.06)	(0.09)	(0.07)
W_r	0.44**	-0.71***	0.05
	(0.18)	(0.25)	(0.22)
U_r	-0.30***	-0.09	-0.14*
	(0.07)	(0.10)	(0.08)
LQ_r	0.62***	0.88***	0.69***
	(0.09)	(0.12)	(0.09)
EDU_r			0.70***
			(0.20)
$INFR_r$			0.15**
			(0.06)
FAM_n			0.17
			(0.13)
Number of observations	n=641	n=446	n=641
Likelihood ratio index	0.06		0.06

*** 1-percent significance level

** 5-percent significance level

* 10-percent significance level

Standard errors are shown in parentheses.

The extent of transportation infrastructure ($INFR_r$) is found to have a positive impact on location choice. A one-unit increase in this index results in an 11 percent increase in the odds of being selected. Having an existing operation in the host-country (FAM_n) is not found to have a significant effect on location choice.

As with the results of their national model, Mayer and Mucchielli found two regional attributes to have a significant positive effect on location choice: market size and industrial agglomeration. They also found wage rates to have a significant deterrent effect. While these results confirm those authors' results for market size and industrial agglomeration, a high regional wage rate (W_r) is not found to have a significant deterrent effect. This difference may be related to differences in the preferences of American and Japanese multinational companies. Yamawaki (2006) examined the regional location choices of American and Japanese multinational companies for new manufacturing operations in Europe and found the Japanese locations to be more sensitive to factor costs. The author speculates that the strategies of Japanese companies may be uniquely geared toward producing in relatively low-wage European countries for export to higher-wage European countries.

5.3 Sequential Choice Model

The assumption that firms simultaneously evaluate all attributes of all alternatives, which was employed in the preceding section, is tested in this section in two ways. First, Hausman Tests are performed to determine whether or not the regional choice model is appropriate. Second, a nested logit model of location choice is estimated to determine whether or not a sequential choice model, in which firms first select a country and then select a region within that country, would be more appropriate than either of the

non-nested choice models in which firms deliberate only over countries or regions. Patterns in the investment data suggesting sequential choice have already been presented in section 2: Regional attributes appear to be important because of the regional concentration of investments within a country, and national attributes appear to be important because, for at least some countries, the regions of those countries have shared attributes that affect location choice.

5.3.1 Hausman Tests

If firms engage in a sequential choice process then the regional choice model would give an inaccurate description of how firms approach location choice. The Hausman Test (Hausman (1978)) provides an indication of whether or not this is the case. It requires the researcher to estimate the regional choice model for the regions of all countries being examined and then estimate the model for the regions of all but one country and, finally, using a chi-square statistic to test for significant differences in the vectors of coefficients that were estimated based on the two samples. If the chi-square statistic is significantly different from zero, the result suggests that the vectors of coefficients from the two estimations of the regional model are significantly different and that there must be some common unobserved attribute of the regions of the excluded country that influences location choice. In other words, the Independence of Irrelevant Alternatives (IIA) assumption, which states that the relative probabilities of any two alternatives is not affected by the composition of the consideration set, is shown to be invalid.
The Hausman Tests provide evidence of a sequential choice process. For five of the seven countries tested—Spain, Germany, France, Italy and the United Kingdom—the estimated coefficients excluding them were significantly different from the estimated coefficients for the full sample, which suggests that the regions of these countries possess some common

Table 5: Hausman Test Results for Europe

Country Excluded	Chi-Square Statistic	Conclusion
Belgium	1.92	IIA cannot be rejected
Spain	16.70**	IIA must be rejected
Netherlands	2.35	IIA cannot be rejected
Germany	14.56**	IIA must be rejected
France	18.62***	IIA must be rejected
Italy	17.21**	IIA must be rejected
United Kingdom	93.78***	IIA must be rejected

*** 1-percent significance level

** 5-percent significance level

unobserved attribute that influences location choice (table 5).[14]

5.3.2 Nested Logit Model

The nested logit model will be used to both confirm violations of the IIA assumption and to test a hypothesized structure for the sequential choice model. The relevant statistic for this purpose is the inclusive value index. As already discussed, the index is theoretically bounded by zero and one. An index of one suggests that countries do not possess unobserved attributes that affect location choice and that the regional model is sufficient, whereas an index of zero suggests that the relevant attributes of the regions are fully described at the national level and that the national model is sufficient. An inclusive value index between zero and one is consistent with sequential choice and the proximity of the index to zero or one indicates the extent to which regional or national attributes,

[14]The critical values for the Hausman test are 14.07 at the 5-percent level of significance and 18.48 at the 1-percent level of significance (with seven degrees of freedom).

respectively, have relatively greater importance. A correctly specified nested logit model will also provide insight into which attributes are most relevant to the decision makers.

In a nested logit model, individual attributes must be assigned to one or more of the choice tiers. The nested logit model estimated here is comprised of two tiers of choice: A first-tier choice of country followed by a second-tier choice of region within that country. The attributes that are expected to be evaluated only at the national level are market size (GP_n), tax rates (TAX_n), and familiarity with the host country (FAM_n). Market size is expected to be evaluated at the national level because of the ease of trade within a country, which stems from both the tangible links—such as physical infrastructure—and intangible links—such as common national languages, laws, and tastes—that serve to unite the regions of a country. Tax rates are expected to be evaluated at the national level because corporate income is generally taxed at that level. The investor's familiarity with the host location is expected to be evaluated at the national level because the sources of risk and uncertainty in unfamiliar environments tend to be national (such as international differences in languages, customs, and laws). The attributes that are expected to be evaluated only at the regional level are wage rates (W_r), the average worker skill level (EDU_r), the unemployment rate (U_r), and the extent of transportation infrastructure ($INFR_r$). Wage rates, worker skills, and the unemployment rate are expected to be evaluated at the regional level because employers generally seek workers from the local labor pool. Transportation infrastructure is expected to be relevant at this level because most of the firm's transportation needs are expected to be local. Industrial agglomeration is expected to be evaluated at both the national (LQ_n) and regional (LQ_r) levels. Its relevance at the national level is related to factors that are summarized in Porter (1990). He maintains that individual countries can

produce global champions in certain industries because of conditions in the home market for those goods or services (such as innovative competitors, highly capable supplying firms, and/or demanding consumers) that push *all* national firms in those industries to excel.[15] The relevance of agglomeration at the regional level reflects localized advantages, such as the presence of supporting industries.

The specification of the nested logit model cannot rest on theoretical considerations alone. Some of the variables could reasonably be expected to be evaluated at a higher or lower tier of the decision tree. For example, it is possible that language or other barriers prevent workers in certain countries from earning as much as comparably skilled workers earn in most other countries. In these cases, one might expect multinational companies to be attracted to these "low-wage" countries but to be attracted to high-wage (and high-skill) regions within those countries; that is, wage rates might actually be evaluated at *both* the national and regional levels. It is also possible that transportation networks are evaluated at the national, rather than regional, level because multinationals probably sell to customers throughout the host country, and beyond. These and other alternative specifications were estimated but the results, which are not presented here, included insignificant coefficients on the relevant variables and inclusive value indexes that were outside of the (0-1) interval, suggesting that the model was not properly specified.

The nested logit results of Mayer and Mucchielli (1999) are not shown here because their hypothesized nesting structure differed from that used in this study. Nevertheless, their nested logit results also found evidence of a sequential choice process.

The estimated coefficients from the nested logit model are presented in

[15]These forces can, of course, be a disincentive to foreign investors if they produce indigenous firms that are overwhelmingly strong in their industries.

Table 6: Nested Logit Coefficient Estimates

Attribute	Greenfield Investments & Acquisitions	Greenfield Investments
National Level		
GP_n	-0.67	0.57
	(0.59)	(1.06)
TAX_n	-0.09	-1.48**
	(0.39)	(0.68)
LQ_n	0.22*	0.20
	(0.13)	(0.22)
FAM_n	0.16	0.28
	(0.14)	(0.26)
Regional Level		
W_r	1.84***	2.09***
	(0.36)	(0.66)
EDU_r	-0.73	-0.97
	(0.58)	(0.96)
U_r	-0.58***	-0.42**
	(0.10)	(0.18)
LQ_r	0.48***	0.53***
	(0.10)	(0.16)
$INFR_r$	0.58***	0.64**
	(0.15)	(0.27)
Number of observations	641	211
Likelihood ratio index	0.05	0.06

*** 1-percent significance level

** 5-percent significance level

* 10-percent significance level

Standard errors are shown in parentheses.

table 6. The results presented in the two columns differ by the composition of the dependent variable used in estimation. The results in the first column ("Greenfield Investments & Acquisitions") are based on dependent variable observations that represent greenfield investments and acquisitions of existing businesses, which is the data sample used for the national and regional choice models. The results in the second column ("Greenfield Investments") are based on dependent variable observations that represent greenfield investments.

At the national level, industrial agglomeration (LQ_n) is the only variable that has a significant impact on location choice, based on the data sample covering greenfield investments and acquisitions of existing businesses. At the regional level, all of the included variables except for the measure of worker skill (EDU_r) have a significant effect with the expected sign.

The coefficients on the labor market variables suggest that labor quality considerations far outweigh labor cost considerations. The positive coefficient on the average wage rate (W_r) suggests that U.S. firms are willing to pay a premium for workers that are more highly skilled in some sense other than their level of education. The negative coefficient on the unemployment rate (U_r) suggests that U.S. firms tend to avoid areas of high unemployment.[16] The positive coefficients on industrial agglomeration (LQ_n and LQ_r) are consistent with the theoretical expectation. The positive coefficient on transportation infrastructure ($INFR_r$) is consistent with the idea that firms rely heavily on the local road network to interact with suppliers and customers.

Market size (GP_n) is not found to be significant whereas it was found to be

[16]The switch in the direction of the effect of high wages between the national model (discouraging investment) to the nested model (attracting investment) may reflect the fact that firms tend to invest in the relatively higher-wage regions of relatively low-wage countries, such as the North of Italy.

Table 7: Nested Logit Inclusive Value Indexes

Country	Greenfield Investments & Acquisitions	Greenfield Investments
Belgium	0.54***	0.75***
	(0.20)	(0.20)
Germany	1.0***	0.86***
	(0.13)	(0.20)
Spain	1.0[1]	1.0[1]
	...	...
France	0.91***	0.74***
	(0.10)	(0.20)
Italy	0.90***	0.81***
	(0.08)	(0.16)
Netherlands	0.67***	0.78***
	(0.12)	(0.13)
United Kingdom	0.94***	0.82***
	(0.09)	(0.15)
Number of observations	641	211

*** 1-percent significance level

** 5-percent significance level

* 10-percent significance level

1. Constrained to equal one.

Standard errors are shown in parentheses.

a significant attribute in the national and regional models. Another difference is that the estimated coefficient on wage rates is larger in the nested choice model than in either of the unstructured choice models. One explanation for these differences is that the measure of market size in the unstructured choice models was capturing elements of worker skill that are captured in the wage variable in the nested choice model.

As noted earlier, roughly two-thirds of the observations of the dependent variable represent acquisitions of existing businesses rather than greenfield investments. Some analysts (such as Nocke and Yeaple (2004)) have noted that the motivations for these two types of investments may differ in at least some respects. For example, acquisitions could be motivated by the proprietary assets of the target firm or, simply, the availability of targets for acquisition.

To test the robustness of the results with regard to the two types of new investments, the model was estimated for greenfield investments only; these results are presented in the column of table 6 labeled "Greenfield Investments." There were a few differences from the results for the full sample at the national level. Most notably, the negative effect of corporate tax rates (TAX_n) is significant. However, at the regional level, the estimated effects of the location attributes are virtually identical to those estimated using the full sample of new investments. Overall, the similarity of the results for the two samples suggests that firms evaluate greenfield investments in at least roughly the same way as they evaluate targets for acquisition.

The estimated inclusive value indexes are shown in table 7. In order to obtain statistically significant inclusive value indexes, it was necessary to constrain the inclusive value indexes for one of the countries. As noted in Hensher et al. (2005) (p.536), when this technique becomes necessary, it is conventional to constrain the inclusive value index of one of the alternatives

to one. Most of the estimated indexes support the notion of sequential, or tiered, choice. Except for the results for the sample covering both types of new investments, the inclusive value indexes are all within the (0-1) interval and are significant in all but one case. These results are generally consistent with a choice process in which firms first choose a country based on certain national attributes and then choose a region within that country based on certain regional attributes. The estimated index is equal, or very close, to one in several cases, suggesting that national attributes are not nearly as important as regional attributes for location choice in these cases.

6 Conclusion

This paper has examined the location choices of U.S. multinational companies for new manufacturing operations in seven European countries over the period 1989-2003. The findings are consistent with most similar studies in that firms appear to employ a sequential choice process in which a host country is first chosen based on one set of attributes and then a region within that country is chosen based on another set of attributes. Other findings that are consistent with the literature are the attractiveness of industrial agglomeration and the apparent dominance of labor quality concerns over labor cost concerns. A novel finding of this paper is that firms appear to evaluate greenfield investments in at least roughly the same way as they evaluate targets for acquisition.

This paper advances the groundbreaking research of Mayer and Mucchielli (1999). However, our understanding of the nature of firms' location choices remains incomplete. Professors Mayer and Mucchielli began with an appropriate test case for their two-tier country-region choice model. The European Union is a largely contiguous collection of national economies in which there is unrestricted movement in trade and persons, making it a

highly plausible consideration set. Yet the question remains of how firms construct their consideration sets for locations in other areas of the world. Mataloni (2007), provides an initial evaluation of the question for another global area, the Asia-Pacific region. The results are broadly supportive of the studies of investment in Europe—both those of Mayer and Mucchielli and those in this paper—but they do raise some important questions. Most importantly, differences between the results covering only high-income countries and the results covering high-income countries and one middle-income country (China), suggest that consideration sets of countries are formed based on some attribute other than major geographic area such as the country's level of economic development. An important area for future research, then, is to extend this research to larger samples of host countries in which there is a significant representation of both high-income and lower-income countries.

A Discrete Choice Models

This appendix provides a technical discussion of the two categories of discrete choice models discussed in Section 3—compensatory choice models and noncompensatory choice models.

A.1 Compensatory Choice Models

McFadden (1973) paved the way for this discrete choice analysis by adapting the conditional logit model of the natural sciences to the utility or profit maximizing model of the social sciences.[17]

In McFadden's framework, the agent chooses the alternative that yields the highest expected utility or profit. In the context of location choice, we consider the case where the firm must choose over N possible locations, such as a country or a city, which are denoted $i = 1, ..., N$. The expected profitability of location i (Π_i) is a function of the identified quantifiable attributes of that location (V_i), referred to as *systematic* value or utility, and a stochastic error term (ε_i) that captures the influence of unobserved (or *latent*) attributes, which are those that were excluded by the researcher, perhaps because they could not be quantified.[18] So we can write:

$$\Pi_i = V_i + \varepsilon_i \tag{A1}$$

Equation (A1) can be re-written to recognize that V_i generally consists of a vector of location attributes (X_i) and parameters to be estimated (Θ):

[17] The conditional logit model is a variation of the basic multinomial logit model in which the choices of more than one decision maker are pooled and simultaneously analyzed. Although McFadden's model is built on an optimization framework, Train (2003) (p. 18) notes that this foundation "does not preclude the model from being consistent with other forms of behavior."

[18] The stochastic error term also captures the influence of decision makers' errors in the optimization process.

$$\Pi_i = \Theta X_i + \varepsilon_i \tag{A2}$$

Under certain assumptions, McFadden (1974) demonstrates that the expected probability of a firm choosing location i can be expressed in terms of the conditional logit model:

$$P_i = \frac{e^{\Theta X_i}}{\sum_{n=1}^{N} e^{\Theta X_n}} \tag{A3}$$

One of the underlying assumptions of the conditional logit model is that the relative probabilities of any two alternatives are unaffected by the addition of any third alternative to the decision maker's consideration set.[19] This assumption, known as the *Independence of Irrelevant Alternatives* (IIA), is particularly strong for choices over geographic locations. It would imply, for example, that the relative probabilities of a foreign industrial company choosing one of two dissimilar location alternatives, such as the Nordrhein-Westfalia region in the industrial heart of Germany and the largely agricultural Southern region of Italy would be unaffected by the introduction of any third alternative, such as the heavily-industrialized Parisian basin. That is, the decision maker is assumed to not view Nordrhein-Welfalia and the Parisian basin as closer substitutes than Nordrhein-Welfalia and Southern Italy.

A.2 Noncompensatory Choice Models

The nested logit model considers the case where the decision maker's choice process can be expressed as a decision tree. Similar lower-tier alternatives

[19] This assumption can be illustrated by considering the ratio of equation (A3) to a similar equation for some other alternative $j \in n = 1, 2, ...N$. Through simplification, it becomes apparent that the relative probabilities of the two alternatives (P_i/P_j) contains only the relative systemic utilities of those alternatives $(e^{\Theta X_i}/e^{\Theta X_j})$; the denominators of the equations for (P_i) and (P_j) cancel out.

form nests below upper tier alternatives; thus, it relaxes the IIA assumption. The model, which was first derived by Ben-Akiva (1973), can be used to express the probability of choosing a region $r \in k = 1, 2, .., K_c$ conditional on having chosen a country $c \in m = 1, 2, .., M$ as:

$$P_{cr} = \frac{e^{\beta X_{cr}}}{e^{I_c}} \frac{e^{\alpha Y_c + \sigma_c I_c}}{\sum_{m=1}^{M} e^{\alpha Y_m + \sigma_m I_m}} \tag{A4}$$

where the decision maker's expected maximum utility from a particular branch in the decision tree—i.e. a particular country and its composite regions—is known as the inclusive value (I_c) which, in turn, can be expressed as:

$$I_c = ln(\sum_{k=1}^{K_c} e^{\beta X_{ck}}) \tag{A5}$$

In equation (A4), the inclusive value index (σ) determines the relevance of the sequential choice model. If (σ) is equal to one then equation (A4) is equivalent to a conditional logit model that is strictly determined by regional attributes. If, on the other hand, (σ) is equal to zero then equation (A4) is equivalent to a conditional logit model that is strictly determined by national attributes. An inclusive value index between zero and one suggests that both regional and national attributes affect location choice, which is consistent with a sequential choice process.

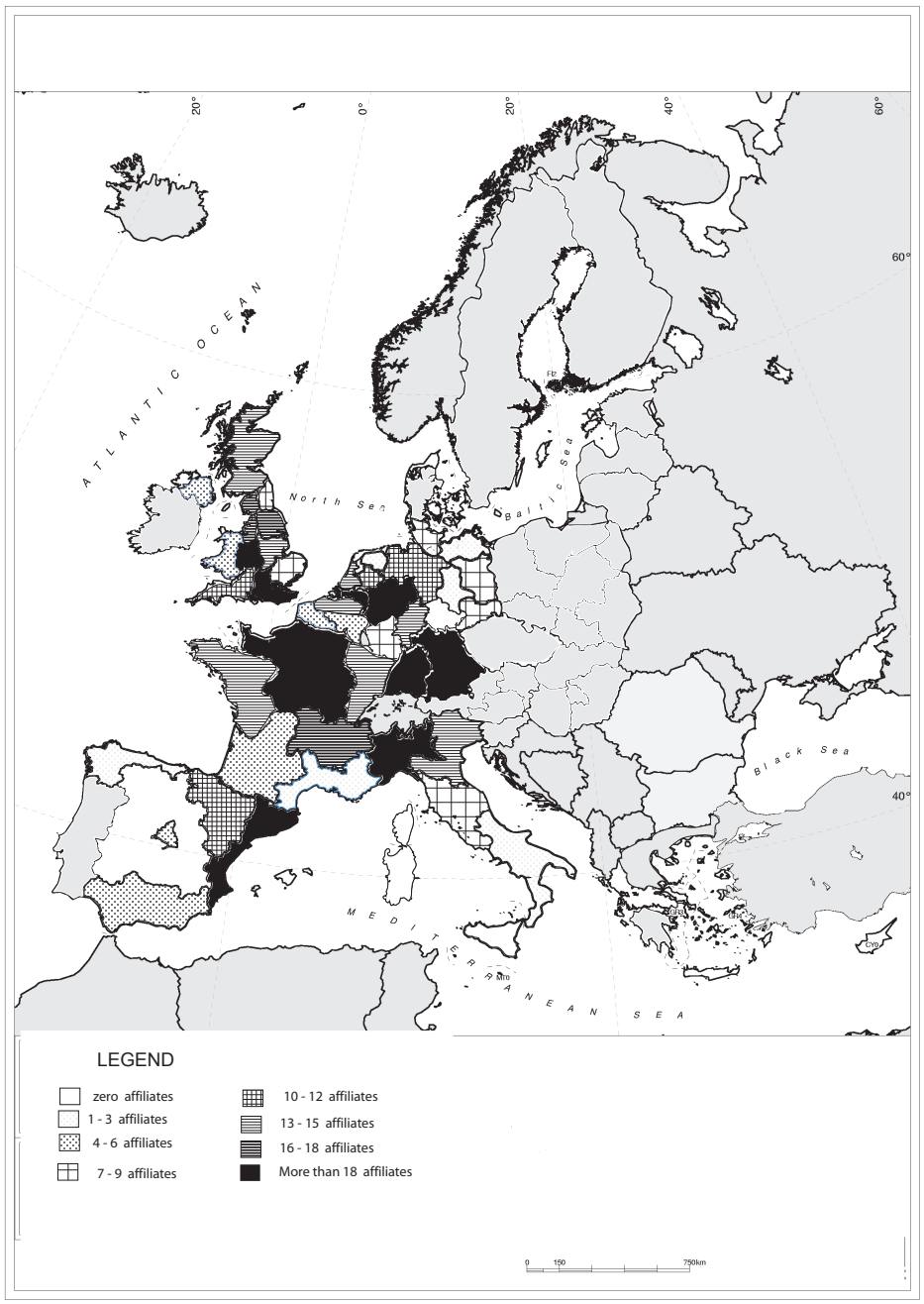
20°
0°
20°
40°
60°
60°
40°
ATLANTIC OCEAN
North Sea
Baltic Sea
Black Sea
MEDITERRANEAN SEA
Fe
Cyp
LEGEND
zero affiliates
1 - 3 affiliates
4 - 6 affiliates
7 - 9 affiliates
10 - 12 affiliates
13 - 15 affiliates
16 - 18 affiliates
More than 18 affiliates
0
150
750km

Figure A-1:

Table A-1: Regional Distribution of New Manufacturing Operations by U.S. Multinational Companies in Seven European Countries from 1989 to 2003

Country	Region	NUTS code	Number of Investments
Belgium	Vlaams Gewest	BE2	16
	Région Wallone	BE3	5
Germany	Baden-Württemberg	DE1	25
	Bayern	DE2	28
	Berlin	DE3	7
	Brandenburg	DE4	4
	Hamburg	DE6	7
	Hessen	DE7	16
	Mecklenburg-Vorpommern	DE8	1
	Niedersachsen	DE9	10
	Nordrhein-Westfalen	DEA	44
	Rheinland-Pfalz	DEB	9
	Saarland	DEC	2
	Sachsen	DED	5
	Sachsen-Anhalt	DEE	2
	Schleswig-Holstein	DEF	6
Spain	Noroeste	ES1	3
	Noreste	ES2	9
	Madrid	ES3	5
	Este	ES5	24
	Sur	ES6	3
France	Île-de-France	FR1	22
	Bassin Parisien	FR2	29
	Nord-Pas-de-Calais	FR3	4
	Est	FR4	13
	Ouest	FR5	17
	Sud-Ouest	FR6	5
	Centre-Est	FR7	16
	Méditerranée	FR8	2
Italy	Nord-Ovest	IT1	11
	Lombardia	IT2	37
	Nord Est	IT3	6
	Emilia-Romagna	IT4	12
	Centro	IT5	8
	Lazio	IT6	4
	Sud	IT7	6
The Netherlands	Nord-Nederland	NL1	3
	Oost-Nederland	NL2	12
	West-Nederland	NL3	14
	Zuid-Nederland	NL4	21
United Kingdom	North East	UK1	4
	Yorkshire and Humberside	UK2	18
	East Midlands	UK3	13
	Eastern	UK4	8
	South East	UK5	56
	South West	UK6	12
	West Midlands	UK7	20
	North West	UK8	16
	Wales	UK9	4
	Scotland	UKA	13
	Northern Ireland	UKB	4

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