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, 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. 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) [27] 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) [9], Guimaraes, Rolfe, and Woodward (1998) [7], Mayer and Mucchielli (1999) [17], Mucchielli and Puech (2004) [19], Schmenner (1994) [26]]. 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 consider [Tversky (1972) [29], Grether and Wilde (1984) [6], Roberts and Lattin (1991) [24]]. 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]

[1]Rumelt (1995) [25] discusses five major sources of organizational inertia: Distorted perception, dulled motivation, failed creative response, political deadlocks, and action

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) [1] 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 (1990) [8], Jayet and Wins (1993) [13], and Bingham and Eisenhardt (2005) [3]. This literature also provides insight into how location consideration sets are restricted. Blackbourn (1974, pp. 249-50) [4] 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. That is, regions in different countries would not compete directly against one another.

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. This revealed preference data on location choice 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 measurement of host-country characteristics is based

disconnects.

on national and regional data on gross domestic product, 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. The composition of consideration sets is evaluated using both basic and nested multinomial logit models. 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) [17].

This paper has four major findings. First, the results indicate that U.S. multinationals tend to employ a sequential choice process when choosing new manufacturing operations in Europe. Second, the importance of industrial agglomeration, found in the aforementioned studies of the locations of multinational companies, is confirmed. This result, combined with a result which indicates that location choices are not sensitive to 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). The other major findings are that firms appear to evaluate greenfield investments, and expansions of existing operations, in at least roughly the same way as they evaluate targets for acquisition.

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, new investments 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-3). This geographic concentration partly reflects the overall pattern of industrial concentration in Western Europe.

To uncover the relative attractiveness of the European regions, beyond that which is related to industrial concentration, an index of regional attractiveness (A), similar to that of Mucchielli and Puech (2004, p. 37) [19], has been constructed. The attractiveness (A) of region (r) in industry group (g) in 1989-2003 is calculated as:

$$A_{rg} = \frac{Number\ of\ Investments_{rg}}{Number\ of\ Investments_{Eg}} / \frac{Labor\ Force_{rg}}{Labor\ Force_{Eg}} \tag{1}$$

The numerator of this ratio measures a region's share of the number of new investments by U.S. multinational companies in the seven European countries (E) covered by this paper and the denominator measures the region's share of the total labor force in those countries.[3] A ratio equal to

[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.

[3]*Number of Investments* is measured as the total number of new investments by U.S.

one indicates that the regional pattern of investments by U.S. multinational companies in a particular industry group is similar to that of employment by European businesses in general. A ratio greater than one indicates that the number of new investments by U.S. multinational companies in a region is greater than that suggested by the regional employment patterns of European businesses in general, which suggests that the region possesses attributes beyond industrial agglomeration forces that are attractive to U.S. multinational companies.

The national patterns in the attractiveness ratios in the top five industry groups for new U.S. investments (chemicals, metals, machinery, electrical equipment, and transportation equipment), shown in Figures A-2 to A-6, suggest that national attributes matter in location choice. First, the number of "exceptionally attractive" regions (those whose attractiveness index exceeds 2.0, which are those shaded orange or red in the figures) is not randomly distributed across countries. If they were randomly distributed, one would expect the share of a country's regions that are exceptionally attractive to be similar across countries. Table 1 summarizes these distributions by comparing the number of exceptionally attractive regions for the five manufacturing industry groups, to the total number of industry group-region pairs for a country.

Using the EA shares in table 1 as a rough measure of national attractiveness in 1989-2003, it would appear that investors perceived countries such as the United Kingdom and the former East Germany to be relatively rich in attributes other than industrial agglomeration, whereas countries such as the former West Germany and Italy were perceived to be relatively poor in those attributes.[4] Second, certain countries tend to show particular attractiveness

multinational companies over 1989-2003 in a particular area (r or E) and industry group (g). *Labor Force* is measured as the median value of employment by all businesses over 1989-2003 in a particular area (r or E) and industry group (g).

[4]See the last paragraph in section 4 regarding the separate treatment of the former

Table 1: Number of Investments by Industry Group-Region Pairs for Five Selected Manufacturing Industry Groups*

Country	EA Pairs	All Pairs	EA Share
United Kingdom	23	55	0.42
East Germany (former)	13	35	0.37
Netherlands	9	25	0.36
France	9	40	0.23
Spain	3	30	0.10
Belgium	1	15	0.07
Italy	2	35	0.06
West Germany (former)	2	40	0.05

EA Exceptionally attractive

* The selected manufacturing industry groups are chemicals, metals, machinery, electrical equipment, and transportation equipment

in specific industries, such as the former East Germany in transportation equipment manufacturing (see Figure A-6) or the Netherlands in electrical equipment manufacturing (see Figure A-5).

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 at least some of the attributes of the location alternatives at one geographic scale or another. 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 the national concentration of the investments that is disproportional to the overall national distribution of the European labor force.

West and East Germanies.

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. McFadden (1974) [18] paved the way for this type of research by adapting the conditional logit model of the natural sciences to the utility or profit maximizing model of the social sciences.[5]

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) which captures the influence of unobserved (or *latent*) attributes, which are those that were excluded by the researcher, perhaps because they could not be quantified.[6] So we can write:

$$\Pi_i = V_i + \varepsilon_i \tag{2}$$

Equation (2) can be re-written to recognize that V_i generally consists of a vector of location attributes (X_i):

[5]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) [28] notes that this foundation "does not preclude the model from being consistent with other forms of behavior."

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

$$\Pi_i = \Theta X_i + \varepsilon_i \tag{3}$$

The dependent variable in a simple conditional logit model is a binary variable, which customarily takes a value of one if investment is observed to occur in a particular location and a value of zero if it does not. In deriving an expression to relate this binary variable to the location attributes, it is necessary to recognize that the predicted values must be bounded by the two extremes—a value of one when investment is certain to occur and a value of zero when it is certain not to occur. Under the assumption that the relative probabilities of any two alternatives is unaffected by changes in the set of all available alternatives, known as the *Independence of Irrelevant Alternatives* (IIA) assumption, McFadden (1974) has shown that the expected probability (P) of investing in location $i \in n = 1, 2, ...N$ can be expressed in the form of the conditional logit model:[7]

$$P_i = \frac{e^{\Theta X_i}}{\sum_{n=1}^{N} e^{\Theta X_n}} \tag{4}$$

An important consideration in modelling firms' location choice set is to test the validity of the IIA assumption. In the words of Hensher *et al.* (2005, p. 479) [12], this assumption amounts to the assertion that "all pairs of alternatives are equally similar or dissimilar." In the case of location choice, one might expect nearby locations to be more similar than distant locations, so the IIA assumption can be particularly suspect. One way to test for and, if necessary, correct for violations of the IIA assumption is to use a nested logit model.

[7]The intuition of the IIA assumption may be grasped by considering an expression similar to equation (4) for the probability of choosing some other alternative $j \in n = 1, 2, ...N$. It can be easily seen that the expression for 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.

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 form nests below upper tier alternatives. In this paper, we consider an upper-tier decision over countries and, nested beneath those choices, a lower-tier decision over regions within those countries. To understand the nested logit model, it is useful to begin with the lower-tier choice because it is a straightforward application of the conditional logit model already described. This paper considers the case where a firm must choose a region $r \in k = 1, 2, .., K_c$ within a country $c \in m = 1, 2, .., M$. The probability of choosing region r conditional on having chosen country c can be expressed as:

$$P_{r|c} = \frac{e^{\beta X_{cr}}}{\sum_{k=1}^{K_c} e^{\beta X_{ck}}} \tag{5}$$

In moving up the decision tree to the first-tier selection of a country, it is necessary to recognize that the decision maker may consider both the attributes of the countries that affect the expected profitability of potential investments and the attributes of the regions that comprise those countries. This interdependence between the first-tier and the second-tier choices is represented by a variable known as the *inclusive value*. This variable may be thought of as a measure of the decision maker's utility of having all related second-tier choices available when making the first-tier choice. In the case of the selection of country c, the inclusive value can be expressed as:

$$I_c = ln(\sum_{k=1}^{K_c} e^{\beta X_{ck}}) \tag{6}$$

This expression represents the maximum expected profitability that could be attained by investing in country c.[8]

[8]To illustrate the inclusive value, consider a person's hypothetical choice over two vacation destinations: mountain and beach. Assume, for simplicity, that this person

Having defined the inclusive value, we can now express the probability of choosing a country (c) as:

$$P_c = \frac{e^{\alpha Y_c + I_c}}{\sum_{m=1}^{M} e^{\alpha Y_m + I_m}} \tag{7}$$

The probability of choosing country (c) is a function of the investor's perception of the attributes of that country that can affect expected profitability (Y_c) and, through the inclusive value, the investor's perception of the relevant attributes of all the regions within that country (X_{ck}).

The product of equations (5) and (7) yields the probability of choosing region r:

$$P_{cr} = P_{r|c} P_c = \frac{e^{\beta X_{cr}}}{e^{I_c}} \frac{e^{\alpha Y_c + I_c}}{\sum_{m=1}^{M} e^{\alpha Y_m + I_m}} \tag{8}$$

To turn from the basic multinomial logit model to the *nested logit model* which allows for sequential choice, an index for the inclusive value (σ_c) must be introduced. The probability of choosing region r can be expressed as:

$$P_{cr} = P_{r|c} P_c = \frac{e^{\beta X_{cr}}}{e^{I_c}} \frac{e^{\alpha Y_c + \sigma_c I_c}}{\sum_{m=1}^{M} e^{\alpha Y_m + \sigma_m I_m}} \tag{9}$$

The inclusive value index (σ_c) measures the sensitivity of the first-tier choice of country to the composition of the second-tier choice set of regions. If (σ_c) is close to one, the ratio of the probabilities of any two nested alternatives within the country-region set MK are independent of any third alternative which is to say that the IIA assumption is valid. In this case, any two given

equally enjoys doing any given activity at either location, but that the distribution of available activities differs between locations. If there are more activities that this person enjoys doing in the mountains than at the beach, then the mountain alternative will have a higher inclusive value than the beach alternative because the person would expect to derive more utility from having available all of the activities he or she enjoys doing in the mountains than from having available all of the things he or she enjoys doing at the beach.

alternatives c_0r_0 and c_0r_1 are perceived as being so different from any third alternative c_0r_2 that the existence of c_0r_2 in the choice set does not affect the relative probabilities of choosing c_0r_0 and c_0r_1. That is, the investor does not perceive there to be any country-specific attribute that is shared by any pair of alternatives in the country-region set MK; therefore, the choice of country is fully dependent on the choice of region. If, on the other hand, (σ_c) is close to zero, then all of the lower-tier alternatives (c_0r_0, c_0r_1, c_0r_2, ..) are perceived as being identical, so that the choice of country can be made independently, without regard to the attributes of its composite regions.

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 682 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). An aspect of new investments by U.S. multinationals that is not captured by these transactions is the significant expansion of established operations. To incorporate this sort of new investment, one estimation of the regression coefficients is based on an expanded dependent variable data set that encompasses all three types of new investments; however, because of source data limitations, these expanded estimates cover a shorter time span (1996-2003) than the baseline estimates. [9] Because the

[9]Substantial growth in the measures of the operations of foreign affiliates can occur for reasons other than the expansion of established facilities such as the rapid growth in assets and employment that occur in the years immediately following the establishment of a new business enterprise as the business grows toward full capacity. Measures of operations can

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 that were uncovered by searching for the business name using the *Google* search engine.

The independent variables measure host country attributes that are most commonly found in other studies of firms' location choice.[10] 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.[11]

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 indus-

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also grow because of changes in corporate consolidation, even though the BEA employs a restrictive policy on the consolidation of foreign affiliate operations: Operations can be consolidated only if the businesses are in the same country, and in the same detailed industry or are part of an integrated business operation, such as crude oil extraction and refining. Established foreign affiliates whose employment and fixed assets both grew at least 25 percent in a single year for reasons other than growing to reach initial capacity or changes in business consolidation were considered to have undertaken a significant expansion in existing operations. There were 48 confirmed increases of this type in the countries and industries covered by this paper in 1996-2003. The time period was restricted to these years because the financial and employment data from Bureau Van Dijk used to help analyze the reasons for the increases did not extend to earlier years.

[10]See table 3 for a list of the independent variables used in this paper. For a tabular summary of empirical findings of earlier studies, see table 2.1 in Mucchielli and Puech (2004) [19].

[11]Jayet and Wins (1993) [13] found, for example, that the median location time for a multinational company investing in France was 12 months.

trial classification system, *Nomenclature générale des Activités économiques dans les Communautés Européennes* (NACE).[12] Table 2 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 tie these data to 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 to determine the regional locations of these businesses.[13]

4.1 Agglomeration Variables

Among the preceding studies, the ones that are most similar to the present study have found industrial agglomeration to be a major determinant of the location decisions of multinational firms. There are a number of possible explanations of the importance of this factor. The most fundamental explanations, put forth by Marshall (1920) [16], 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

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

[13]The BEA data are classified by industry using the Bureau's own International Surveys Industry (ISI) codes, but these were not used in constructing the data set because they are not fully compatible with NACE codes. (The mechanical assignment of a NACE code to the BEA data based on concordances between the industrial classification systems at a somewhat aggregated level accorded with the assignment based on a detailed description of the affiliate's activity in roughly four-fifths of the cases.)

Table 2: 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

Knickerbocker (1973) [15], have considered an industrial organization perspective in which firms in oligopolistic industries tend to mimic the entry patterns of their rivals in an effort to "fare no worse" than their competitors. Still others, such as Johanson and Widersheim-Paul (1975) [14], offer a signalling 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 [2]). 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:

$$\frac{EMP_{ir}}{EMP_r} / \frac{EMP_{ie}}{EMP_e} \tag{10}$$

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 1989-2003 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

Most empirical studies have found market size to be positively related to industrial location. The underlying rationale is that proximity to customers can yield cost reductions and productivity enhancements related to factors such as reduced distribution costs and increased customer feedback. 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 (see, for example, U.S. Department of Commerce (2004) [21]). The gross product data are from Eurostat.

Table 3: The Independent Variables

Variable	Definition	Source	Expected sign
GP_n	National gross product (millions of euros)	Eurostat	+
LQ_n	National location quotient	Author's calculations based on Eurostat data	+
W_n	National average annual wage by industry (thousands of euros)	Eurostat	-
EDU_n	National share of the workforce with a secondary level of education (percent)	Eurostat	+
U_n	National long-term unemployment rate (percent)	Eurostat	?
TAX_n	National statutory income tax rate (percent)	University of Michigan World Tax Database	?
FAM_n	Dummy variable for an existing presence in the host country	BEA	+
GP_r	Regional gross product (millions of euros)	Eurostat	+
LQ_r	Regional location quotient	Author's calculations based on Eurostat data	+
W_r	Regional average annual wage by industry (thousands of euros)	Eurostat	-
EDU_r	Regional share of the workforce with a secondary level of education (percent)	Eurostat	+
U_r	Regional long-term unemployment rate (percent)	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 per capita annual 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) in the expanded specification of the model; these data are from Eurostat.[14]

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

[14]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.

of new industrial enterprises.[15] The measure of unemployment used in this paper is the ratio of long-term 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 as Park and Lessig (1981)[22]). Likewise in the direct investment literature, some (such as Rangan (2000)[23]) 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 also 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,

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

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.[16] 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 national tax rate data used in this paper are the maximum statutory corporate tax rates from the University of Michigan's World Tax Database.[17]

A final data note deals with the treatment of Germany. Although the former East and West Germanies were unified throughout the period covered by the data, the results indicate that the former East Germany was generally viewed differently by U.S. multinational companies than the former West Germany during the period considered. Therefore these two regions were treated as separate countries in the analysis.[18]

[16]See, for example, Desai and Hines (1996) [5].

[17]Although some foreign affiliates may effectively pay a rate that differs from the maximum statutory rate, these differences probably depend mostly on firm-specific circumstances and therefore the statutory rate seems like the one that most firms would consider when evaluating different locations.

[18]The data on national gross product, and the estimated location quotients, for these two former countries were derived by summing the Eurostat data for the appropriate regions. The data for average wage rates and unemployment rates were derived by averaging the regional data.

5 Results

The importance of modelling decision makers' consideration sets in a way that approximates reality has already been discussed. As will be shown, it is possible for several alternative specifications of a basic logit model to all perform satisfactorily in terms of basic statistical tests. Therefore the researcher should also employ more flexible models, such as the nested logit model, to see whether or not the data suggest that decision makers construct their consideration sets in a sequential way rather than considering all alternatives at once as suggested by the basic logit model. The empirical tests in this section closely follow Mayer and Mucchielli's study [17] of the European location choices of Japanese multinational companies. Therefore the results of those authors are presented alongside the results of this paper.[19] The first two parts of this section employ the conditional logit model to determine whether or not the location consideration sets of multinational companies are comprised, respectively, of only countries *or* only regions within countries. The last part employs the nested logit model to determine whether or not U.S. multinational companies employ a sequential choice process in which both countries *and* regions are considered. The weight of the evidence appears to support the sequential choice model.

5.1 National Choice Model

The first empirical model considers the case in which companies 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 more deliberate choice. The coefficients are estimated

[19] 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.

using the conditional logit model using data that are measured at the national level.

Table 4: Conditional Logit Results at the National Level

Attribute	Baseline Model	Mayer & Mucchielli	Expanded X	Expanded X & Y
GP_n	0.72***	0.36***	0.61***	0.79***
W_n	-0.71***	-0.41	-0.72***	-0.60***
U_n	-0.54***	-0.14	-0.27***	-0.26**
LQ_n	0.66***	0.67***	0.74***	0.71***
TAX_n	-0.29	n.a.	-0.22	0.98
EDU_n			0.69***	0.85***
FAM_n			0.24***	0.28***
Number of observations	n=682	n=446	n=682	n=424
Likelihood ratio index	0.07	n.a.	0.07	0.09

*** 1-percent significance level

** 5-percent significance level

n.a. Not available

The results are presented in table 4. 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 X") presents the baseline model with two additional explanatory variables: The measure of the average worker skill level (EDU_n) and the measure of the investing firm's familiarity with the host country (FAM_n). The fourth column ("Expanded X & Y") includes both the added explanatory variables and the added dependent variables representing significant expansions in established operations.[20]

[20]The number of observations for this specification is smaller than that for the baseline

The results support the findings of Mayer and Mucchielli regarding the attractiveness of market size (GP_n) and industrial agglomeration (LQ_n). In terms of marginal effects, a 1-percent increase in host-country market size would be associated with a 0.7-percent increase in the probability of being selected, and a 1-percent increase in the location quotient would be associated with a 0.7-percent increase in a country's probability of being selected.[21] Host-country tax rates were not found to be a significant factor in the U.S. firms' location choices. However, as mentioned above, this result may simply reflect inherent difficulties in measuring the *net* impact of host-country tax rates on firms' location choices, or in measuring the expected effective tax rates that investors will face.

Unlike Mayer and Mucchielli, 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 1-percent decrease in host-country wages would be associated with a 0.7-percent increase in the probability of being selected, and a 1-percent decrease in the host-country unemployment rate would be associated with a 0.5-percent increase in the probability 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.

Both of the variables in the expanded model, the percentage of the national labor force with at least a secondary education (EDU_n) and an established presence in the host country by the investing firm (FAM_n), were found to have a significant positive impact on location choice.

specification and the "expanded X" specification because the sample for this specification covers fewer years.

[21]Because the logit model has a non-linear functional form, the estimated marginal effects will vary at different points in the distribution of the independent variables. The marginal effects reported here are calculated at the means of the independent variables.

Overall, the model does not explain a large share of the variance in the dependent variable, with a log-likelihood ratio of 0.07 to 0.09.[22] Nevertheless, it important to remember that the results are only meaningful if the model is a reasonable approximation of how firms actually approach location choice.

5.2 Regional Choice Model

The second empirical model considers the case in which companies 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 55 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 5. As with the national model, the regional results support the findings of Mayer and Mucchielli regarding the attractiveness of market size (GP_r) and industrial agglomeration (LQ_r). Unlike Mayer and Mucchielli, the average regional wage in the investor's industry (W_r) is not found to have a significant effect, and the regional unemployment rate (U_r) is found to have a significant negative effect.

Both of the variables in the expanded model, the percentage of the regional labor force with at least a secondary education (EDU_r) and an established presence in the host country by the investing firm (FAM_n), were found to have a significant positive impact on location choice.

Overall, the model does not explain a large share of the variance in the dependent variable, with a log-likelihood ratio of 0.05 to 0.06. In any case,

[22] Train (2003, p. 72) [28] defines the log-likelihood ratio as an index that "ranges from zero, when the estimated parameters are no better than zero parameters, to one, when the estimated parameters perfectly predict the choices of sampled decision makers." Hensher and Johnson (1981, p. 50) [11] note that values "between 0.2 and 0.4 are considered extremely good fits."

Table 5: Conditional Logit Results at the Regional Level

Attribute	Baseline Model	Mayer & Mucchielli	Expanded X	Expanded X & Y
GP_r	0.61***	0.15***	0.68***	0.70***
W_r	-0.06	-0.71***	-0.20**	-0.01
EDU_r			0.60***	0.57***
U_r	-0.28***	-0.09	-0.14**	-0.28***
LQ_r	0.51***	0.88***	0.54***	0.58***
FAM_n			0.21***	0.24***
Number of observations	n=682	n=446	n=682	n=424
Likelihood ratio index	0.05	n.a.	0.05	0.06

*** 1-percent significance level

** 5-percent significance level

n.a. Not available

the following results of the sequential choice model suggest that neither this model nor the national choice model is a good approximation of how firms actually approach location choice.

5.3 Tests for Sequential Choice

The assumptions employed in the preceding sections regarding the composition of firms' consideration sets can be tested in at least two ways. First, Hausman Tests can be performed to determine whether or not the regional choice model is appropriate. Second, a nested logit model of location choice can be estimated to determine whether or not a sequential choice model would be more appropriate than either of the non-sequential choice models. This section presents the results of these tests, as well as an estimated nested logit model for greenfield investments only. The results indicate that

a sequential choice model is appropriate and that firms evaluate greenfield investments in roughly the same way as they evaluate targets for acquisition.

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) [10]) provides an indication of whether or not this is the case. It does so by first estimating the regional choice model for the regions of all countries being examined and then estimating the model for the regions of all but one country and, finally, using a chi-squared statistic to test for significant differences in the vectors of coefficients that were estimated based on the two samples. If the chi-squared 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 is shown to be invalid.

The Hausman Tests provide evidence of a sequential choice process. For seven of the eight countries tested—Belgium, Spain, the Netherlands, the former East 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 unobserved attribute that influences location choice.

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

Table 6: Hausman Test Results

Country Excluded	Chi-Squared Statistic	Conclusion
Belgium	24.72***	IIA must be rejected
Spain	31.40***	IIA must be rejected
Netherlands	13.04**	IIA must be rejected
West Germany (former)	3.16	IIA cannot be rejected
East Germany (former)	21.55***	IIA must be rejected
France	11.62**	IIA must be rejected
Italy	48.80***	IIA must be rejected
United Kingdom	33.17***	IIA must be rejected

*** 1-percent significance level

** 5-percent significance level

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, 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 specifying a nested logit model, the analyst must assign individual attributes to one or more of the choice tiers.[23] The nested logit model estimated

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

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), and the unemployment rate (U_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. Industrial agglomeration is expected to be evaluated at both the national (LQ_n) and regional (LQ_r) levels. Its relevance at the national level reflects the advantages countries can possess—such as innovations by indigenous firms—that are not fully shared across national borders. Its relevance at the regional level reflects localized advantages, such as the presence of supporting industries.

The nested logit results are presented in table 7. The results presented in the three columns differ by the composition of the dependent variable used in estimation. The results in the first column ("Green") are based on dependent variable observations that represent greenfield investments. The results in the second column ("Green & Acq") are based on dependent variable observations that represent greenfield investments and acquisitions

Table 7: Nested Logit Results

Attribute	Green	Green & Acq	Green, Acq, & Exp
National Choice			
GP_n	0.53	-0.27	-3.68***
TAX_n	-1.26	0.22	2.84***
LQ_n	0.57**	0.66***	0.71***
FAM_n	0.17	0.13	0.25
Regional Choice			
W_r	1.84**	1.68***	2.35***
EDU_r	-0.61	0.07	0.94
U_r	-0.57***	-0.68***	-1.08***
LQ_r	0.46***	0.50***	0.47***
Inclusive Value Index			
Belgium	0.24	0.31	0.14
East Germany (former)	0.31	0.41	0.40
West Germany (former)	0.34	0.47**	0.74***
Spain	0.28	0.48	0.56
France	0.26	0.52**	0.75***
Italy	0.27	0.48**	0.67***
Netherlands	0.30	0.20	0.32
United Kingdom	0.34	0.23**	0.72***
Number of observations	212	670	416
Likelihood ratio index	0.06	0.05	0.08

*** 1-percent significance level

** 5-percent significance level

("Acq") of existing businesses. The results in the third column ("Green, Acq, & Exp") include dependent variable observations that represent all three forms of new investments: greenfield investments, acquisitions of existing businesses, and significant expansions ("Exp") of established businesses.

The estimated inclusive value indexes support the notion of sequential, or tiered, choice; they are all well within the (0-1) interval and, in the specifications based on the two largest samples, they are statistically significant for about half of the countries considered. These results are 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. At the national level, industrial agglomeration (LQ_n) is the only included variable that consistently has a significant impact on location choice. At the regional level, all of the included variables except for the measure of worker skill (EDU_r) consistently have a significant impact.

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.[24] The positive coefficient on industrial agglomeration (LQ_r) is consistent with this attribute's presumed benefits.

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) [20]) have

[24]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 companies tend to invest in the relatively higher-wage regions of relatively low-wage countries, such as the North of Italy.

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 7 labelled "Green." At the national level, the positive effect of industrial agglomeration (LQ_n) remains significant. At the regional level, the estimated effects of the average wage rate (W_r), the unemployment rate (U_r), and industrial agglomeration (LQ_r) are virtually identical to those estimated using the more inclusive concepts of new investments. The similarity of the results from the two samples suggests that firms evaluate greenfield investments in at least roughly the same way as they evaluate targets for acquisition.[25]

The results based on all three types of new investments—newly acquired operations, newly established operations, and significant expansion of established operations—are completely consistent with the other two estimations at the regional level, but not so at the national level. For some reason, the sign of the coefficients on market size is unexpected and the coefficient on taxes is strongly positive. Although it is possible to explain the coefficient on tax rates, it is difficult to explain the negative coefficient on market size. This unusual result may be related to unavoidable biases in the sample of expansions in existing operations that are related to the small size of the sample (see the appendix).

[25]Although none of the inclusive value indexes are significant, this is probably related to the small number of observations available for greenfield investments.

6 Conclusion

This paper has examined the location choices of U.S. multinational companies for new manufacturing operations in seven European companies 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. Novel findings of this paper are that firms appear to evaluate greenfield investments, and expansions of existing operations, in at least roughly the same way as they evaluate targets for acquisition. Areas for future research include testing alternative nesting structures and expanding the coverage of the study to include more countries and/or industries.

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7 Appendix: Coverage of the BEA Data

The BEA data on new investments by U.S. multinational companies are based on mandatory annual surveys of U.S. direct investment abroad conducted by the Bureau. A report must be filed for each foreign business enterprise, above a certain size threshold, in which a U.S. company has a direct investment interest (i.e. a 10-percent or greater equity stake); these enterprises are called "foreign affiliates." Newly established and newly acquired enterprises are identified by a check box question on the survey form. Significant expansions in existing operations are identified based on changes in the fixed assets and the employment of existing foreign affiliates, as described in footnote 9.

The lowest thresholds are applied in benchmark survey, or census, years; in other years, known as "annual survey" years, the threshold is raised to reduce the reporting burden on survey respondents. To be reportable on the 1989 benchmark survey, a foreign affiliate had to have assets, sales, or net income (positive or negative) of at least $3 million; the threshold for the 1990-93 annual surveys was $15 million; for the 1994 benchmark survey, it was $3 million; for the 1995-98 annual surveys, it was $20 million; for the 1999 benchmark survey, it was $7 million; and for the 2000-03 surveys, it was $30 million.

Although the reporting thresholds can differ, by year, the geographic distribution of new investments, in the countries covered by this study, tends to be relatively unaffected (see columns 1 and 2 of table A-1). In the case of significant expansions of existing operations, the geographic distribution of the observations tends to be erratic across time, probably reflecting the small sample size.

Table A-1: Percentage of New Investments by Country

	All Investments		Expansions only	
	BMK years	NBMK years	BMK years	NBMK years
Belgium	4	2	20	6
France	16	19	0	15
East Germany (former)	5	5	0	2
West Germany (former)	18	23	0	17
Italy	14	12	20	9
The Netherlands	8	6	0	2
Spain	7	7	0	11
The United Kingdom	29	26	60	39

BMK Benchmark

NBMK Non-benchmark

Table A-2: 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	15
	Région Wallone	BE3	5
West Germany (former)	Baden-Württemberg	DE1	30
	Bayern	DE2	29
	Hessen	DE7	16
	Niedersachsen	DE9	11
	Nordrhein-Westfalen	DEA	46
	Rheinland-Pfalz	DEB	9
	Saarland	DEC	1
East Germany (former)	Berlin	DE3	7
	Brandenburg	DE4	4
	Hamburg	DE6	7
	Mecklenburg-Vorpommern	DE8	1
	Sachsen	DED	6
	Sachsen-Anhalt	DEE	2
	Schleswig-Holstein	DEF	7
Spain	Noroeste	ES1	3
	Noreste	ES2	12
	Madrid	ES3	5
	Este	ES5	25
	Sur	ES6	4
France	Île-de-France	FR1	24
	Bassin Parisien	FR2	32
	Nord-Pas-de-Calais	FR3	4
	Est	FR4	13
	Ouest	FR5	18
	Sud-Ouest	FR6	5
	Centre-Est	FR7	18
	Méditerranée	FR8	3
Italy	Nord-Ovest	IT1	13
	Lombardia	IT2	37
	Nord Est	IT3	6
	Emilia-Romagna	IT4	13
	Centro	IT5	8
	Lazio	IT6	4
	Sud	IT7	5
The Netherlands	Brabant	NL1	3
	Oost-Nederland	NL2	12
	West-Nederland	NL3	14
	Zuid-Nederland	NL4	21
United Kingdom	North	UK1	9
	Yorkshire and Humberside	UK2	18
	East Midlands	UK3	14
	East Anglia	UK4	8
	South East	UK5	60
	South West	UK6	12
	West Midlands	UK7	22
	North West	UK8	16
	Wales	UK9	4
	Scotland	UKA	14
	Northern Ireland	UKB	6

Sources: U.S. Bureau of Economic Analysis,
Bureau Van Dijk and others

Table A-3: Industrial Distribution of New Manufacturing Operations by U.S. Multinational Companies in Seven European Countries from 1989 to 2003

NACE code	Description	Number of Investments
da	Food Products, Beverages, and Tobacco	42
db	Textiles and Textile Products	18
de	Pulp, Paper and Paper Products Publishing and Printing	38
dg	Chemicals, Chemical Products and Man-made Fibers	114
dh	Rubber and Plastic Products	57
di	Other Non-metallic Mineral Products	10
dj	Basic Metals and Fabricated Metal Products	59
dk	Machinery and Equipment Not Elsewhere Classified	110
dl	Electrical and Optical Equipment	133
dm	Transport Equipment	83
dn	Manufacturing Not Elsewhere Classified	17
Source:	U.S. Bureau of Economic Analysis	