

# Location Choice Network Patterns of Japanese Multinational Companies in Europe

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## Abstract

This research investigates network patterns of location choice of multinational companies by using multinomial logit method. It empirically analyses regional economic factors, which were significant for attracting investments of Japanese companies during the last decade, by using the most detailed regional data possible. In addition to previous studies, this paper particularly addresses factors, which follower Japanese companies considered important in their investment decisions. For Japanese multinational company to locate near to other already established company from the same country there could be such reasons as: they tend to follow their business customers or because of existing intra-firm linkages already established in Japan, which they carry on in their investment decisions.

The aim of the paper is threefold. Firstly, it analyzes significant regional economic factors, which follower Japanese companies consider important in choosing regions with already established Japanese firms and, secondly, it analyzes those regional economic factors, which are significant for those companies, which choose to locate near to hubs of other Japanese companies. Thirdly, by using distances between regional centers, this paper tries to establish significance of physical distance in establishing hub of Japanese companies. Paper hypothesizes that Japanese companies disregard geographical distance in their investment decisions as they create networks of Japanese companies.

**Keywords:** Japanese companies, location choice, regional network, multinomial logit

## 1. Introduction

Nowadays firms are free to choose locations, which best suit their interests. Although some companies in industries such as mining and retail are limited to certain locations where natural resources or customers are, most manufacturing and wholesale industries are relatively free to choose where to be located. Moreover, transportation costs have been decreasing and modernization of telecommunications have facilitated and fastened flow of information. For instance, European regional integration has greatly reduced trade costs and barriers to serve customers in a different country or region. Some researchers use term “footloose” which refers to idea that company is not tied to a specific location, but is free to choose any location according to the factors they find important (Clark, 1969).

On the other hand, companies are exposed to greater competition in such an integrated area, because number of potential competitors increases as well, compared to number of competitors they face in a country protected by entry barriers. As a result, one of solutions to stay competitive in such wide and integrated markets is to select the location, which best suits their strategic, operational and financial interests.

In previous studies, several factors emerge according to which multinational companies choose investment location. The first one is a market—companies want to serve markets where demand is high (market potential factor and companies can enjoy economies of scale), the second one is costs—companies want to locate where operational costs are smaller (this includes labor costs, expenses of renting/buying property, various taxes etc.), the third one—companies tend to locate in the same region as companies with similar attributes are located—this includes similar industries and similar country of origin (so called agglomeration effect) and the fourth one—availability of resources as companies don't want to face shortages of labor force,

government services, natural resources etc.

This study analyzes location choice of 1,023 Japanese investments in 236 regional locations belonging to 18 European countries over the time period from 1995 to 2005. Following results derived from McFadden's (1984) paper, logit model is chosen. This study analyzes company's location choice from the perspective of European regions—the ability of regions to attract Japanese investment, attract followers and attract companies, which might serve neighboring regions.

In earlier papers, the most common model used was conditional logit and there were number of papers, which use nested logit and mixed logit models. This research uses multinomial logit, which allows classification of regions to reflect their experience of attracting Japanese companies and their position in the network of Japanese companies.

By using nested logit method, Head (2004) analyzes location choices of Japanese investment in nine EU countries during the period from 1984 till 1995. This study explores various market potential indices, notably the index developed by Harris (1954) and Krugman (1992). They also include other variables to characterize production costs—wage rate, corporate and social tax. It has been found that market potential is a significant and positive factor for investors' location choice. Social tax and corporate tax rate are found to be negative and significant. For nested logit model analysis, regions are grouped into their respective non-overlapping country groups.

Earlier paper by Head (1995) uses conditional logit to analyze location choice of 751 Japanese manufacturing plants in US in the 1980s. They found strong agglomeration effects on location choice, especially for companies within a similar industry or belonging to keiretsu. Similarly, Basile (2003) analyzes location choice of EU and US multinational companies in Europe. Contrary to the study by Head (2004), they try to different groups of countries e.g., North-South, Anglo-Continent-South etc. It has been found that country boundaries don't matter in the case of EU and US multinational companies. Contrary to agglomeration forces—peripheral regions also attracted significant investment and regions receiving assistance from structural funds were particularly attractive to European and US multinationals.

By using conditional logit model, Alegira (2006) analyzes location decisions of European firms across Europe with large sample size of 4,803 foreign investment projects in 246 regions. This study considerably extends geographical areas of previous location choice papers. Similarly to previous studies, market potential has been found to have positive and significant influence. For other included variables, income per capita is insignificant at country and regional levels. This study measures agglomeration effects by the number of foreign projects located in the region or country one year before the location decision is made. Study of agglomeration effects reveal that they tend to dominate on regional level, but at the country level economic activity tends to concentrate on peripheral countries.

Heterogeneity of investors has been analyzed with the mixed logit method, which has been used in Rasciute (2007) paper on the location choice of foreign investors in 13 Central and Eastern European Countries. This study reports high heterogeneity of investment location decisions. Market effect also has been observed, suggesting that larger host country will be more likely to be selected and this effect tends to be stronger for larger investing firms. In addition, less profitable firms are likely to invest in central locations, whereas more profitable firms will choose peripheral countries.

There are also studies comparing investment location choices in different areas of Europe. Disdier (2004) analyzes location choice of French firms in Eastern and Western Europe by using both conditional and nested logit methods. Results suggest that French firms will choose countries with already established French firms of the same industry, which confirms with results of previous papers. Other factors such as GDP and unemployment have positive and significant influence. Negative influences have been observed for such variables as GDP per capita, distance from France and wage rate. Additionally, this paper also introduces exchange rate volatility, which has negative and significant effect.

Several papers include unemployment rate, but results are mixed for this factor. As Disdier (2004) points out that high unemployment rate might suggest labor market imperfections, but on the other hand from investor's view point might signal availability of large labor supply. For example in case US, positive influence has been reported by Coughlin (1991).

This empirical research contributes to previous studies in such a way as it extends geographical spectrum of analysis and lowers statistical level of regional analysis. This paper also introduces several new factors in our analysis to characterize development level of infrastructure, distance to other Japanese companies and their

investment pattern.

The rest of this paper is organized as follows. Section 2 outlines theoretical models used in our analysis. Section 3 describes data sources. Section 4 analyzes the empirical results and Section 5 concludes.

**2. Theoretical Models**

Discrete choice models are widely used to analyze firms’ location choice. Most accepted model in recent studies is conditional logit model developed by McFadden (1984) for the analysis of consumers’ utility, but this model can be well applied to analysis of investors’ location choice. The proposed model maximizes firm’s profits—Japanese investors will choose particular location if that location offers the highest profits among other possible alternatives.

Firm’s location decision depends on the set of observable and unobservable factors. As rational decision maker, firm will choose to invest in the location, which offers the biggest profit  $\pi$  at the specific location  $\pi_j = V_j + \varepsilon_j$  where  $V_j$  is attributes to location  $j$  and  $\varepsilon_j$  is error term. Here, subscript  $j = 1, \dots, J, [\varepsilon_1, \varepsilon_2, \dots, \varepsilon_J] \sim N[0, \Sigma]$ .

Linear expression is given as  $V_j = \beta X_j$  where  $X_j$  is a vector of observable characteristics of location  $j$  and  $\beta$  is a vector of estimated parameters. Coefficients  $\beta$  are further estimated by maximum likelihood technique.

A firm chooses the location which offers the highest profits, compared to any alternative location  $k$ . Equation 1 below gives the probability of a firm choosing location  $j$  over location  $k$ .

$$P_j \equiv \text{prob}(\pi_j > \pi_k) = \text{prob}(\varepsilon_k < \varepsilon_j + b(X_j - X_k)), \forall k \neq j \tag{1}$$

Further, McFadden proved that probability of firm choosing location  $j$  is given by Equation 2. Further model is estimated using maximum likelihood method.

$$P_{jt} = \frac{e^{\beta_j X_{jt}}}{\sum_{k=1}^n e^{\beta_k X_{kt}}} \tag{2}$$

Dependent categorical choice variable  $P_{jt}$  of this model is described as such: base category takes value(0), when particular region is not selected at the particular year and at any year leading to this year. Category(1) is assigned to the region, which has been selected for the first time in particular year, and region belongs to category (2), if Japanese company invests in region with already established Japanese company presence and region has category(3) if Japanese company invests in any region (selected by other company or not) and if this region borders other two regions, which has already established Japanese company branches (additional explanation in Figure 1). Information about categories has been gathered by looking into all regions in the dataset and searching data in the previous years for company presence. Distribution regions by number of shared borders are given in Figure 2.

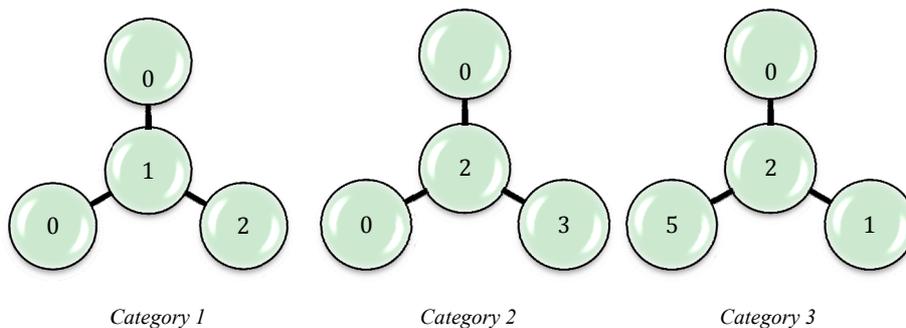


Figure 1. Schematic outline of the three categories

Three categories describe regional attractiveness. Circles shows regions and links between indicate they share common border. Number of companies in the region is indicated inside circles. Category 1 describes situation, when region attracted company, which is a newcomer and no other 2 regions with Japanese companies’ presence border this region. Category 2 describes situation, when region has attracted the follower company – number of companies in the region is more than 1. Category 3 describes situation, when region attracted company, but also other regions bordering this region have attracted Japanese companies. Variable distance measures geographical distance to the region with the largest numerical presence of established Japanese companies for all categories. For example, in the case of Category 3, distance will be measured to region, which has 5 companies located in it. In the case of Category 1 and Category 2, if it is possible to find Japanese company located in the neighboring region, distance will be included.

Since in multinomial logit models, the ratio of probabilities of choosing three types of locations are assumed to be independent of the characteristics of other locations, regions are not direct substitutes to each other. For example, category (1) is lesser independent from categories (2) and (3) as, when new company selects region, it possibly can turn either (2) or (3) and changing category away from (1), which is not related to initial choice of first comer company. Category (2) is more dependent from category (1), but independent from category (3), as by selecting new region it is possible for this region to become part of a hub. For category (3) there is not difference between large or small hubs of companies, which might violate IIA assumption. In addition, category (3) is distantly related to category (1). In the most cases, IIA assumption is assumed to be observed in this model.

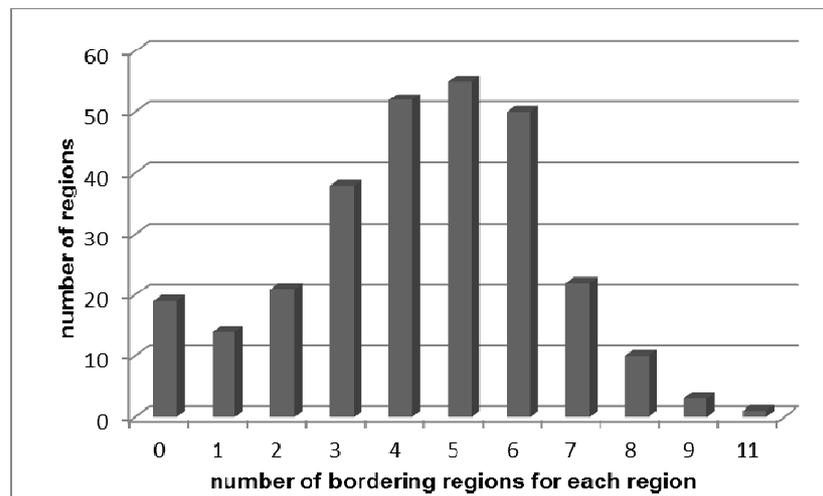


Figure 2. Number of bordering regions for each of the region in a dataset

### 3. Data and Sources

Location data about investment of Japanese companies were collected from *Toyo Keizai* database of year 2006 (Toyo Keizai, 2006). Database covers Japanese investments abroad and contains such information as name of affiliate company, address, year of investment, area of industry etc. There were 3349 Japanese companies investing in 27 European Union countries, which were member countries in year 2012.

EU country and regional statistical data were gathered from Eurostat homepage. Due to limited data availability of statistical data about Denmark, Romania and Bulgaria, national and regional data from those countries were removed from the dataset.

In addition, choices which don't contain any entry of Japanese company presence and are not bordering other regions with presence of Japanese companies were removed from dataset. For example, countries such as Cyprus, Estonia, Lithuania, Latvia and Malta did not attract Japanese investment during observed timer period and were not neighboring regions, which attracted investment. Further, overseas regions and dependent territories were excluded from the dataset. For the empirical analysis of this paper, there remained 236 regions in 18 countries for the period of ten years long time span from 1995 to 2005.

From all regions, 19 did not have any bordering region and 14 had just one bordering region. These regions could not become category (3) region in this research, but 252 regions could become category (3) region, because they were bordering two and more regions.

During this sample period, Europe has removed barriers to internal trade, adopted common currency and expanded into new countries, bringing foreign investors and importers into the largest market in the world. Further, euro was adopted as official currency of EU and accession negotiations started with applicant countries. This could give overseas investors preparation time and idea of further integration.

Chosen analysis method is multinomial logit model. On the left hand side of the equation, the dependent variable is categorical variable indicating whether region has been chosen by one or number of multinational companies. Variable takes value 1, if region attracted one Japanese investor in the previous years or in the particular year. Variable takes value 2, region has been chosen more than once in the previous years or in the particular year and there are no other Japanese investor locating in the neighboring 2 regions till given year. Variable takes value 3,

if one or several Japanese companies are located in the region, which numbers more than two regions with present Japanese investor, thus forming hub of Japanese companies. If a region receives no new investment from Japanese investors, the value of the variable is 0. Presence of Japanese company in the region is determined by its registered address provided in the database.

On the right hand side, independent variables are region specific with a few country specific variables. For a summary of the independent variables, see Table 1. Size of the region is characterized with number of population, which can also characterize market potential. Labor costs and labor availability in the region is calculated by an average wage in the region and unemployment rate, which is country specific variable. Development level of infrastructure is captured by density of roads in the region, which is year specific, and by dummy variable, which characterizes that region has or is located in directly neighboring region of a large airport (20 million passenger movements per year). Distance captures physical distance between region centers of the selected region and region, which has the largest number of present Japanese companies.

Table 1. Data summary

	Mean	Standard deviation	Min	Max
Dependent variable			0	3
Ln Population	14.1483	0.8061	10.1329	16.2491
Ln Av Wage rate	0.01890	0.0087	0.0021	0.0576
Ln Unempl. Rate	2.10992	0.3938	0.7885	2.9957
Ln Road density	1.41740	1.4774	0	9.3009
Airport dummy			0	1
Distance	106.83	97.93	0	417

Wage rate might characterize labor cost as well as income level. High income levels in the region might be attractive for Japanese investors, but in the same time high labor costs have negative influence. In addition, higher labor costs might also indicate high labor quality, which is also attractive. Positive, insignificant coefficient is reported in Alegria (2006). Another labor characteristic is unemployment rate, which signals availability of labor force in the region.

Disdier (2003) uses both GDP and GDP per capita, which could be used interchangeably with wage rate. Similarly, Head (2004) and Alegria (2006) uses several market potential calculation methods, which also include neighboring economies' GDP weighted by distance. The expected sign suggested by previous studies is positive.

Infrastructure in a region is measured by road density, which is calculated as a ratio of length of road network to the area of the region. Positive value is expected for this variable as investors will prefer to invest in the region with already established infrastructure. Another measurement of infrastructure development is availability of a large international airport in the region and surrounding regions. Distance is measured by geographical distance to the assumed center of the region (source MCRIT database, 2006).

Multinomial logit has been used in several papers related to analysis of location choice. Wei (2005) analyzes entry modes of FDI in China by using categorical variables of entry mode. In case of Europe, Louri (2000) uses multinomial logit to determine outward FDI activity of Greek firms, where the categories are firms' decisions to export, engage in FDI or not in engage at all in export or FDI activities.

Japanese investors are more likely to select region where is already established companies, because of positive spillover of information and possible cost savings in procurement. It is also possible that branches from same parent company are established in the same region for purpose of cost savings and facilitation of information exchange between daughter companies.

#### 4. Empirical Results

In the first part of analysis, results of multinomial logit are reported in Table 2, which represents likelihood of regions to attract Japanese investors. There are totally 236 regions in the study, which roughly corresponds to number of regions at NUTS2 level.

Three categories, which represents manner of investment, are distributed rather evenly over the eleven years, with

212 or 8.2% entry regions of any given time have been chosen once, 353 or 13.6% regions during observation period have been chosen more than once, 601 or 23.2% regions in the similar time period has been located next to more than two regions with Japanese companies. The rest is 1430 or 55.08% of regions, which has not been chosen at all.

Results are reported in two specifications, where in the second specification variables measuring infrastructure development are not observed. Log likelihood doesn't improve significantly. Most variables for category (1) are insignificant at observed significance levels, but for categories (2) and (3)—largely significant. Scope of this research concentrates on follower companies, which are represented by those categories (2) and (3).

It has been observed that size of region measured by the number of inhabitants has been negative for the first two categories, and positive, significant for companies located in hubs—category (3). On the other hand, other labor characterizing factor average wage rate in the region are positive and significant for the category (2). There is no variation between categories, but for category (3) this variable is insignificant.

Table 2. Multinomial logit regression results, all regions

Specification	(1)			(2)		
Category	(1)	(2)	(3)	(1)	(2)	(3)
Ln Population	-0.1340 (0.1311)	-0.1035 (0.1197)	0.1970 <sup>b</sup> (0.0862)	-0.0689 (0.1249)	-0.0690 (0.1141)	0.2592 <sup>a</sup> (0.0827)
Ln Average Wage rate	12.8576 (13.8160)	19.3452 <sup>c</sup> (12.4715)	3.1586 (8.5476)	21.0409 <sup>b</sup> (13.0606)	24.2782 <sup>b</sup> (11.9242)	10.1168 (8.1434)
Ln Unempl. rate	-0.0115 (0.2917)	0.4921 <sup>b</sup> (0.2794)	0.1153 (0.1853)	-0.1303 (0.2791)	0.3431 (0.2669)	0.0612 (0.1777)
Ln Road density	0.1307 <sup>b</sup> (0.0701)	0.1406 <sup>b</sup> (0.0665)	0.0798 <sup>b</sup> (0.0494)			
Airport	0.7416 (0.5840)	0.2785 (0.6010)	0.8251 <sup>b</sup> (0.4003)			
Distance	-0.0031 <sup>a</sup> (0.0012)	0.0016 <sup>b</sup> (0.0009)	0.0004 (0.0007)	-0.0032 <sup>a</sup> (0.0012)	0.0015 <sup>b</sup> (0.0009)	0.0004 (0.0007)
Constant	0.5144 (1.9150)	-1.3301 (1.7638)	-2.8910 (1.2385)	-0.0879 (1.8142)	-1.3826 (1.6704)	-3.6415 (1.1824)
Log Likelihood		-1503.00			-1508.68	
Frequency(%)	212 (8.2%)	353 (13.6%)	601 (23.2%)	212 (8.2%)	353 (13.6%)	601 (23.2%)
Observations		2596			2596	

*Dependent variable is discrete variable of location choice at the regional level that is regions ability to attract Japanese foreign direct investment given certain selected regional characteristics. Category (1) attributes to the regions chosen by Japanese companies for the first time, category (2) attributes to the regions, which attracted Japanese companies more than once and category (3) attributes to the regions, which borders at least 2 other regions with Japanese companies present. Significance indicators: a—at 1% level, b—at 5% level, c—at 10% level. Standard errors are in parenthesis.*

Unemployment rate, which could be explained as an indicator of availability of labor force, has negative sign for the first category, although insignificant. Variable turns significant for category (2) in the first model, suggesting Japanese investors' preference for regions with higher unemployment rate.

Earlier studies show various signs for unemployment rate influence on the investment decisions. For example in

the case of French companies, Disdier (2003) reports positive and significant estimated coefficient. On the other hand, Head (2004) study of Japanese companies with conditional logit model reports negative and significant sign. This might suggest different approaches to labor market by multinational companies of different country of origin.

In the model (1), variable which characterize infrastructure development—road density is positive and significant for all specifications. This suggests that regions with developed road infrastructure were better able to attract Japanese investors. As most of European regions have reached comparable level of infrastructure development, investors have access to good road infrastructure in all regions of Europe.

Dummy variable—large airport existence is significant for companies investing in regions, which are part of hubs and is not significant for companies, which are investing for the first time in the region and companies which were not in the regions with hubs of Japanese companies.

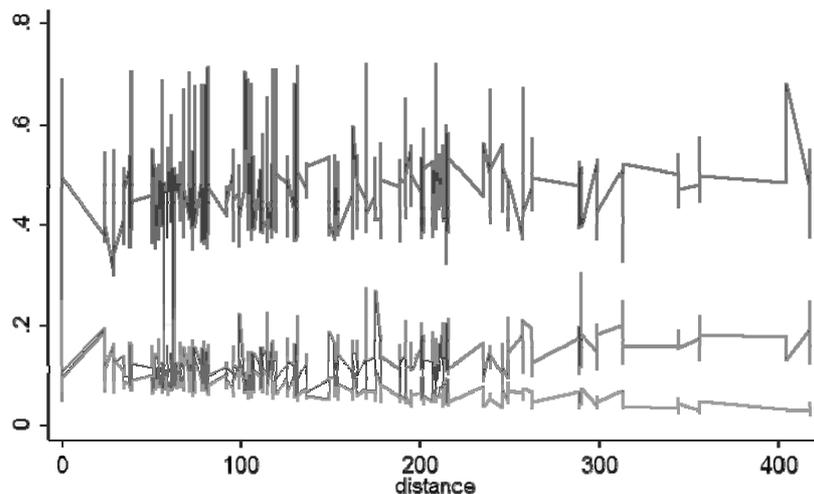


Figure 3. Probability of selecting region in relation to distance variable

*Upper line shows probability of choosing category (3), middle line – category (2) and bottom line category (1).*

Variable measuring distance between regions of Japanese companies' investment presence is significant and sign varies across categories. Longest distance between region centers of established Japanese companies is 417 km with average being 107 km (see Table 1). Distance for the category (1) is negative and significant. Companies, which established in the region for the first time, prefer to be located not far away from other established companies, wherefore distance is a negative factor. For the category (2), distance turns positive and significant, which suggests, that these regions are located far from other Japanese companies. For the category (3), coefficient is not significant, suggesting that distance is not important factor for those companies, which choose to locate in the region bordering more than 2 regions with presence of Japanese companies. Figure 3 shows probably of selecting region in relation to distance for three categories.

Results suggest that there is no evidence that distance between Japanese companies can be significant factor for Japanese investors, except for the newcomers.

## 5. Conclusions

By using firm level data and latest regional statistical data, study empirically analyzed determinants of regional attractiveness for Japanese companies in Europe at the regional level.

Several factors were chosen to characterize region specific qualities. Multinomial logit model shows that distance is not significant when companies choose to be located in the regional hubs of Japanese companies. On the other hand, companies, which are newcomers in the region, consider distance as a significant factor.

Such factors as size of regional population, average wage rate and unemployment are not significant factors to attract Japanese investors. In contrary, significant factors are infrastructure advancements, distance to other Japanese companies. In addition, companies tend to locate in the vicinity of an airport, which were significant

factor for those companies investing close to hubs.

Companies, which are followers and did not invest in the regions close to regional hubs, found such factors significant as average wage rate, unemployment rate, infrastructure development level and distance. Insignificant factors were presence of a large airport and population size.

Those companies located close to the hubs of Japanese companies considered such factors significant as: population size of the region and infrastructure development level.

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