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**How do Firms Agglomerate?  
A Study of FDI in France**

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**2000.50**

# How do Firms Agglomerate?

## A Study of FDI in France \*

Matthieu Crozet<sup>†</sup>      Thierry Mayer<sup>‡</sup>      Jean-Louis Mucchielli<sup>§</sup>

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### Abstract

This paper studies the determinants of location choice by foreign investors in France. A new sample of almost 4000 location choices over 10 years and 92 administrative locations is used to measure two important issues: To what extent do foreign investors cluster spatially and are the decision makers sensitive to investment incentives? Concerning the agglomeration effects, we find very strong evidence of positive spillovers between firms and identify the countries of origin and the industries for which those spillovers are the most substantial. Concerning promotion policies, we find very little evidence of any positive impact of either the national or European regional policy on location choices. Finally, we identify for some European countries a “learning process” of foreign direct investment, the location decisions gradually becoming more remote from the country of origin during the period we study.

JEL classification: F23, R3, R58

Keywords: Industrial location, conditional logit, FDI, regional policy.

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# 1 Introduction

Promotion policies are largely used by local, national or European authorities in order to try and influence the location of economic activity in favor of lagging regions. Public authorities are particularly anxious to attract foreign investors often thought to be source of productivity increases by local firms in addition to creating new jobs. Related to these practices, is the now well documented finding that firms cluster in space (see Henderson and Kuncoro, 1996 ; Ferrer, 1998 ; Devereux and Griffith, 1998 ; Mayer and Mucchielli, 1999 ; Head et al., 1995 and 1999, for recent results on that topic). The decision makers implementing promotion and regional policies often have this idea in mind that being successful in attracting a first critical set of firms will generate a virtuous mechanism of self-reinforcing agglomeration of firms in the territory targeted.

This paper analyzes location choices of foreign investors in France. It is particularly focused on the measurement of agglomeration effects –the positive influence of a firm’s location choice on the probability that the subsequent firms make the same choice– and the identification of the effect of promotion policies used by local authorities to attract firms.

The existing empirical literature on agglomeration effects has mainly consisted of national level studies (Wheeler and Mody, 1992, Devereux and Griffith, 1998) or choices of states in the USA (Carlton, 1983, Friedman et al. 1992, Head et al. 1995, 1999). The preceding work on location choices in Europe at a lower geographical level than countries has considered choices of regions by foreign investors on the European territory (Ferrer, 1998). Mayer and Mucchielli (1999) considered in an integrated way the national and regional choices of Japanese investors in Europe. Some papers considered location problems at a very thin geographical level for Brazil (Hansen, 1987), China (Head and Ries, 1996) or Indonesia (Henderson and Kuncoro, 1996). However, nobody has yet to our knowledge studied the determinants of location choice at a

very detailed level for a European country that would be a major receiver of FDI (see however Guimarães et al., 2000 for a very thin analysis of location choice of FDI within Portugal). This paper is the first to consider individual firms' decisions for over 90 territorial units in France.

One of our objectives is to study in more detail the characteristics of agglomeration effects. Due to a very large dataset, we are in particular able to differentiate the determinants of location depending on the country of origin of the investor and the industry of the plant located in France. Our results give insights for the following questions that are likely be important for the policy maker: Does the nationality of the firms matter for agglomeration effects? Do firms cluster more with other firms from the same country? Do firms show a preference for regions within France that are near to their home market? Do all industries exhibit the same pattern of geographic concentration? We show that the nationality of the investor is of crucial importance in location patterns. There are certain countries sharing a border with France for which investors show a very strong tendency to locate near their country of origin. However this tendency is declining over time which suggests some learning process in the difficulty of operating a plant abroad. We also observe very different behaviours depending on industries. Concerning agglomeration effects, it is shown that firms cluster with their competitors but that this behaviour depends on the nationality of both the competitors and the investor.

We then analyze the effect of both French and European regional policies on location choice. We show that foreign investors are, to a large extent, *not* sensitive to investment incentives. Even when promotion policies appear to have a statistically significant positive effect, the magnitude of this effects is very low compared to other determinants.

The remainder of the paper is as follows: Section 2 presents the theoretical determinants of location choice using a very simple oligopolistic competition model that yields an estimable equation for the location choice of firms. Section 3 describes the econometric model and the data used. Section 4 presents results on general and industry level location patterns, focusing

on agglomeration effects. Section 5 presents results on the impact of promotion policies and section 6 concludes.

## 2 Theoretical foundations

Location choice determinants can be broadly classified in four large groups: Demand that can be expected on the chosen location, factor costs that would be faced, the number of “local” and foreign firms active in that same location and public policies designed to attract firms.

The sign expected on the two first variables is very widely accepted to be respectively positive and negative. The influence of the number of firms is more complicated and results from a trade off between agglomeration and dispersion forces. On the one hand, location theory generally finds that geographic distance isolates firms from competition. A rise in the number of firms in a given location shifts prices down in that location and therefore decreases incentives to locate there. On the other hand, positive externalities between firms can emerge from technological spillovers or other mechanisms recently celebrated by the economic geography literature (Krugman, 1991, Venables 1996). These forces contribute to the geographical clustering of firms and the sign of this determinant will therefore depend on the relative strength of the two forces.

Investment promotion policies can take various forms: job creation subsidy, temporary exemption from local taxes, low levels of corporate taxation... Everything else equal, firms should be positively influenced by this determinant in their choice.

All those determinants can be synthetized in a very simple formal framework yielding an estimable equation describing the profitability of choosing a particular location. Suppose firms use quantity as their strategic variable and let demand take a generalized Cobb Douglas form where price and income elasticities can differ from 1:

$$Q = \frac{\alpha m^\gamma}{p^\beta}. \quad (1)$$

$\alpha$  is the share of income spent on the particular good considered,  $m$  is income (exogenous here) of consumers,  $\beta$  is price elasticity and  $\gamma$  income elasticity.  $Q$  is total quantity demanded at price  $p$ , this demand being satisfied by locally producing firms<sup>1</sup>. Suppose that firms have identical production costs when producing in the same location, ensuring the individual quantities will be equal in equilibrium:  $Q = Nq$ ,  $N$  being the number of active firms on the market. After tax profits of a representative firm willing to produce and sell at this location is:

$$\pi = (1 - t)(p - c)q, \quad (2)$$

where  $t$  is the corporate tax rate (representing promotion policies in a large sense) and  $c$  is a unit production cost function. First order condition for profit maximization is:

$$p \left( 1 - \frac{q}{\beta Q} \right) - c = 0.$$

Using (1) and adding first order conditions over the  $N$  firms, we obtain the following expression for total equilibrium quantity:

$$Q = Nq = \frac{\alpha m^\gamma}{N^\beta} \left[ \frac{N\beta - 1}{c\beta} \right]^\beta,$$

which gives equilibrium price:  $p = \frac{N\beta}{N\beta - 1}c$ . Substituting  $q$  and  $p$  in the profit function, we obtain the following expression:

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<sup>1</sup>This assumption is of course not realistic as firms in each location usually serve consumers in several locations. It is however only made for analytical clarity and our demand variable will take into account the fact that firms serve several locations.

$$\pi = (1 - t) \left[ \frac{\alpha m^\gamma}{N^{(\beta+1)}} \left( \frac{\beta}{N\beta - 1} c \right)^{1-\beta} \right]$$

Supposing that price elasticity is superior to 1 ( $\beta > 1$ ), profit is a decreasing function of corporate tax rate, production costs and number of active firms, that is competition intensity (a traditional effect in location theory, see d'Aspremont et al., 1979). Profit is also an increasing function of consumers' expenditure, i.e. of market size.

Let us specify a bit more the unit cost function such that unit cost is a function of ongoing wage ( $w$ ) and includes a positive externality related to the number of firms<sup>2</sup>:

$$c = w^{\theta_w} N^{-\theta_N}, \quad \theta_w > 0, \quad \theta_N > 0.$$

The influence of the number of firms is then ambiguous. Suppose the number of firms is such that  $N\beta$  constitutes a reasonably good approximation of  $N\beta - 1$ . The profit function can then be written as:

$$\pi = (1 - t) \alpha m^\gamma (w^{\theta_w})^{1-\beta} N^{(-\theta_N - 1)(1-\beta) - (\beta+1)}. \quad (3)$$

Equation (3) is log-linear and gives us the theoretical foundations of our empirical estimation of location determinants. The signs of the first three variables are still clearly determined, but the sign of the count of firms variable is now depending on the importance of the externality parameter relative to the negative impact of competition.

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<sup>2</sup>This externality takes a form comparable to the one specified by Belleflamme, Picard and Thisse (1999). For the foundations of such externalities and distinctions between different possible types of externalities, the reader can get back to the seminal work of Marshall (1920), recently inspiring a large number of papers including Krugman (1991), David and Rosenbloom (1990), Arthur (1990, 1994), Fujita and Thisse (1996, 1999).



### 3 Implementation of the location choice model

#### 3.1 The econometric model

The economic decision studied in theoretical location models is by nature a discrete choice among several alternatives made by individual firms. Turning to empirical matters, the econometric model should therefore ideally have these features too. For this reason, models with a qualitative endogenous variable and particularly conditional logit models have been widely used in the preceding empirical work on industrial location.

This model assumes that firms maximize a profit function subject to uncertainty when choosing a location. The deterministic component of the profit function consists of the various attributes of locations that can influence the profitability of building a plant in a particular location (equation 3). The random component consists of maximization errors, unobserved characteristics of choices or measurement errors. While the real underlying profit yielded by alternative locations cannot be observed, what is observed is the actual choice of each firm and the characteristics of the alternative locations.

There is a set  $I = (i, j, \dots, n)$  of possible location sites and the location  $i$  offers a profit  $\pi_i$  to investors according to a set of variables  $\mathbf{U}_i = [\ln X_{i1}, \dots, \ln X_{ik}]$ ,  $\mathbf{X}_i = [X_{i1}, \dots, X_{ik}]$  being the vector of observable characteristics of location  $i$ .

$$\pi_i = \mathbf{b}\mathbf{U}_i + \epsilon_i$$

Where  $\mathbf{b}$  is the vector of unknown coefficients to be estimated and  $\epsilon_i$  is the unobservable advantage of location  $i$ . All characteristics vary among locations, some fluctuate among industries as well but they are constant across firms. It is assumed that an investor chooses location  $i$  if it yields higher profits than any other possible choice. The probability of choosing  $i$  is thus :

$$\text{Prob}(\pi_i > \pi_j) = \text{Prob}(\epsilon_j < \epsilon_i + \mathbf{U}_i - \mathbf{U}_j) \quad \forall j \neq i.$$

This probability of choosing location  $i$  was shown to take the following form (McFadden, 1984) under a type I extreme value distribution of the error term:

$$P_i = \frac{e^{\mathbf{b}\mathbf{U}_i}}{\sum_{j=1}^n e^{\mathbf{b}\mathbf{U}_j}}.$$

Using this formula for the probability of investing in each location, the coefficient on each variable is then estimated by maximum likelihood. The expected signs and magnitudes of those coefficients are dictated by equation (3).

## 3.2 The data

### The dependent variable

We consider location decisions by foreign investors in France. The left hand side variable needed is the location choice of each investor over all the 92 French départements<sup>3</sup> with its nationality, date of investment and industry. The main database (IEF) comes from the Direction du Trésor and was constructed based on the (now softened) legal obligation for foreign firms to ask for an administrative authorization to invest in France. This database reports many information on foreign affiliates operating in France including date and town of investment, employment, the different shareholders, their nationality and respective shares... We use the 1996 version of the database and consider investments from 1985 to 1995 mainly because of data limitations on the right hand side variables. We consider only firms for which the industry reported is manufacturing. We sum up the shares of foreign investors by country of origin and then keep only the firms for which the largest share is held by a foreign country and for which this share

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<sup>3</sup>Which correspond to the NUTS 3 level in the Eurostat geographical classification of regions for France.

is at least 10%. We attribute the firm to the first country of ownership when several countries have shares in a given firm.

The main problem of this database is that only the location of the headquarters is reported. However using the identification number of the firm, it is possible to track the producing units belonging to the firm and then get its precise location using a different database made available by the Ministry of Industry. The procedure has therefore been the following : take all investments with their dates in IEF and keep all producing units that belonged to a firm in IEF and were “born” the same year or after the date reported in IEF. The date of creation of the plant is inferred by looking at the first year where that establishment was reported by the French Ministry of industry. This gives us our sample of location choices which consists of a close to exhaustive list of producing units owned by foreign companies in France and established during that period. The sample contains 3902 observations over 206 industries.

### **Agglomeration variables**

The agglomeration variables consist of cumulated counts of firms based on that sample. The calculation follows Head et al. (1995) and consists of the count of firms belonging to the same industry (but not belonging to the same parent company) that were located in each département a year before the considered investment.

We here introduce new dimensions in the measurement of agglomeration effects. We first try to identify the “nationality” of the agglomerative force. We try to answer the following question: Does a firm exhibit a tendency to cluster equally with other firms from the same origin country, other non-French firms and/or French firms? There will therefore be three agglomeration variables: NH, NO and NF accounting respectively for the effect of the presence of same home country firms, other foreign firms and French firms. The sign and magnitude of each coefficient on those variables is dependent on the relative strengths of the competition

effect and positive externalities exposed in the theory section. The comparison of coefficients on those variables will enable us to draw insights on the possibly different effects depending on different nationalities of the investors.

Second, we are able, due to the large size of the sample to differentiate between country of origin and industry in the location behavior of multinational firms. This is of course of primary importance for policy issues as it will appear that there is a large amount of heterogeneity calling for different measures by public authorities if they intend to attract FDI and conduct regional policies.

### **Demand variable**

Unlike most of the empirical literature on location choice<sup>4</sup>, the demand variable taken here is not local GDP. The French départements are of relatively little size and it seems clear that foreign investors target consumers far beyond the frontier of the département they choose to locate in. However, transport costs make distant consumers more difficult to reach and we must take this difficulty of access into account. We do so by using a variable inspired by the concept of market potential introduced by Harris (1954):

$$\text{MARK}_i = \text{GDP}_i + \sum_{j \neq i} \left( \frac{\text{GDP}_j}{d_{ij}} \right).$$

Our demand variable, labeled MARK, therefore takes into account local GDP of the chosen location and adds the GDPs of all other locations weighted by their distance to the chosen location.

The source of the GDP data is REGIO, the Eurostat regional database that allocates French GDP between French départements. The distance variable consists of real road distances (fastest

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<sup>4</sup>A notable exception being Friedman et al. (1992) who use a demand variable similar to the one used here in their analysis of foreign investment in the United States.

trip between the respective centers of the two départements) that have been collected using an electronic road atlas. MARK is of course only a proxy for the real demand perceived by firms. It is very difficult here to obtain data that could allow for more sophisticated demand variable at this geographical level. We believe that this proxy is however reasonable for a large proportion of the industries in the sample and the results seem to confirm this belief.

### **Labour costs variable**

We were able to calculate a very precise wage per capita variable at the département and 4-digit industry level. Using data on producing units operating in each département<sup>5</sup>, we include the average wage per capita of the industry, département and year relevant for the investment considered. The variable is labeled W.

### **Distance to home country variable**

As shown below, the location choices of FDI are also influenced by proximity with the investor's home market. We take into account this tendency of foreign firms to invest in locations near their country through a distance variable labeled DIS (the great circle distance between the economic center of the investing firm's country of origin and the center of each département available as a location).

### **Grants variables**

The main instrument of regional policy available to the French government is called the *Prime d'Aménagement du Territoire* (PAT) and consists of labor related grants for creating or maintaining jobs in lagging regions. Both French and foreign investments are eligible for these grants and about half the annual funding goes to foreign investors. We estimate the influence of this

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<sup>5</sup>When data was missing because the département had no firm in the 4-digit industry, we used an average of the average national wage for this industry and the average wage across industries in this location.

policy instrument on location choice by introducing a variable called PAT which takes into account the funds granted to each region for the year of the considered investment.

Some French regions are also eligible to the European Commission regional policy involving grants that are sometimes used to attract FDI but most of the time consists of attempts to improve the economic environment with an expected indirect effect on attractiveness.

There are three main Objectives under which the Commission grants structural funds to European Regions. Objective 1 is aimed at promoting development and structural adjustments in regions that are lagging behind (defined as those with GDP per head below 75% of the Union average). No French region considered in this paper is in this case, due to the fact that we do not consider Corsica as part of the choice set. Objective 2 is aimed at promoting the conversion of areas affected by industrial decline. Objective 5b is aimed at rural areas affected by problems linked to the decline of agriculture. There are numerous French regions receiving grants under those two objectives, the two main receivers being Nord-Pas-de-Calais and Lorraine. We also include the “community initiatives” funds. The corresponding variables are the grants given to each region under each relevant objective, respectively : OBJ2, OBJ5B, HOBJ.

## 4 Results

### 4.1 Spatial patterns of investment

Figures 1 and 2 show the spatial distribution of foreign affiliates in France for investors originating from other European countries (all affiliates in the département being attributed to the central city for this graph). It is readily apparent that the region around Paris has been a major recipient of investments for FDI from all origin countries. It is also striking that some investors have a preference for locations in France that are near the border with their origin country. This is particularly apparent for FDI originating from Belgium, The Netherlands, Germany and

Figure 1: Patterns of foreign affiliates in France: FDI from Belgium, Germany and the Netherlands

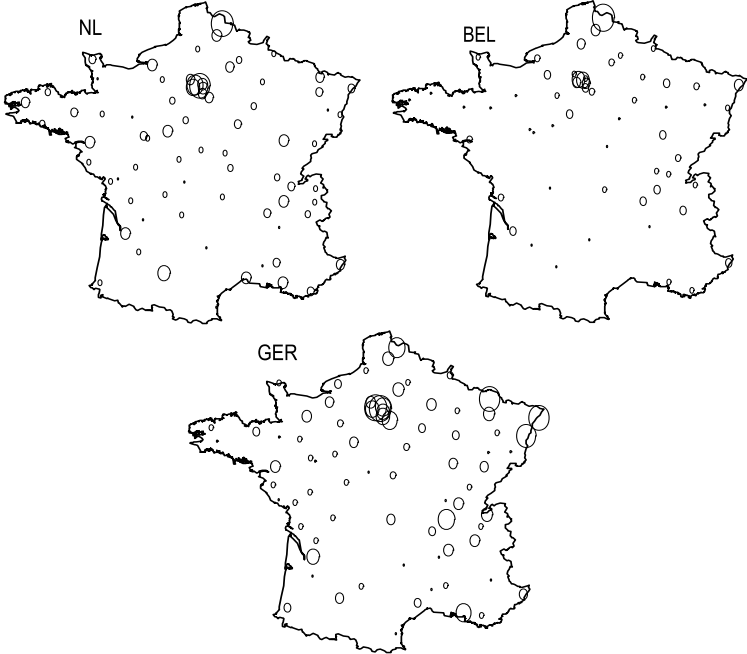
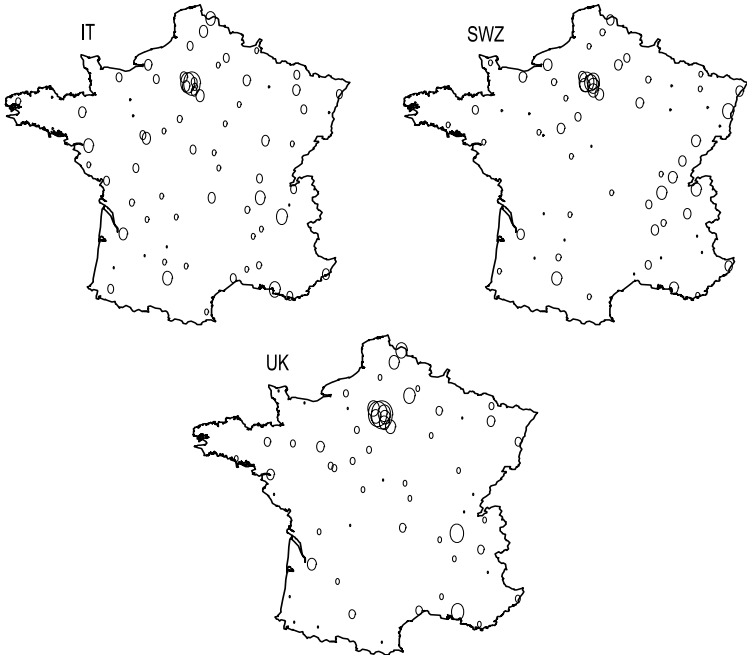


Figure 2: Patterns of foreign affiliates in France: FDI from Italy, Switzerland and the United Kingdom



Switzerland. Similarities in culture, language, tastes, distribution networks... might therefore be an important determinant of location choices by investors originating from a country that has a common border with France. This behaviour is to be compared with other econometric relationships uncovered in international trade and FDI studies exhibiting a positive impact of cultural similarity on goods or factors flows. Concerning trade flows for instance, it is well known that a common language constitutes a powerful motivation for bilateral trade. It has furthermore been recently showed by Rauch (1999) that colonial ties had a strong positive effect on trade. Head and Ries (1998) also found a positive impact of migrants from the partner country on bilateral trade.

This pattern suggests that regions in France that share a border with the country of origin of the investor offer important advantages in the trade off between the costs of operating abroad and the access to French consumers: Whereas those locations might not offer an ideal access to the rest of French consumers, they present a whole set of features that are common with the country of origin of the investor and can therefore diminish the cost of operating abroad.

## 4.2 Results by country of origin

We now proceed to the estimation of the determinants of location choice of foreign investors in France by country of origin. Tables 1 and 2 present the results for the 8 main investing countries in France, that is the United States (21.3%), Germany (16.2%), the Netherlands (12.5%), Italy (10.9%), the United Kingdom (10.4%), Switzerland (9.3%), Belgium (6.4%), and Japan (2.1%).

The global regression shows, as expected, a positive influence of the market potential and a negative influence of wages. We also get a positive effect of competitors presence. This shows that agglomeration forces dominate dispersion forces on average, this finding being an indicator of spillovers that might exist between firms. It is noteworthy that the agglomeration with French firms is much higher than agglomeration with other foreign firms either of the same or a different



Table 1: Location choice of foreign investors in France.

| Model :                                | Dependent Variable: Location choice |                    |                    |                    |                    |                   |
|----------------------------------------|-------------------------------------|--------------------|--------------------|--------------------|--------------------|-------------------|
|                                        | Total                               | Belgium            | Netherlands        | Germany            | Italy              | UK                |
| ln Nb. of same home country firms (NH) | 0.18***<br>(0.06)                   | 0.31<br>(0.29)     | -0.51**<br>(0.25)  | -0.28*<br>(0.15)   | 0.04<br>(0.30)     | 0.53**<br>(0.21)  |
| ln Nb. of other foreign firms (NO)     | 0.29***<br>(0.03)                   | 0.55***<br>(0.14)  | 0.12<br>(0.10)     | 0.65***<br>(0.09)  | 0.28***<br>(0.10)  | 0.18<br>(0.11)    |
| ln Nb. of French firms (NF)            | 0.76***<br>(0.02)                   | 1.11***<br>(0.10)  | 0.55***<br>(0.06)  | 0.79***<br>(0.06)  | 0.36***<br>(0.07)  | 0.97***<br>(0.07) |
| ln market potential (MARK)             | 0.43***<br>(0.03)                   | 0.38***<br>(0.12)  | 0.66***<br>(0.10)  | 0.32***<br>(0.07)  | 0.66***<br>(0.10)  | 0.69***<br>(0.10) |
| ln wage (W)                            | -0.31***<br>(0.09)                  | -1.20***<br>(0.36) | -0.80***<br>(0.25) | -0.05<br>(0.25)    | -1.25***<br>(0.21) | -0.24<br>(0.31)   |
| ln distance to home country (DIS)      | -0.75***<br>(0.05)                  | -0.86***<br>(0.12) | -0.22<br>(0.14)    | -1.32***<br>(0.11) | -0.51**<br>(0.22)  | 0.02<br>(0.14)    |
| N. obs.                                | 3902                                | 251                | 489                | 632                | 425                | 404               |
| Pseudo R <sup>2</sup>                  | 0.166                               | 0.273              | 0.127              | 0.182              | 0.096              | 0.239             |

Note: Standard errors in parentheses with \*\*\*, \*\* and \* respectively denoting significance at the 1%, 5% and 10% level.

Table 2: Location choice of foreign investors in France.

| Model :                                | Dep. Var: Location choice |                   |                    |
|----------------------------------------|---------------------------|-------------------|--------------------|
|                                        | USA                       | Japan             | Switzerland        |
| ln Nb. of same home country firms (NH) | 0.12<br>(0.10)            | 1.33*<br>(0.70)   | -0.27<br>(0.19)    |
| ln Nb. of other foreign firms (NO)     | 0.28***<br>(0.08)         | 0.38<br>(0.26)    | 0.81***<br>(0.11)  |
| ln Nb. of French firms (NF)            | 1.18***<br>(0.05)         | 1.50***<br>(0.19) | 1.07***<br>(0.08)  |
| ln market potential (MARK)             | 0.16**<br>(0.07)          | 0.53***<br>(0.20) | 0.17*<br>(0.10)    |
| ln wage (W)                            | 0.86***<br>(0.21)         | -0.69<br>(0.59)   | 0.03<br>(0.34)     |
| ln distance to home country (DIS)      | -0.95<br>(1.26)           | 1.03<br>(6.98)    | -0.59***<br>(0.13) |
| N. obs.                                | 833                       | 83                | 363                |
| Pseudo R <sup>2</sup>                  | 0.191                     | 0.291             | 0.198              |

Note: Standard errors in parentheses with \*\*\*, \*\* and \* respectively denoting significance at the 1%, 5% and 10% level.

country of origin. This might indicate that competition faced by a foreign investor in France is fiercer with other foreign firms than with French firms. This might also be the sign that the technological spillovers passing through informal communication or inter-firm mobility of qualified workers is substantially easier with French firms. Another interpretation of that result can be made in term of informational externalities (see Banerjee, 1992, and De Coster and Strange, 1993, for theoretical models). Supposing that French firm have a better information than foreign companies on the “true” compared attractiveness of French départements, the location of French firms would therefore convey more information than the location of foreign affiliates for the prospective investor. As a consequence, foreign investors would be more willing to replicate French firms’ choices than choices made by other multinational companies that might not have any better information than them.

The results show however a substantial variability depending on the country of origin of the firm. Some countries like Italy or the Netherlands show very low agglomeration effects compared to the rest of the sample. Those two countries, as Belgium, are also much more sensitive to the level of labor costs in their location choices. The American investors seem to search very productive workers despite their higher cost as shown by the positive coefficient on wages. Together with Swiss investors, they also show a less than average tendency to locate near final demand perhaps denoting the fact that the products sold are less tied to local demand than others.

This very large dataset enables to uncover important differences in firms’ behaviour in terms of clustering behaviour. While on average firms tend to moderately follow the choices of competitors from the same country, there are large differences depending on the nationality of the investor. English firms for instance tend to follow English competitors as strongly as firms from the Netherlands tend to avoid other firms from the Netherlands. This is one of the first study where such heterogeneity, informative of relative strength of competition and agglomeration

effects, is identified. It is also noteworthy that the coefficient on this variable, while it can be of either sign in theory, had never to our knowledge been significantly negative before this paper.

Finally, we observe in the regressions the impact of distance already seen in figures 1 and 2 for certain countries. The negative effect of distance from the country of origin is specially strong for Germany, Belgium and Switzerland and negative while insignificant for the Netherlands. We now focus for a moment on this determinant and its evolution over time.

### 4.3 The learning process of foreign investment

A possible explanation of the negative sign of distance from the origin country on location choice is that proximate départements share common characteristics with the origin country that make them particularly favorable sites for location<sup>6</sup>. Behind the fact that some investors show a preference for regions in France contiguous with their home market might be a trade off between access to French consumers and ease of operation. The disadvantage faced by foreign affiliates with respect to local firms due to their lower knowledge of the characteristics of the local market is one of the oldest ideas in the theory of FDI (see Hirsch, 1976 for instance). It is likely that locations in France near the German border share a sufficient amount of common “cultural” characteristics with Germany so that the cost of operating there (relative to local firms) is lower, *ceteris paribus*, than the cost of operating in more western locations in France.

The existence of transport costs however do not make those locations ideal basing points to serve the majority of French consumers. The trade off could then work as follows: Supposing that firms gradually learn the characteristics of the French market once they have an affiliate anywhere in France, the first waves of investment could then be concentrated near the German border in order to lower the disadvantage of being a foreign affiliate. The next waves could

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<sup>6</sup>One might also envision that this result reflects a relocation pattern of FDI: Investors look for a location in France near their home market to enjoy relatively low production costs compared with the ones they face in their own country, without increasing too much the transport cost to their home market. If this explanation might be plausible for Swiss or German investors, it does not seem credible for Belgian nor Dutch ones.

gradually move West in order to improve the access to consumers because firms have learned some of the characteristics of this market, reducing thereby their initial disadvantage.

Support for this intuition can then be found by looking at the evolution of the coefficient on distance and market potential. We expect a rise in both, the first becoming less negative with time and the second more positive. If following your rivals also participate in reducing your information gathering costs about the characteristics of the French market, we should then also expect a fall of the coefficient on NH.

Figure 3: The evolution of coefficients over time

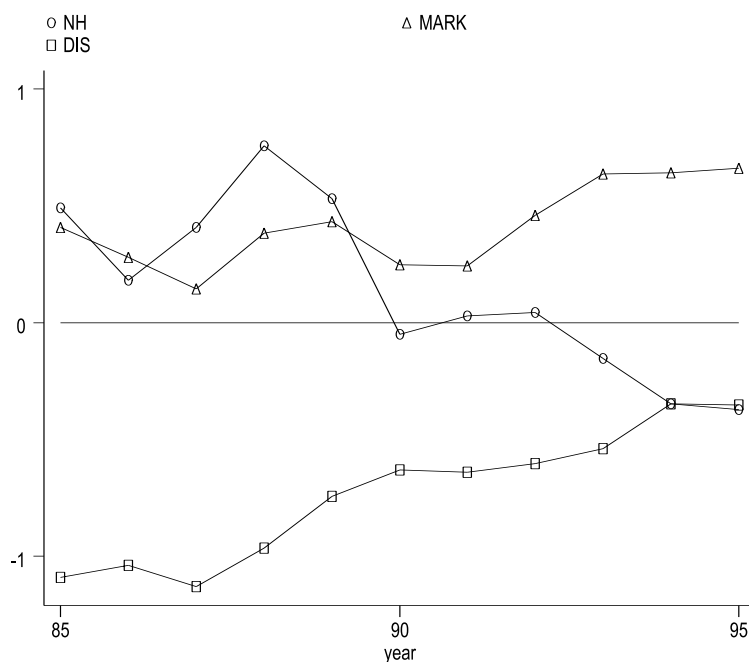


Figure 3 plots the three coefficients mentioned over the period of our sample and confirms the expected evolution for all three variables<sup>7</sup>. The negative effect of distance is sharply declining over time, with a simultaneous increase of the coefficient on the market potential variable. The coefficient on distance starts at -1.08 and ends at -0.35: At the beginning of the sample, decreasing distance by 50% from the country of origin increases the probability of receiving

<sup>7</sup>In order to improve stability and robustness of those estimations, we run logits for each couple of successive years (1985-1986, 1986-1987...).

an investment by roughly 50%, only about 17% at the end. We interpret this as evidence of some learning process of foreign investors gradually moving from “familiar” locations near the country of origin to more central locations in France, where access to consumers is better. It is also to be noted that the coefficient on same country of origin competitors is shifting from a clustering behaviour to an avoiding behaviour (the coefficient is significantly negative at the end of the period)

#### 4.4 Results by industry

We now proceed to regressions at the industry level to see which industries exhibit the most significant agglomeration effects and thus potentially constitute the most interesting targets for promotion policies as an initial advantage in the attraction of those industries could then result in self reinforcing agglomeration in the départements taking a good start. Due to the very large sample used we are able to conduct the analysis at the 4-digit level guaranteeing a very precise assessment of the industries that are more subject to agglomeration economies. Tables 7 and 8 in the appendix rank industries using the average value of the 3 agglomeration variables coefficients. Table 7 lists industries for which all three agglomeration variables have significant positive signs and table 8 lists the other industries. There are 76 industries for which estimation of all variables is possible. Of these, 8 have all three agglomeration variables significantly positive.

We see that industries often mentioned as characterized by strong positive spillovers appear in the first group of industries where we find very significant agglomeration effects. Computers is of course one of those as office machinery for which the coefficients are extremely large<sup>8</sup>, a 10% increase in the number of firms in a département roughly increasing probability of investing there by 40%, for this industry.

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<sup>8</sup>All variables are taken in logs. As a consequence, all coefficients can roughly be interpreted as elasticities for an “average” investor of the change of each variable in a location on the probability of investing in that location.

Another interesting result is the fact that in the clothing industry, often referred to as characteristic of a low-skill labor intensive industry, the investors are very sensitive to wage differentials and much less to agglomeration economies (there is even a significant repulsion effect of other origins foreign investors in women's apparel). On the other hand, the industries with significant agglomeration effects do not seem to be sensitive to the level of labor costs.

We are therefore able to confirm here differences in the location decisions of investors across industries that were previously largely hypothesized in the literature without being rigorously tested due to lack of data. We found in particular that industries that were often thought to be characterized by strong agglomeration economies more than labor costs considerations (like computers, machine tools or car parts) indeed show this tendency. Conversely, low skill industries like clothing are not very sensitive to agglomeration economies but seem to favor costs differentials. Also, industries that are closely spatially tied to final consumption like magazine or newspaper editing show an overwhelming tendency to follow the spatial distribution of consumers rather than the spatial distribution of competitors.

## **5 The influence of promotion policies on location choice**

### **5.1 The impact of the European Commission regional policy**

In this section, we estimate the influence of Structural funds granted to French Regions by the European Commission. The data made publicly available by the Commission is surprisingly scarce. However we have the grants by Objective and region in France for the years 1989, 1990 and 1991 which were the years where FDI in France was at its peak. We are therefore able to estimate the influence of those grants on location decisions of foreign investors for those three years because the number of observations remains substantial.

It appears in tables 3 and 4 that very few coefficients on the different grants of the Euro-

Table 3: Location choice of foreign investors in France.

| Model :                                | Dependent Variable: Location choice |                    |                    |                    |                   |                   |
|----------------------------------------|-------------------------------------|--------------------|--------------------|--------------------|-------------------|-------------------|
|                                        | Total                               | Belgium            | Netherlands        | Germany            | Italy             | UK                |
| ln Nb. of same home country firms (NH) | 0.33***<br>(0.11)                   | -0.17<br>(0.62)    | 0.22<br>(0.65)     | -0.53*<br>(0.29)   | 0.70<br>(0.89)    | 0.55<br>(0.34)    |
| ln Nb. of other foreign firms (NO)     | 0.31***<br>(0.06)                   | 0.64**<br>(0.27)   | 0.18<br>(0.15)     | 0.68***<br>(0.16)  | 0.40<br>(0.26)    | -0.05<br>(0.19)   |
| ln Nb. of French firms (NF)            | 0.78***<br>(0.04)                   | 0.93***<br>(0.17)  | 0.41***<br>(0.08)  | 1.02***<br>(0.11)  | 0.58***<br>(0.16) | 1.01***<br>(0.14) |
| ln market potential (MARK)             | 0.42***<br>(0.06)                   | 0.67***<br>(0.24)  | 0.80***<br>(0.14)  | 0.35**<br>(0.15)   | 0.63**<br>(0.27)  | 0.59***<br>(0.18) |
| ln wage (W)                            | -0.49***<br>(0.17)                  | -2.18***<br>(0.70) | -1.02***<br>(0.35) | -0.10<br>(0.43)    | -1.42**<br>(0.69) | -0.02<br>(0.53)   |
| ln distance to home country (DIS)      | -0.80***<br>(0.09)                  | -1.07***<br>(0.33) | -0.68**<br>(0.28)  | -1.64***<br>(0.19) | -0.97<br>(0.60)   | 0.20<br>(0.28)    |
| ln objective 2 grants (OBJ2)           | -0.01<br>(0.01)                     | -0.01<br>(0.04)    | -0.01<br>(0.02)    | -0.02<br>(0.02)    | 0.04<br>(0.03)    | -0.01<br>(0.02)   |
| ln objective 5b grants (OBJ5B)         | 0.00<br>(0.01)                      | 0.02<br>(0.06)     | 0.06**<br>(0.03)   | 0.04<br>(0.03)     | -0.04<br>(0.05)   | -0.06*<br>(0.04)  |
| ln community initiatives grants (HOBJ) | 0.03**<br>(0.01)                    | 0.03<br>(0.05)     | -0.02<br>(0.03)    | 0.05*<br>(0.03)    | 0.07<br>(0.05)    | 0.04<br>(0.03)    |
| N. obs.                                | 1264                                | 76                 | 270                | 193                | 66                | 146               |
| Pseudo R <sup>2</sup>                  | 0.166                               | 0.287              | 0.13               | 0.208              | 0.159             | 0.208             |

Note: Standard errors in parentheses with \*\*\*, \*\* and \* respectively denoting significance at the 1%, 5% and 10% level.

pean Commission are significantly positive. Furthermore, when the impact of those grants is significantly positive, the size of the effect is lower than all other determinants by an order of magnitude. This means that, even in the few cases where some results of such policies are to be expected, they will be very largely outweighed by agglomeration or market potential considerations. Worse, the only significant coefficient that appears to be non negligible is a negative one for Japanese investors. This result is not the first to find little or even negative effect of European grants on attractiveness (see Ferrer, 1998). This does not mean that those policies



Table 4: Location choice of foreign investors in France.

| Model :                                | Dep. Var: Location choice |                   |                   |
|----------------------------------------|---------------------------|-------------------|-------------------|
|                                        | USA                       | Japan             | Switzerland       |
| ln Nb. of same home country firms (NH) | -0.15<br>(0.19)           | 1.75<br>(1.31)    | -0.48<br>(0.34)   |
| ln Nb. of other foreign firms (NO)     | 0.53***<br>(0.14)         | 0.37<br>(0.49)    | 0.91***<br>(0.20) |
| ln Nb. of French firms (NF)            | 1.21***<br>(0.10)         | 1.47***<br>(0.36) | 1.11***<br>(0.14) |
| ln market potential (MARK)             | 0.24*<br>(0.14)           | 0.34<br>(0.38)    | -0.51**<br>(0.23) |
| ln wage (W)                            | 0.81**<br>(0.38)          | -0.55<br>(0.95)   | 0.26<br>(0.65)    |
| ln distance to home country (DIS)      | 0.37<br>(2.49)            | 15.45<br>(14.11)  | -0.51**<br>(0.24) |
| ln objective 2 grants (OBJ2)           | 0.00<br>(0.02)            | -0.04<br>(0.06)   | 0.02<br>(0.03)    |
| ln objective 5b grants (OBJ5B)         | 0.01<br>(0.03)            | 0.09<br>(0.10)    | -0.07*<br>(0.04)  |
| ln community initiatives grants (HOBJ) | 0.00<br>(0.03)            | -0.23**<br>(0.10) | -0.04<br>(0.04)   |
| N. obs.                                | 242                       | 29                | 107               |
| Pseudo R <sup>2</sup>                  | 0.212                     | 0.274             | 0.188             |

Note: Standard errors in parentheses with \*\*\*, \*\* and \* respectively denoting significance at the 1%, 5% and 10% level.

are inefficient generally speaking, but it casts doubts on the idea that the regional policy of the European Commission can actually influence or even reverse the “natural” location patterns of economic activity in Europe.

There is a problem with the evaluation of the influence of those funds which is often mentioned to explain the apparent poor and even sometimes negative influence of those grants. The regional policies are designed to help the catching up of lagging regions or compensate a fall in their employment due to a structural crisis in the industries in which those regions are

specialized. The fact that a region was not successful at attracting FDI is often a cause for its economic problems and the consequence of this can be a negative coefficient on the grant variable observed by the researcher. Our econometric implementation taking into account fundamental characteristics of regions, the market potential and wage variables should capture these structural issues and avoid any potential reverse causality problem when estimating the effect of grants on foreign investors.

We however evaluate the robustness of this apparent inefficiency of European grants on regional attractiveness by assessing the influence of past regional policy on present location choices. With some time, the funds might have improved the attractiveness of the region and the investors in subsequent years might be less repelled by this region. We therefore estimate the impact of the cumulated funds received by French regions between 1989 and 1991 on the choices between 1992 and 1995 and compare the coefficients with the preceding regression<sup>9</sup>. In order to save space, we do not include the results table here<sup>10</sup> but the results are strikingly similar. No coefficient is significantly positive and all significant coefficients are negative. All estimates of the impact of regional European grants are furthermore of very low magnitude. We can therefore safely conclude that, if the European grants in French regions have had any impact on the location of FDI, this impact was very slightly negative for some origin countries. In general there is simply no identified relationship between the amount given to a region by the European Commission and the probability that foreign investors choose to locate an affiliate in a département belonging to that region.

Table 5: Location choice of foreign investors in France.

| Model :                                | Dependent Variable: Location choice |                    |                   |                    |                    |                   |
|----------------------------------------|-------------------------------------|--------------------|-------------------|--------------------|--------------------|-------------------|
|                                        | Total                               | Belgium            | Netherlands       | Germany            | Italy              | UK                |
| ln Nb. of same home country firms (NH) | 0.18***<br>(0.06)                   | 0.30<br>(0.29)     | -0.55**<br>(0.25) | -0.29**<br>(0.14)  | 0.05<br>(0.30)     | 0.53**<br>(0.21)  |
| ln Nb. of other foreign firms (NO)     | 0.29***<br>(0.03)                   | 0.54***<br>(0.14)  | 0.11<br>(0.10)    | 0.65***<br>(0.09)  | 0.27**<br>(0.10)   | 0.18<br>(0.11)    |
| ln Nb. of French firms (NF)            | 0.76***<br>(0.02)                   | 1.10***<br>(0.10)  | 0.54***<br>(0.06) | 0.79***<br>(0.06)  | 0.40***<br>(0.07)  | 0.97***<br>(0.07) |
| ln market potential (MARK)             | 0.48***<br>(0.03)                   | 0.42***<br>(0.13)  | 0.77***<br>(0.10) | 0.38***<br>(0.08)  | 0.77***<br>(0.11)  | 0.67***<br>(0.11) |
| ln wage (W)                            | -0.20**<br>(0.10)                   | -1.12***<br>(0.38) | -0.50*<br>(0.28)  | 0.09<br>(0.26)     | -1.05***<br>(0.22) | -0.29<br>(0.33)   |
| ln distance to home country (DIS)      | -0.74***<br>(0.05)                  | -0.83***<br>(0.13) | -0.24*<br>(0.13)  | -1.28***<br>(0.11) | -0.33<br>(0.22)    | 0.04<br>(0.14)    |
| ln French regional policy grants (PAT) | 0.02***<br>(0.00)                   | 0.01<br>(0.02)     | 0.04***<br>(0.01) | 0.02*<br>(0.01)    | 0.05***<br>(0.02)  | -0.01<br>(0.01)   |
| N. obs.                                | 3902                                | 251                | 489               | 632                | 425                | 404               |
| Pseudo R <sup>2</sup>                  | 0.166                               | 0.273              | 0.129             | 0.182              | 0.099              | 0.24              |

Note: Standard errors in parentheses with \*\*\*, \*\* and \* respectively denoting significance at the 1%, 5% and 10% level.

## 5.2 The impact of French regional policy

We now turn to the analysis of the impact of French regional policy on location choices by foreign investors. One can justify the extremely small consequences of European grants on FDI flows, saying they have for objective to promote the regional development and attractiveness but not to affect directly location choices. On the contrary, the PAT is explicitly a direct regional policy in favor of foreign investments. However, we see in the tables 5 and 6 that the impact of French regional policy (at least the PAT) is far from being as influential on location choices as

<sup>9</sup>Such a test is only relevant if one supposes that *past grants* do not directly improve the *current* regional market potential, nor increase the wage and the number of local firms. We regressed these variables on the amount of grants received during the preceding period. We found no influence on the number of local firms and a very small negative impact on market potential and wage.

<sup>10</sup>They are available upon request.

Table 6: Location choice of foreign investors in France.

| Model :                                | Dep. Var: Location choice |                   |                    |
|----------------------------------------|---------------------------|-------------------|--------------------|
|                                        | USA                       | Japan             | Switzerland        |
| ln Nb. of same home country firms (NH) | 0.10<br>(0.10)            | 1.30*<br>(0.70)   | -0.31<br>(0.19)    |
| ln Nb. of other foreign firms (NO)     | 0.28***<br>(0.08)         | 0.39<br>(0.26)    | 0.82***<br>(0.11)  |
| ln Nb. of French firms (NF)            | 1.19***<br>(0.05)         | 1.50***<br>(0.19) | 1.07***<br>(0.08)  |
| ln market potential (MARK)             | 0.12<br>(0.07)            | 0.50**<br>(0.22)  | 0.10<br>(0.11)     |
| ln wage (W)                            | 0.78***<br>(0.21)         | -0.76<br>(0.61)   | -0.21<br>(0.35)    |
| ln distance to home country (DIS)      | -0.41<br>(1.33)           | 1.35<br>(7.12)    | -0.63***<br>(0.13) |
| ln French regional policy grants (PAT) | -0.02<br>(0.01)           | -0.01<br>(0.03)   | -0.04**<br>(0.01)  |
| N. obs.                                | 833                       | 83                | 363                |
| Pseudo R <sup>2</sup>                  | 0.191                     | 0.292             | 0.199              |

Note: Standard errors in parentheses with \*\*\*, \*\* and \* respectively denoting significance at the 1%, 5% and 10% level.

the policy makers would like it to be. The global effect is significantly positive but again the magnitude of the effect is the lowest of all determinants. The only three countries for which we find a positive impact are The Netherlands, Germany and Italy. Even for those countries, the effect of grants on location choice is very marginal when compared to other determinants.

The Italian case is very interesting as it appears that investors from this country are very sensitive to monetary incentives compared to other investors. Indeed the positive effect of the grants is highly significant and the largest of all countries. Furthermore, Italian firms proves to be also among the most highly sensitive to wage differentials and show very little tendency to agglomerate relative to other nationalities. German and Dutch investors also show a much

smaller tendency to cluster than the rest of the sample (even showing significant dispersion in the NH coefficient). Combined with the fact that those three countries are the ones which seems to be attracted by investment incentives, our study leaves therefore very little prospective for an efficient attractiveness policy. Indeed the investors that are sensitive to these measures, are only slightly so and do not cluster, hence the benefits of the grants to the region are likely to be very small. Succeeding in attracting initial investments from those countries is not sufficient to generate a self-reinforcing agglomeration of firms from those countries.

## 6 Conclusion

We assess in this paper the determinants of location choice of foreign investors in France. We focus in particular on the existence and magnitude of agglomeration economies and identify the countries of origin and industries for which positive spillovers suggested by the observed clustering between firms are the more pronounced. It appears that computers, car parts, machine tools and office machinery are instances of sectors characterized by the strongest agglomeration effects. A 10% increase in the number of competitors in a location can raise by up to 40% the average probability of investing in that location. On the other hand, firms originating from countries like Italy or the Netherlands and from industries like clothing are much less subject to clustering and more sensitive to the level of wages in their location patterns.

We also uncovered general patterns of FDI location that had not been, to our knowledge, the subject of rigorous empirical investigation. Among these, the location behaviour of foreign firms in France over time seems to suggest that a learning process is taking place in location choices over time: Firms tend to choose locations in France that are near their home market over the whole period, particularly when the investor is from Germany, Belgium, Switzerland and the Netherlands. However, this pattern gradually fades out over the period as the impact

of the market potential gets bigger and clustering behaviour gets weaker. We interpret this evolution as evidence of learning of the French market characteristics by foreign firms: As time passes it becomes more and more important to be near final demand and less and less important to be in locations sharing common attributes with the home country.

We finally try to assess the impact of French and European regional policies through the inclusion of investment incentives and structural funds in the location choice but hardly find any positive impact of either measure on the actual choices of investors. Even if important agglomeration economies might be a favorable ground for effective attractiveness and regional policies, the evidence for France is very negative: We don't find any rise in the attractiveness of French départements when investing there is associated with grants from public authorities.

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## Appendix: Location choice determinants by industry

Table 7: Most agglomerated industries.

| Industry         | N. obs. | NH      | NO      | NF      | MARK    | W      | DIS     |
|------------------|---------|---------|---------|---------|---------|--------|---------|
| Office machinery | 9       | 3.61**  | 3.85**  | 5.09*** | -1.64*  | 0.91   | -1.9    |
| Lightning        | 19      | 2.44**  | 2.25*** | 1.91*** | -1.26** | 0.79   | -1.44*  |
| Machine tools    | 23      | 1.64*   | 1.36*** | 1.29*** | 0.76**  | -0.32  | -1.19** |
| Misc. rubber     | 36      | 1.86*** | 0.92*** | 1.3***  | 0.48    | -0.65  | -0.91   |
| Computers        | 71      | 1.16*** | 1.05*** | 1.35*** | -0.35   | 0.99** | 0.43    |
| Lifts            | 85      | 1.28**  | 0.44*   | 1.61*** | -0.27   | -1.05* | -0.14   |
| Paints           | 65      | 0.93**  | 0.85*** | 1.28*** | -0.09   | -0.12  | -0.06   |
| Car parts        | 115     | 0.51**  | 0.29*   | 0.93*** | 0.19    | 0.75   | -0.72*  |

Note: \*\*\*, \*\* and \* respectively denote significance at the 1%, 5% and 10% level.

We provide here the complete list of industry level results. Tables 7 and 8 list the coefficient on each variable on the 76 industries where estimation was possible.

Table 8: Location patterns of other industries.

| Industry                   | N. obs. | NH      | NO      | NF      | MARK    | W       | DIS      |
|----------------------------|---------|---------|---------|---------|---------|---------|----------|
| Springs                    | 11      | 3.45*   | 0.82    | 3.62*** | 0.03    | -4.03** | 0.81     |
| Plaster for construction   | 7       | 4.16**  | 1.09    | 2.58*** | -0.25   | 1.4     | -0.93    |
| Paste and Glue             | 21      | 1.42    | 1.66**  | 3.28*** | -0.85*  | 2.9*    | -1.39**  |
| Transmission parts         | 17      | 2.71    | 1.93*** | 1.68*** | 0.25    | 3.25    | 0.03     |
| Basic plastics             | 17      | 2.31*** | 0.53    | 2.31*** | 1.01    | 0.35    | -2.76*** |
| Screws                     | 7       | 2.28    | 1.36    | 1.33**  | 0.79    | -0.18   | -2.67*   |
| Soap                       | 17      | 2.35**  | 0.43    | 2.17*** | -0.4    | 2.36    | -1.58*   |
| Small metal articles       | 10      | 1.41    | 1.91    | 1.49**  | -0.03   | 0.22    | -3.6***  |
| Cardboards                 | 11      | 2.68*   | 0.36    | 1.69*** | -0.14   | 1.76    | -0.7     |
| Curved Glass               | 8       | 4.17*   | -2.4    | 2.68*** | -1.94** | -5.63** | -3.77**  |
| Industrial Gaz             | 50      | 2.09**  | 0.44    | 1.85*** | -0.38   | -1.05   | 0.3      |
| Cables and Wires           | 20      | 1.97**  | 0.69    | 1.33*** | 0.1     | -1.41   | -0.18    |
| Agricultural Machinery     | 11      | 1.95    | 0.36    | 1.59*** | 1.03*   | -0.71   | 1.2      |
| Navigation equipment       | 26      | 1.49    | 1.34**  | 0.94*** | -0.38   | -0.71   | -1.25**  |
| Small gen, eng and transf. | 9       | 0.04    | 1.38    | 2.26*** | -1.79** | 2.55    | -3.01**  |
| Misc elec. mat             | 12      | 1.59    | 1.03    | 0.97    | 0.48    | 1.18    | 0.5      |
| Car bodies                 | 21      | 1.22    | 1.1*    | 1.08*** | 0.52    | 1.33    | -0.22    |
| Dom. elec. appliances      | 13      | -0.24   | 1.86**  | 1.6***  | -0.68   | 3.5***  | -0.35    |
| Mechanical handling eq.    | 27      | 0.83    | 0.98*** | 0.98*** | 0.46    | 0.05    | -0.51    |
| Active electronic comp.    | 21      | -0.12   | 1.08**  | 1.74*** | 1**     | 0.19    | 0.77     |
| Locks                      | 19      | 1.08    | 0.31    | 1.19*** | 0.75**  | -1.61   | -0.91    |
| Tabs                       | 27      | 1.29    | 0.31    | 0.96*** | 0.05    | 2.07    | -0.04    |
| Office furniture           | 20      | 2.32**  | -0.34   | 0.51    | 1.05**  | -1.05   | -0.88    |
| Essential oils             | 26      | 0.05    | 1.07*** | 1.32*** | 1.38*** | -1.05   | 0.28     |
| Mechanical tools           | 51      | 0.84    | 0.83*** | 0.63*** | 0.12    | -0.24   | -0.21    |
| Industrial chemicals       | 47      | 0.06    | 0.93*** | 1.25*** | -0.03   | 2.38**  | -0.79    |
| Shoes                      | 19      | 1.21    | 0.4     | 0.6***  | 1.33*** | -1.31   | -1.1     |
| Transmission equipment     | 20      | 0.33    | -0.01   | 1.74*** | 0.36    | 0.94    | 4.28**   |

*continued on next page*

| <i>continued from previous page</i> |         |         |         |         |         |          |          |
|-------------------------------------|---------|---------|---------|---------|---------|----------|----------|
| Industry                            | N. obs. | NH      | NO      | NF      | MARK    | W        | DIS      |
| Batteries                           | 22      | -0.95   | 0.9     | 2.09*** | -0.03   | 0.86     | -1.2     |
| Construction machinery              | 31      | 1.35*   | -0.39   | 1.06*** | 0.53    | 0.3      | -0.7     |
| Food ind. machinery                 | 51      | 0.58    | -0.02   | 1.4***  | 0.42    | 0.96     | -1.25**  |
| Tech. plastic parts                 | 45      | 0.81    | 0.22    | 0.94*** | 0.11    | 0.5      | -1.03**  |
| Metal treatment                     | 29      | -0.27   | 1.18*** | 1.03*** | 0.14    | -0.87    | -1.24**  |
| Concrete for construction           | 29      | 0.27    | 0.73**  | 0.94**  | 0.69*   | 0.13     | -1.35*** |
| Low tension elec. eq.               | 68      | 0.42    | 0.66**  | 0.7***  | 0.54**  | -1.25    | -0.19    |
| Perfume                             | 49      | 0.36    | -0.71** | 2.09*** | -0.1    | 0.57     | -0.92    |
| Glasses                             | 12      | -0.2    | 0.57    | 1.35*** | 0.26    | 3.5      | -0.62    |
| Men's apparel                       | 10      | 0.71    | -0.63   | 1.64*** | 0.22    | -3.64**  | -1.71**  |
| Clothing accessories                | 28      | 0.23    | 0.07    | 1.4***  | -0.68   | 1.81     | -2.21*** |
| Light metal packaging               | 14      | 0.19    | -0.38   | 1.88*** | 1.17*** | -2.16    | -0.61    |
| Cement                              | 15      | -0.36   | 0.86    | 1.14**  | -0.17   | 1.29     | -1.94*** |
| Plastic for packaging               | 42      | 0.85    | 0.12    | 0.66*** | 0.76*** | -0.79    | -0.72    |
| Telephones                          | 32      | -0.25   | 0.51    | 1.3***  | -0.31   | 1.87*    | -0.28    |
| Pumps and compressors               | 49      | -0.58   | 0.9***  | 1.22*** | 0.05    | 3.12***  | 0.51     |
| Wood structure                      | 8       | 1.36    | 0.2     | -0.03   | 1.87*** | -2.83    | -3.56*** |
| Misc. organic chemicals             | 19      | -0.07   | 0.47    | 1.12*** | 0.89**  | -0.5     | -1.19*   |
| Pharmaceuticals                     | 126     | 0.22    | 0.43**  | 0.78*** | 0.32    | 0.5      | -0.54    |
| Scientific inst.                    | 117     | -0.09   | 0.27    | 1.06*** | -0.09   | 1.3**    | -0.87**  |
| Agri. use chem.                     | 37      | -1.89   | 0.99**  | 2.09*** | -0.43   | 2.09***  | 1.81**   |
| Ind. refrigerating mach.            | 71      | -0.56   | 0.4*    | 1.22*** | -0.29   | 0.79     | -0.52    |
| Books editing                       | 321     | 0.31    | 0.42*** | 0.2**   | 0.73*** | -1.29*** | -0.37*   |
| Boilermaking                        | 30      | 0.08    | 0.42    | 0.3     | 0.62*   | 2.23     | -1.12**  |
| Misc. machinery                     | 25      | 1.46    | -1.65   | 0.96*** | 0.45    | -0.83    | 0.04     |
| Clocks                              | 13      | -1.69** | 0.26    | 2.08*** | 0.91    | 1.23     | -2.63**  |
| Passive electronic comp.            | 43      | -0.55   | -0.07   | 1.22*** | 0.47    | 1.15     | -1.45*   |
| Plastic tubes                       | 46      | -0.56   | -0.11   | 1.24*** | 0.55**  | -0.46    | -0.62    |
| Oil refining                        | 184     | -0.47   | -0.06   | 1.07*** | 0.63*** | -0.33    | 0.16     |
| Plastics for construction           | 60      | -0.78*  | 0.09    | 1.07*** | 0.74*** | -1.39*   | -1.71*** |
| Hydraulic transmissions             | 40      | -1.1    | -0.1    | 1.58*** | 0.36    | -0.77    | -0.28    |
| Paper and cardboard                 | 17      | -0.2    | -1.07   | 1.54*** | -0.41   | 3.04**   | -1.52    |
| Women's apparel                     | 251     | 0.2     | -0.26*  | 0.31*** | 1.09*** | -0.93*** | -0.1     |
| Printing                            | 37      | -0.52   | -0.2    | 0.96*   | 0.4     | 0.96     | -1.65*** |
| Other paper and cardboard art.      | 35      | -2.09   | 0.72**  | 1.15*** | 0       | -0.83    | -0.78    |
| General Machinery                   | 28      | -1.14   | 0.19    | 0.34    | 1.35*** | -1.79    | -1.7***  |
| Silk manufacturing                  | 13      | -2.2    | 0.51    | 0.8*    | 1.18*** | -2.67**  | 0.46     |
| Newspapers editing                  | 25      | 0.09    | -0.28   | -0.75   | 5.17*** | 1.66     | 0.29     |
| Underwear                           | 8       | 0.69    | -1.89   | 0       | 2.98*** | -3.85*   | -1.49    |
| Magazines editing                   | 27      | -1.16   | 0.2     | -0.63   | 3.84    | 6.02*    | -1.14    |

Note: \*\*\*, \*\* and \* respectively denote significance at the 1%, 5% and 10% level.