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ECONOMIES OF SCALE, TRADE BARRIERS AND FOREIGN DIRECT INVESTMENT IN SPAIN

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This article uses the predictions of a model for horizontally integrated multinationals to look at the determinants of foreign direct investment in Spain. Data used is for the 1990-1995 period. The key explanatory variables are transport costs and scale economies at the firm and plant level. The results are mixed: Transport costs have a positive impact on foreign direct investment, whereas scale economies at the plant level show a nonmonotonic effect, first increasing then decreasing, which contradicts the expected result of a negative sign on the regressions. These effects are more important when we try to explain the probability of an investment project be realized.

Keywords: Foreign Direct Investment, Horizontal Integration.

(*JEL* F21, F23)

1. Introduction

Foreign direct investment (FDI), the multinational strategy of firms, has experienced a huge increase at both the world and Spanish levels. During the second half of the eighties, FDI at the world level grew at an average rate of 24% per year, while in the same period world trade grew at an average rate of 6.5%, and world GDP at only 3.5%. The origin and destination of FDI at the world level show that FDI is basically an economic phenomenon that takes place among developed countries: they account for 97% of origin, and 80% of destination of

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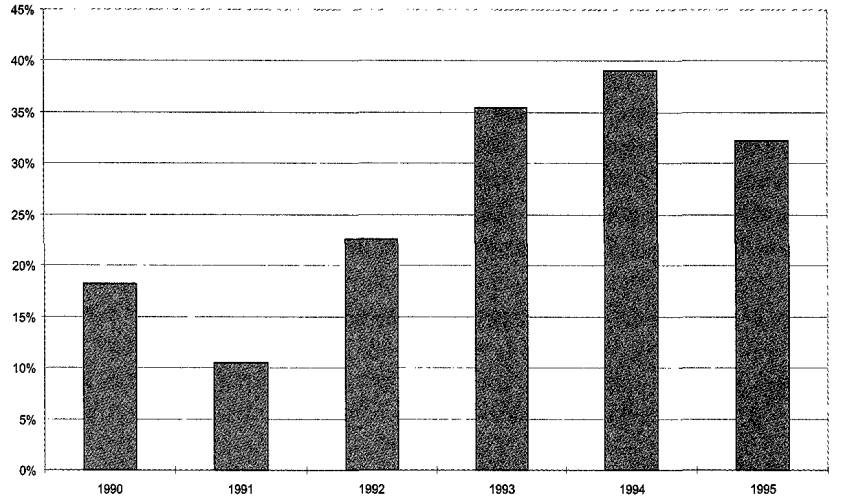
total world FDI. For countries such as the USA, multinational sales tend to substitute exports, the former being five times the latter. The same is true for Europe: during the 1981-1990 period, European exports to the USA grew 104%, while FDI grew 354%[1]. This suggests a growing volume of direct investment flows among developed countries, motivated by access to new markets, rather than a search for cheaper production factors[2].

FIGURE 1
Evolution of FDI in billions of 1990 pta.



Source: DGPCIE

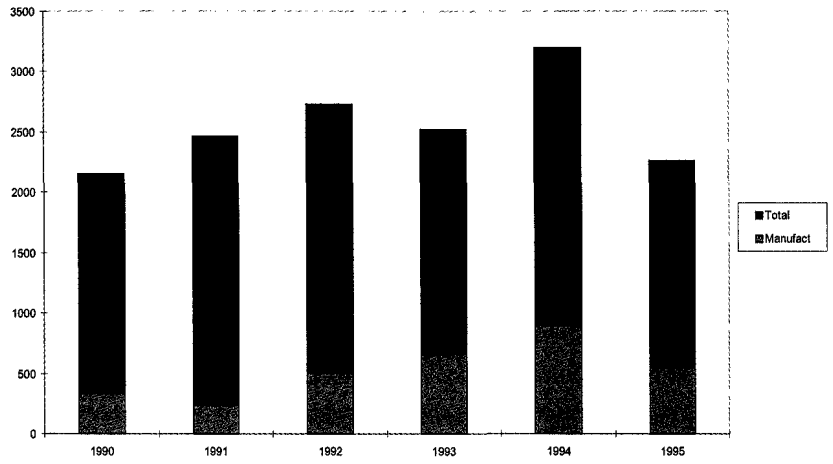
Spain has not been unaffected by this phenomenon. During the 1986-1990 period, FDI grew at an annual rate of 47% (a caveat has to be introduced here: the proportion designated to the financial and services industries was, in that period, 55% of total volume), with the known consequences of significant economic growth rates and technological development for Spain. After the big boom of FDI in Spain during the late eighties, there was a slowdown in the early nineties (Figure 1), concurrent with the world recession experienced in those years. Moreover, Figure 2 shows that the ratio of FDI destined for manufacturing sectors to total FDI has had a declining trend, with a

[1] Following Markusen (1995), "A Process of Multinationals Displacing Trade has Begun" (p.181).

[2] In fact, Martínez Serrano and Myro (1992) point out that, in the case of Spain, the main reason for the purchase of Spanish firms by foreign multinationals was to strengthen and reinforce their position in the Spanish market.

substantial decline in 1990-1991, after which there was a small recovery. Despite the decreasing proportion of FDI in the manufacturing sector, it is still of great relevance as it is an alternative way to direct trade, and a way for capital and technology to come from abroad.

FIGURE 2
Percentaje of FDI in Manufacturing



Source· DGPCIE

The literature on international trade has tried to explain the reasons behind FDI, and several models try to identify and explain the determinants for the horizontal expansion of firms. These models try to replicate several stylized facts that define the characteristics of the multinational firm:

· At the macroeconomic level, FDI has grown rapidly during the eighties and nineties, due mainly to horizontal expansion and integration of firms, as a two way flow, between and within countries with similar *per capita* income, factor endowments, and relatively low barriers to trade.

· At the microeconomic level, multinational firms arise in industries in which intangible, firm specific assets are important. The volume of FDI grows relative to trade as tariffs and transport costs grow.

Since Spain is a developed economy belonging to the OECD, it follows that the predictions of models of horizontal integration can be applied and tested to analyze the activity of multinational firms. Such models, like the ones described in Brainard (1993) and Markusen and Venables (1995), emphasize the relevance of firm scale economies

with respect to plant level scale economies, and the presence of trade barriers, to explain multinationalization, given convergence among countries. By definition, multinational firms are involved in foreign direct investment, so we will use both concepts interchangeably.

The study of FDI in Spain is not yet extensive, but it has generated a growing empirical literature during the nineties. In Bajo and Sosvilla (1992) FDI is analyzed from a macroeconomic perspective, using balance of payments data and applying cointegration techniques. However, this approach used data that was too aggregated for an economic phenomenon observed mainly at the firm level. That is why Bajo and López Pueyo (1996) look at less aggregated, industry-level data to look at the explanatory power of variables including industry features and basic macroeconomic indicators. Others, such as Martínez Serrano and Myro (1992) and Ortega (1992), study FDI from industry characteristics. However, they perform only a descriptive analysis, leaving aside any kind of econometric estimation.

The goal of this article is to test the predictions of a model of horizontally integrated multinationals to explain the main features of FDI in the Spanish manufacturing industry during the 1990-1995 period. This work contains three main features: First, following Brainard's (1997) study[3], we analyze FDI in two dimensions, industrial and national, using characteristics of the Spanish manufacturing industries and macroeconomic indicators of the countries that invest in Spain as explanatory variables. Second, new econometric methods, such as a discrete choice model and nonlinear and panel data estimation techniques, are used to study FDI. Third, we explicitly use a microfounded model to explain FDI in Spain.

The paper is organized as follows: In section 2, the theoretical framework used in this article is outlined. In section 3, the econometric tools are explained, and the variables used in the study are described. In section 4, the data and also the recent evolution of FDI in Spain are discussed. In section 5, the main results are presented, leaving section 6 for the conclusions.

[3]Where she tests her own model, (Brainard, 1993), analyzing the volume of sales of subsidiaries of American multinationals in a country over the sum of sales of subsidiaries of American multinationals plus exports of the USA to that country, as a proxy to multinational activity In fact, the initial motivation for this article came from reproducing that paper using Spanish data Unfortunately, we could not construct such a dependent variable

2. Theory

The so-called "new trade theory", by introducing elements of industrial organization (i.e. product differentiation, imperfect competition, and increasing returns) into the analysis of international trade, showed how trade and gains from trade may arise beyond the Ricardian or Heckscher-Ohlin models through intraindustry trade. This new development in international trade theory deviated from reality most significantly in the way that firms were introduced into the models: firms were seen as a plant or production facility that produces one good in one location. Therefore, multiproduct or multiplant production was generally excluded in the first generation of models. In fact, the industries in which those key elements of industrial organization are more present are dominated by multinational firms.

More recently, many international trade economists have developed models similar to those of the new trade theory, where the informal empirical evidence is introduced by letting multinational firms arise in equilibrium. A lot of literature explains the characteristics of multinational firms at an informal level, but do not explicitly provide explicit formal models. We have chosen explicit formal models to analyze FDI in Spain.

2.1 Why do multinational firms exist?

Undertaking production in a foreign country has important costs (e.g., cultural differences, introduction of new products, hiring and training employees in the host country). Therefore, there must be offsetting advantages for firms engaged in multinationalization. Several advantages were first identified by Dunning (1977) and are:

· Ownership: the firm owns a product, production process, or other intangible asset that gives it a market power or cost advantage and is generally associated with increasing returns to scale at the firm level. Broadly speaking, one can think of returns obtained through R&D: patents, production processes, chemical formulas, designs, and other intangible assets such as trade marks or reputation for quality. Moreover, the asset is a production factor with a public good character, that can be transferred to the subsidiaries at a negligible cost. A new concept is associated with this advantage: *economies of multiplant production.* If R&D costs are high relative to those of production, it is going to be more efficient to have one firm with two production

facilities than two firms that incur the same costs separately.

· Internalization: a firm cannot take all of the profits of this intangible asset due to market failures, such as transaction costs or asymmetric information. This explains why a firm may decide to expand directly into a new market rather than licensing the product to a firm in the host country.

· Location: the most obvious reasons are avoiding quotas, tariffs, transport costs, and searching for cheaper production factors. There are also other inherent advantages such as establishing near local customers.

In the literature about multinational firms it is assumed that firms have the ownership advantage. Models, therefore, focus on the internalization advantage, on the location advantage, or on both. Models that examine the internalization advantage deal mainly with elements of contract theory, incomplete markets and the theory of the firm. We will examine the location advantage because to us the relevant question is whether to export to the foreign country or to produce *in locus*[4].

Models that try to explain the location advantage incorporate multinationals in a general equilibrium framework, assuming that the firm possesses a specific asset that gives it increasing returns at the firm level. Product differentiation and monopolistic competition are assumed. The main difference is the way in which foreign direct investment takes place: some models seek to explain *vertical* integration, while others try to explain *horizontal* integration.

Vertical integration models can be summarized through the pioneering work of Helpman (1984). He attempts to set a theory of the multinational enterprise in a general equilibrium framework. The features he tries to capture are the existence of differentiated products, economies of scale and monopolistic competition, and the existence of inputs that can serve product lines without being located in their plants. Multinationals emerge as a result of the tendency for factor rewards to differ across countries, because countries have different relative factor endowments. Firms try to exploit cross-country differences by shifting activities to the cheapest locations. Transport costs, tariffs, or tax advantages do not explain the emergence of multinationals. In this model, multinational firms are characterized by the activity of R&D

[4]However, there is not a clear distinction between models that explain the internalization or the location advantages. For instance, the models we have chosen to explain the location advantage also assume the internalization advantage.

and the production of the final good being geographically separated. In other words, firms open only one center of production of the final good. He can also explain the trade patterns in the presence of multinationals, where there is interindustry, intraindustry and intrafirm trade. The analysis is extended in Helpman and Krugman (1985)[5] by introducing more stages of production with an intermediate good. The results are similar, but more complex structures of intraindustry and intrafirm trade can be generated depending on the relative endowment of the factors.

Horizontal integration models appeared to explain the empirical observation that most FDI occurs in OECD countries and is two-way investment. Brainard (1993) and Markusen and Venables (1995) are good examples of this literature and are, therefore, the references we have chosen to use later in the empirical work. These models try to capture the relationship between multinationals and countries with similar incomes and relative factor endowments. Here, the presence of barriers to trade (such as tariffs or transport costs) causes some firms to find it more profitable to incur the fixed cost of opening another center of production in the host country in order to save variable trade costs, even with equal factor endowments. When multinationals arise in equilibrium, they are multiplant, meaning that more than one center of production of the final good is opened, in the home and in the host country. Multinationals are more likely to arise in equilibrium the higher are the firm-level scale economies with respect to the plant-level scale economies, and the higher are barriers to trade.

Lately, a new kind of model has appeared trying to explain both vertical and horizontal investment (see Markusen, 1997), introducing several stages of production, intermediate goods and differentiated inputs so that under several different economic policy scenarios complex production structures arise.

2.2 A horizontal integration model [6]

Assume an economy with two countries, A and B. Both countries have equal factor endowments and nonmobility of production factors and consumers among countries are assumed. There are two kinds of goods: agricultural and manufactured. The manufactured good is

[5] Refer to chapters 12 and 13 of their book.

[6] This section highlights the main results of Brainard's (1993) model. Markusen and Venables (1995) develop a similar model.

differentiated. Consumers have homothetic and separable preferences among the two goods, and have identical preferences among varieties of the manufactured good, which are of the Dixit-Stiglitz-Spence type.

On the production side, there are two production factors: land and labor. Land is used only in the production of the agricultural good, labor in the production of both. The agricultural good is produced under constant returns to scale, and its market structure is perfect competition. The manufacturing sector exhibits increasing returns to scale in production, and its market structure is monopolistic competition with free entry. The production of each differentiated good can be separated into two stages: entrepreneurial activity and final good production. The product of the first stage is an input that has a "public good" character, in the sense discussed earlier. It can be thought of as being the result of R&D. Firms producing the manufactured good face three types of costs:

· Establishing costs. They are increasing in the R&D level. It is a fixed cost necessary to start the firm. This gives the firm increasing returns at the firm level.

· Fixed costs per production facility. They are not affected by the choice of R&D, and imply increasing returns at the plant level for the firm.

· Variable costs of production. It is assumed that they are decreasing with the R&D level.

Firms choose the level of R&D that minimizes the sum of the three costs. Finally there is a trade barrier cost that includes all possible disadvantages associated with trading abroad (e.g. transport costs, quotas and tariffs, cultural and linguistic barriers, and slow response by local consumers). It is modelled as the fraction of the product that "survives" transit. Let q_i be the quantity produced in country i, the quantity that actually arrives at the destination market is smaller the larger are distance (D) and the trade barrier cost (T):

$$q_i e^{-Td_{ij}},\ d_{ii} = 0, d_{ij} = D, i = A, B, j = A \text{ when } i = A, \text{ and viceversa} \qquad [1]$$

Firms compete in the manufacturing sector in two stages, and there exists a Nash equilibrium in each. In the first stage, firms choose the number of production plants. In the second stage, knowing all competitors' decisions from the first stage, firms decide prices simultaneously, thus obtaining a Bertrand equilibrium. Solving the first order

conditions, we obtain the following pricing policy as a mark-up over the marginal cost (V):

$$P_{ij} = \left[1 - \frac{1}{\sigma}\right]^{-1} V(.)e^{Td_{ij}}, \text{for } i = A, B \text{ and } j = A, B \qquad [2]$$

where P_{ij} is the price charged by a firm located in country i selling its product to country j and σ is the elasticity of substitution among varieties of the manufactured good.

Given the model's assumptions, in equilibrium, wages are equalized among countries, and prices of manufactured goods produced in both markets are also equalized. For imported goods, price exceeds that of the domestically produced goods proportionate to the trade barrier cost. In this model, as in many others, when multinational firms are not allowed, there is a bias in consumption towards home production.

Depending on the model's parameters there are three possible equilibria which can be derived from the conditions of free entry (zero profits) and no deviation from equilibrium:

· Only "national" firms, in the sense that only one production facility is opened in the same country where the headquarters are located.

· Only multinational firms, where firms open production facilities in both countries.

· Mixed.

For instance, in the only "national" firms equilibrium, a firm located in country A will not undertake production in country B unless the increase in variable profits offsets the fixed cost incurred in opening the production plant in B. It can be derived that the "national" firms equilibrium will be most likely to occur:

· the larger the fixed cost at the plant level.

· the smaller the distance between markets and the lower the trade barrier cost.

· the smaller the fixed cost at the firm level.

· the smaller σ, the elasticity of substitution among manufactured goods.

We will observe this equilibrium when scale economies at the plant level are large relative to those at the firm level (favoring concentration of production) and when the trade barrier cost is relatively low.

Conversely, for the multinational equilibrium to hold, we require parameters to have the opposite behavior. In this case, the equilibrium is more likely when firm level scale economies are large with respect to plant level scale economies, and when the trade barrier cost is higher. In this case, intra-industry trade between countries disappears and is completely replaced by multinational sales.

3. Econometric specification

3.1 Estimation

We examine a set of FDI panel data with a double dimension: country of origin and industry of destination. The value is positive when an investment project in an industry from a foreign country is observed, and zero otherwise. Brainard's (1993) model discusses the probability of observing multinational firms as some parameters of the model change. Hence, a straightforward examination of the model suggests estimating a discrete choice model, such as a Probit, to contrast the model's predictions, given that the model tries to explain *decision* rather than *intensity.*

We should emphasize that the dependent variable used here is different from Brainard (1997). In a sense, both her dependent variable and ours can be used to test decision. Outside the scope of the results of Brainard's model (1993), we would like to discuss the quantities observed. However, since the dependent variable is not the same, we cannot say that we are testing the same effect when we try to explain intensity. Given the nature of the data, a Tobit model and an exponential regression will also be estimated.

The Probit model assumes that there is a latent variable:

$$y_i^* = x_i'\beta + u_i$$

And we observe only the following binary variable d_i:

$$d_i = \begin{cases} 1 \text{ if } y_i^* > 0 \\ 0 \text{ if } y_i^* \leq 0 \end{cases}$$

So, under the assumption that $(u_i \mid x_i) \sim i.i.d.N(0, \sigma^2)$, it is well known that

$$\begin{aligned} \Pr(d_i &= 1) = \Pr(y_i^* > 0) = \Pr(u_i > -x_i'\beta) \\ &= 1 - F\left(-\frac{x_i'\beta}{\sigma}\right) = F\left(\frac{x_i'\beta}{\sigma}\right) \end{aligned}$$

where F is the cumulative distribution function of a standard normal distribution. We can consistently estimate $\frac{\beta}{\sigma}$ by maximum likelihood. The log-likelihood function is the following:

$$L_{PR}(\frac{\beta}{\sigma}) = \sum_{i=1}^{N}\{d_i \log F\left(\frac{x_i'\beta}{\sigma}\right) + (1-d_i)\log F\left(-\frac{x_i'\beta}{\sigma}\right)\}$$

The Tobit model is a regression model with the dependent variable censored at the left at zero. The same latent variable as in the Probit model in assumed, but in this case we observe y_i:

$$y_i = \begin{cases} y_i^* \text{ if } y_i^* > 0 \\ 0 \text{ if } y_i^* \leq 0 \end{cases}$$

such that $y_i = max\{x_i'\beta + u_i, 0\}$. Assuming that $(u_i \mid x_i) \sim i.i.d.$ $N(0,\sigma^2)$, we can estimate β and σ separately by maximum likelihood. The log-likelihood function of a Tobit can be separated into a Probit $(L_{PR}(\frac{\beta}{\sigma}))$ plus a truncated regression $(L_{TR}(\beta,\sigma^2))$ as follows:

$$L_{TOBIT}(\beta,\sigma^2) = L_{PR}(\frac{\beta}{\sigma}) + L_{TR}(\beta,\sigma^2), \text{where :}$$

$$\begin{aligned} L_{TR}(\beta,\sigma^2) \;=\; & \sum_{i=1}^{N} d_i\{-\frac{1}{2}\log(2\pi) - \frac{1}{2}\log(\sigma^2) \\ & -\frac{1}{2\sigma^2}(y_i - x_i'\beta)^2 - \log F\left(\frac{x_i'\beta}{\sigma}\right)\} \end{aligned}$$

and $L_{PR}(\frac{\beta}{\sigma})$and d_i are as previously defined. In this case, the coefficients will give information on the probability of an investment occurring, and, if it does, the quantity. Moreover, we can perform a likelihood ratio test to examine whether the estimated coefficients explain both decision and quantity, or, conversely, if the determinants of the former and the latter are different.

The exponential regression is used when a linear regression using logarithms of the dependent variable should be done, but the dependent variable contains observations with zeroes. So the following relationship is estimated:

$$y_i = \exp(x_i'\beta) + u_i$$

using nonlinear least squares, again assuming that $(u_i \mid x_i) \sim i.i.d.$ $N(0,\sigma^2)$. In this case, one cannot identify separability between quantity and decision. We only obtain information on quantities since there is no underlying choice model as in the previous case.

3.2 Empirical relationship

As noted in the introduction, the explanatory variables are classified in two blocks. On one side, our database contains variables that describe characteristics of a given Spanish industry (subscript j). On the other side, our database also contains variables that collect features of the countries that invest in Spain (subscript i). Additionally, the explanatory variable nominal protection is the only variable that has a double dimension (industry-country). When the variable takes a time dimension, it will also have a subscript t.

The dependent variable, foreign direct investment in 1990 pesetas (FDI_{ijt}), takes two forms:

· A binary variable with value $d_{ijt} = 1$ if $FDI_{ijt} > 0$ and value $d_{ijt} = 0$ if $FDI_{ijt} = 0$ when we estimate the Probit.

· The quantity itself in all other estimations.

Hence, the following Probit is going to be estimated:

$$\begin{aligned}\Pr(d_{ijt} = 1) &= F(\alpha + \beta_1 NPR_{ijt} + \beta_2 TRC_{it} + \beta_3 SCE_j \\ &\quad + \beta_4 R\&D_{jt} + \beta_5 ADV_{jt} + \beta_6 DPCI_{it} \\ &\quad + \beta_7 DGDP_{it} + \beta_8 D\Pi I_{it} + \beta_9 E_{it} + \eta_j + \nu_i + \lambda_t)\end{aligned}$$

And when we look at the determinants of quantities, the empirical relationship will be:

$$\begin{aligned}FDI_{ijt} &= g(\gamma + \delta_1 NPR_{ijt} + \delta_2 TRC_{it} + \delta_3 SCE_j \\ &\quad + \delta_4 R\&D_{jt} + \delta_5 ADV_{jt} + \delta_6 DPCI_{it} + \delta_7 DGDP_{it} \\ &\quad + \delta_8 D\Pi I_{it} + \delta_9 E_{it} + \eta_j + \nu_i + \lambda_t) + \varepsilon_{ijt}\end{aligned}$$

where g is the function that relates the nonlinearity of the Tobit, truncated or exponential regression to FDI_{ijt}, and $\varepsilon_{ijt} \sim i.i.d.N(0, \sigma^2)$.

It is important to examine generally which variables are included in the regressions, why they are included, and what effect they are expected to have on the dependent variable. For a specific definition of the variables and how they were constructed, please refer to the appendix.

Some variables are derived directly from Brainard's (1993) model:

· Nominal protection against country i on goods of industry j (NPR_{ijt}). We include this variable because it counts as an additional cost in case a firm wants to export from its home country to Spain. A positive

effect of this variable on FDI is expected, since higher tariffs induce firms to produce in Spain rather than export.

· Transport costs from country i to Spain (TRC_{it}). A positive sign is also expected, applying the same reasoning as nominal protection above.

· Scale economies at the plant level in industry j (SCE_j). Ideally, we would estimate production functions for each industry, we would analyze its functional form and then we would deduct if that industry exhibits increasing, constant or decreasing returns to scale. However, this would be a work outside the scope of this article. Scale economies at the plant level can be approximated by using the gross added value measured at current cost per establishment[7]. This approximation is widely used in empirical industrial organization, and its reasoning relies on the fact that an industry with greater scale economies uses larger facilities, and should generate a larger GAV per establishment. As the model suggests, a negative relationship between this variable and the dependent variable is expected. Another possible specification uses dummy variables on GAV ranges. In this case, a sequence of positive and decreasing estimates is expected. By "jumping" from one range to the other the effect should be smaller. It is important to note that this variable will not take a time dimension, since for the sample period used (1990-1995) we do not expect scale economies of a given industry to change significantly. We confirmed that the ranking among industries did not change over the sample period.

The next two variables can be seen as proxies for scale economies at the firm level, but they are also closely related to the internalization advantage noted previously[8]. Here, unlike the case of scale economies at the plant level, time variation was important enough to use these variables with a time dimension:

· Ratio of R&D spending plus payments for technology abroad over sales in industry j ($R\&D_{jt}$). Consider this to be a measure of "technological differentiation" that can be extended to subsidiaries at a negligible cost once incurred (production factor with "public good" character), which gives the firm certain technological advantages that should be exploited by the firm internally. In principle, a positive relationship is expected.

[7]Following the terminology used in the *Encuesta Industrial* (Industrial Survey).
[8]See Bajo and López Pueyo (1996) for a longer discussion.

· Ratio of advertising spending over sales in industry j (ADV_{jt}). This is used as proxy for product differentiation: firms that incur advertising costs have a tendency to locate production near consumers to satisfy their preference for diversity. Moreover, marketing campaigns have a "public good" character once the headquarters have incurred the cost of designing them. This coefficient is expected to be positive.

It is important to note that we will be using data on the Spanish manufacturing industry for these two variables. As will show up later, this could pose some problems since it would be desirable to have data on the countries of origin of FDI. Under the assumption that Spain is technologically similar to the rest of the countries in this study, it will be valid to use Spanish data. Another option is to say, following Brainard (1997), that what we are testing is the effect of the scale economies at the firm level in Spain on the investment decision. We discuss this point later in the results section.

We also include the following variables for comparability with previous work in the field[9]:

· The differential in *per capita* income measured using PPP between the foreign country i and Spain ($DPCI_{it}$). Assuming *per capita* income measured using PPP as a proxy for relative factor endowment, a positive sign would be associated with a model of vertical integration, since it would imply that Spain, as a labor intensive country, receives FDI for that reason. Another interpretation is that a growth of Spanish *per capita* income measured using PPP would make domestic demand increase, hence the volume of imports and FDI would also grow, and we would expect a negative sign on this coefficient.

· The differential in GDP growth between the foreign country i and Spain ($DGDP_{it}$). Since higher GDP growth in Spain makes the market more attractive, a negative sign is expected.

· The differential in inflation rates of industrial prices between foreign countries and Spain ($D\Pi I_{it}$). A negative coefficient is expected because, *ceteris paribus*, a higher price of industrial products in Spain makes both exporting to Spain or engaging in FDI more profitable[10].

[9] See Bajo and López Pueyo (1996), Bajo and Sosvilla (1992), Brainard (1997), and the references therein

[10] Look at equation (2), and let's suppose that changes in prices come through the parameters of the demand function. However, the opposite sign would be expected if we used consumer prices, taking into account considerations of macroeconomic

· Nominal exchange rate (E_{it}). In a monetary model of international trade this is usually a key variable. The effect should be positive since a devaluation makes imports more expensive, so goods produced in Spain by multinationals will not suffer this price effect. Moreover, a devaluation of the peseta makes domestic assets for foreign investors cheaper.

· We also account for possible fixed effects for industry, country and year (η_j, ν_i, λ_t).

4. The data

The database was constructed using several sources because no organization supplies all of the necessary variables. In the appendix, we provide an exhaustive description of data sources. The sample

TABLE 1
Industry Classification following Encuesta Industrial and CNAE 93

Industry	Encuesta Industrial	CNAE 93
Ferrous Metals	10,11	27
Nometallic Mineral Industries	13-18	26
Chemicals	19-30	24
Metallic Products	31-35	28
Mechanical Equipment	36,37	29
Office and Data Procesing	38	30
Electrical Machinery	39	31
Electronic Material	40	32
Automobiles	41	34
Shipbuilding	42-45	35
Precision Instruments	46	33
Food, Beverages and Tobacco	47-64	15-16
Textiles	65-68	17
Leather, Footwear and Clothing	69-74	18-19
Timber and Cork	75-79	20
Paper and Publishing	80-82	21-22
Rubber and Plastics	83,84	25
Other Manufacturing	85-89	36

period is from 1990 to 1995, inclusive. To study FDI in Spain, we considered the other fourteen countries of the EU, Switzerland, the USA, Canada and Japan. The destination industries of FDI considered can be found in Table 1, following the classification system of CNAE 93[11] and the *Encuesta Industrial* (1978-1992). We account for all industries in the *Encuesta Industrial* with the exception of extraction activities.

stability, as one referee has suggested

[11] CNAE is the acronym for National Accounting of Economic Activities (in Spanish).

We exclude from the analysis industries of a nontradeable nature (financial activities, services industry, and extraction activities) because, for obvious reasons, this type of production requires presence in the destination market.

In Figure 1, we can observe the evolution of FDI in Spain, both total and for the manufacturing sector. After significant expansion during the 1986-90 period (also referred to in the introduction, when FDI grew at a yearly rate of 47%), the next five years (1990-1995) experienced some stagnation. Specifically, FDI in the manufacturing sector slowed dramatically in 1990 and 1991. In those years, FDI was directed mainly toward real estate and financial investment, owing to intrinsic characteristics of those markets (we do not discuss an explanation of this phenomenon in this article). This empirical fact can also be observed in Figure 2, which shows the proportion of FDI destinated to manufacturing. There is a large decrease for 1990-1991, and a significant recovery thereafter. However, the percentages for 1992-1995 are far away from those observed in the 1960-1990 period as we can see from Table 2.

TABLE 2
Evolution of FDI in Manufacturing over total

Period	% over total
1961-65	54 6
1966-70	73.5
1971-75	79.3
1976-80	71 0
1981-85	62 0
1986-90	45 9
1990-95	26.1

Source Bajo and López Pueyo (1996) and DGPCIE

Looking at the countries of origin of FDI in manufacturing (Table 3), the Netherlands stands out as the country that invests the most. This is, however, misleading, and is accounted for by the fact that many multinationals of other countries have their European headquarters located there. When these firms undertake an investment project in Spain, it is therefore registered as coming from the Netherlands. France, Germany and the USA are the next largest investors, in that order, between 10% and 20%. The next group of countries, which includes Belgium, Italy, the UK and Switzerland, contribute approximately a 5% of total volume.

Note that Japan did not invest much in Spain during that period,

accounting for only 2.5% of total volume, and it is decreasing in the sample period. The other countries in the sample supply insignificant percentages. We must also account for the fact that data published by the DGPCIE includes Spain as an origin country of FDI in Spain. This occurs when investment projects are undertaken by the Spanish subsidiary of a foreign multinational. For obvious reasons these data were suppressed since it was not possible to determine the actual country of origin.

TABLE 3
Countries of Origin of FDI in Manufacturing in Spain (1990-1995)

% over total	1990-92	1993-95	1990-1995
France	19 20	16.39	17.34
Belgium	6.35	3.24	4 29
Netherlands	29.00	30 75	30.16
Germany	13.81	15.59	14.99
Italy	6.35	5 83	6.00
UK	5.11	5.63	5.46
Ireland	0.01	0.02	0.01
Denmark	0 78	0 51	0.60
Greece	0.00	0.00	0 00
Portugal	3.01	0 54	1.37
Sweden	0.22	0.57	0.45
Finland	0.42	0 15	0.24
Austria	0.17	0.07	0.11
Switzerland	3.89	5.81	5.17
Luxemburg	0 23	0 72	0.55
USA	6.63	12.63	10.61
Canada	0.30	0 07	0.15
Japan	4.51	1.49	2 50
Total	100.00	100.00	100.00
Total (in billions of pta.)	1,067.62	2,108 73	3,176 36

Source DGPCIE

Table 4 shows the destination of FDI among the Spanish manufacturing industry. As a main feature, note the great variability that the percentages show in the two subsample periods of 1990-1992 and 1993-1995[12]. The industry that receives FDI the most is Chemicals, with 21.3% of the total, but it exhibits a declining trend. The next industries are Motor Vehicles (15.51%) and Food, Beverages and Tobacco (13.83%), both with an increasing trend, and Rubber and Plastics (13.06%), which exhibits a declining trend. Following them, Non-metallic Mineral Industries (7.41%, but with rapidly expanding gro-

[12]This division is arbitrary and was done to show the reader the large variability of FDI when it is analyzed from the perspective of destination industries with respect to origin countries.

wth because no investment projects were registered between 1990 and 1992), Electrical Machinery (stable at 6%) and Paper and Publishing (5.67%). The remaining industries received percentages under 5%.

TABLE 4
FDI by industries of Destination (1990-1995)

% over total	1990-92	1993-95	1990-1995
Ferrous Metals	0 00	0.95	0 63
Nometallic Mineral Industries	0 00	11.17	7.41
Chemicals	29 32	17.24	21.30
Metallic Products	0 00	2.75	1.82
Mechanical Equipment	0 00	2.04	1.35
Office and Data Procesing	0.00	2.04	1.35
Electrical Machinery	5 68	6.17	6.01
Electronic Material	4.93	3.35	3 80
Motor Vehicles	6.85	19.89	15.51
Shipbuilding	5.64	0 61	2.30
Precision Instruments	3.75	0.19	1.39
Food, Beverages and Tobacco	4.52	18 54	13 83
Textiles	0.00	0.79	0.52
Leather, Footwear and Clothing	0.00	0 32	0.21
Timber and Cork	0.00	0.00	0 00
Paper and Publishing	2.00	7.53	5 67
Rubber and Plastics	26.59	6.20	13.06
Other Manufacturing	10.71	0.22	3 75
Total	100.00	100.00	100.00
Total (in billions of pta.)	1,067 62	2,108 73	3,176 36

Source DGPCIE

5. Results

5.1 Probit model

Table 5 shows the results, using the gross added value as a proxy for the scale economies at the plant level, whereas Table 6 shows dummy variable results for ranges of scale economies, as specified earlier and in the appendix. We have also included dummy variables for industry, country and year, to account for possible fixed effects. Given that there are 2268 observations[13], no problems arise with respect to the degrees of freedom (adding dummy variables for year, industry and country totals to 44). Only the significant dummy variables are shown. As a main result, note particularly that the coefficients on transport costs, exchange rate, and advertising expenditures have the expected positive sign, and are all significant. On the other hand, the key varia-

[13] We use 21 industries as classified by CNAE 93, 18 countries and 6 years. This makes 2268 observations.

TABLE 5
Probit estimates using GAV as proxy of scale economies at the plant level

Variable	Estimate	z-statistic
Constant	-3.72	-15.26
NPR	-0 77	-2.27
DPCI	1 14E-4	6 23
E	5.91E-3	7.42
TRC	1.45	3.07
GAV	0.016	9.18
GAV^2	-2.64E-5	-7.13
R&D	-14.03	-3 82
ADV	10.13	2.37
France	2.02	12.24
Belgium	1.02	5.98
Netherlands	1.87	12.3
Germany	1.01	6.75
Italy	1.73	9.93
Portugal	1.28	5.26
Sweden	0.5	2.93
Switzerland	0.69	4.40
USA	0.48	2 92
Industry 15	0.55	3.48
Industry 19	-0.86	-3.47
Industry 20	-0.84	-2.18
Industry 27	23.28	5.67
Industry 30	10.48	4 95
Industry 34	11.36	5.63
Year 94	0.18	2.11
Log-Likelihood	-899.31	
Observations	2268	

ble of R&D is significant but has the opposite sign. This could occur because we are using data on the Spanish industries. The model stipulates that R&D activity is done in the headquarters country and is then transmitted to the production facilities at a negligible cost[14], so we should use an indicator of investment in technology in the origin country. This argument is not necessarily applicable to advertising expenditures because, although a marketing campaign might be designed at the headquarters, the effective expenditure to make them go public may be made by the subsidiary. However, in all variables that describe an industry characteristic (subscript j), we are using repre-

[14] In fact, Martínez Serrano and Myro (1992) show empirical evidence to verify that the majority of mergers and acquisitions of Spanish firms by foreign investors take place in low technology intensive industries. Many other studies, however, and informal empirical evidence show the opposite result: FDI occurs in industries with medium and high R&D activity.

sentative data of the entire industry and not only on firms controlled by a foreign investor. Hence, what we are testing is the effect of scale economies at the firm level in Spain on the investment decision.

TABLE 6
Probit estimates using dummy variables as proxies of scale economies at the plant level

Variable	Estimate	z-statistic
Constant	-3.4	-14.85
NPR	0.4	1.11
DPCI	2.13E-4	9.52
E	3.52E-3	3.66
TRC	0.96	2 18
D1	0.05	0.3
D2	-0.23	-1.41
D3	1.42	7.31
D4	1.56	7.92
R&D	-12.78	-3.37
ADV	16.59	6.60
France	2.04	12.48
Belgium	0.95	5.56
Netherlands	2.05	12.94
Germany	1.06	7.23
Italy	1.76	9.93
Portugal	1.58	6.36
Sweden	0.44	2 53
Industry 16	-0.97	5.57
Industry 21	1.1	6.38
Industry 22	0.51	2.60
Industry 25	0.62	3.34
Industry 26	0.62	3.34
Industry 29	1.06	5.75
Industry 34	1.29	6.40
Year 94	0.32	3.53
Log-Likelihood	-854 1	
Observations	2268	

The proxy variable for the scale economies at the plant level has an unexpected behavior: a linear positive relationship between GAV_j and the probability of observing FDI is suggested (see Table 5). This effect contradicts completely the theory. Nevertheless, Table 6 shows that the intermediate ranges (d_3 and d_4) have a positive and significant effect with respect to the smallest ($d_1$and d_2) and the largest (not included to avoid multicollinearity). This suggests a nonmonotonic, first increasing and then decreasing, concave relationship of scale economies at the plant level to the dependent variable. This observation caused us to include the variable GAV_j squared (GAV_j^2) in the regression of

Table 5, which confirms the relationship by having a negative and significant coefficient[15]. This, in turn, further confirms that the trade-off between proximity and concentration only occurs at very high levels of scale economies[16], only partially contradicting the theory. It is worth noting, however, that this variable could be capturing the effect of minimally efficient size per establishment, so we may be observing a positive effect in the intermediate ranges. Moreover, it is a proxy variable, and not an exact indicator of the effect of scale economies at the plant level.

The results with respect to nominal protection are surprising. The coefficient has a negative and significant sign (Table 5), which becomes positive but not significant in Table 6. The optimal way to measure tariff barriers is effective protection. As explained in the appendix, we could not construct such variable. Hence the results on the effect of trade barriers on FDI have to be taken carefully.

Another remarkable result is the sign of the coefficient on the differential of *per capita* income measured in PPP. It has a positive sign and in both cases is significant. This would suggest that the greater the difference between Spain and the other country, the higher the probability of observing FDI, and this result is more consistent with a model of vertical integration. Neither the differential of GDP growth nor the differential of industrial price inflation was significant in either of the two Probit specifications (the z-statistics being smaller than one in absolute value), so they were not included. With respect to dummy variables, it is worth drawing attention to the surge in investment that occurred in 1994, coincidental with the end of the recession (see Figure 1).

5.2 Looking at the determinants of quantities

Outside the scope of Brainard's model, and for comparability with previous work in the field, we would like to discuss the determinants of quantities. In this subsection we comment on the results of the Tobit estimation, as well as running truncated and exponential regres-

[15] The function would have its maximum at GAV_j=303.03 millions of pta., which is a value inside the sample, and more concretely, in the $d3$ range. This confirms that the effect is directly present in the data and is not due to cross effects.

[16] Contradicting other work in the field, such as Bajo and López Pueyo (1996), who do not find a significant effect. They also cite a work by Bajo (1991) in which he found a negative effect. Brainard (1997) also obtains a negative effect.

sions, to see if we can shed some light on the determinants of observed quantities of FDI observed. As explained in the section on econometric specification, the log-likelihood of a Tobit can be decomposed into the log-likelihood of a Probit plus the log-likelihood of a truncated regression.

TABLE 7
Tobit estimates using GAV as proxy of scale economies at the plant level

Variable	Estimate	t-statistic
Constant	-50424	-13 92
NPR	-119.02	-2.53
DPCI	1.6993	5.11
E	75.076	6.64
TRC	209.22	3.08
GAV	185.46	7.63
GAV^2	-0.28	-5.89
R&D	-1615.5	-3.34
ADV	1328	4.16
France	24846	11.36
Belgium	13476	5.59
Netherlands	26521	13.69
Germany	14631	7.42
Italy	20561	8.41
Portugal	16594	4.68
Sweden	5854.1	2.34
Switzerland	8793.7	4.01
USA	6010.3	2.69
Industry 15	11476	5.42
Industry 19	-11711	-3.16
Industry 20	-12207	-2.13
Industry 27	251960	4.66
Industry 30	112560	4.04
Industry 34	125430	4.74
Year 94	3815.9	3.24
σ	14554	3.24
Log-Likelihood	-6746.08	
Observations	2268	

To check if the parameters of the Tobit determine both decision and quantity, the likelihood of the Probit and of the truncated regression can be maximized separately, and a likelihood ratio test can be then performed to check if the parameters are (statistically) similar. The results of the Tobit regressions, which are shown in Tables 7 and 8 as an analogy to the Probit specifications in Tables 5 and 6, indicate that the coefficients of the Tobit are similar to those of the Probit (in all cases the significance and sign of the coefficients are the same, and

in the majority of cases the value of the coefficient is quite similar)[17]. The results of the truncated regression (not shown) are also similar, but in most cases coefficients are not significant, despite a low correlation between the regressors (which makes problems associated with multicollinearity unlikely).

TABLE 8
Tobit estimates using dummy variables as proxies of scale economies at the plant level

Variable	Estimate	t-statistic
Constant	-46287	-13.61
NPR	28.78	0.58
DPCI	2.51	8.06
E	53.86	4.07
TRC	133.88	2.19
D1	1976.6	0.83
D2	-3506.6	-1.46
D3	14524	5.52
D4	17487	6.63
R&D	-15.25.1	-3.13
ADV	2046.9	6.26
France	24296	11.54
Belgium	12170	5.16
Netherlands	27279	13.83
Germany	14082	7.47
Italy	20135	8.39
UK	11234	4.42
Portugal	19951	5.69
Sweden	4785.4	1.91
Industry 16	-11647	-3 79
Industry 21	10751	4.47
Industry 22	11551	4.89
Industry 25	6168.5	2.63
Industry 26	11545	4 59
Industry 29	12421	4.79
Industry 34	17074	6.35
Year 94	5375.5	4.52
σ	14517	32.96
Log-Likelihood	-6728 24	
Observations	2268	

In the truncated regression using GAV_j and GAV_j^2, only these two variables are significant with the expected signs (the first positive, the second negative). The exchange rate and the expenditure on advertising are significant at the 10% level, with the same sign as in both the

[17] Remember that with the Probit we estimate $\frac{\beta}{\sigma}$ and with the Tobit we can estimate β and σ separately.

Probit and the Tobit specifications. The remaining coefficients have the same sign as the Tobit but with t-statistics less than one in absolute value. Running the truncated regression with dummy variables as proxies of scale economies at the plant level yielded the result of all coefficients having t-statistics less than one in absolute value, except the differential of *per capita* income, which was negative and significant.

Moreover, in both specifications of scale economies at the plant level, the likelihood ratio test with the null hypothesis testing whether the coefficients of the Probit and the truncated regression were equal (and by extension, those of the Tobit) was rejected. This result indicates that the coefficients of the Tobit give us complete information about the *probability* of observing a foreign direct investment, but it is not clear what they show about the quantities[18].

Another way to examine the determinants of quantities is to run exponential regressions. The results are not shown as these regressions perform poorly. We comment briefly on the results of the exponential regression, but it should be taken into account that the exponential regression, informally, would be rejected in a likelihood ratio test with the Tobit, since the exponential model exhibits log-likelihoods of -23000 and the Tobits, log-likelihoods of -6700, estimating the same parameters, with no need to do a specific contrast. We included the differential of GDP growth and inflation of industrial prices because they turn out to be very significant. Summarizing results in the exponential regressions, nominal protection, exchange rate, and differential in industrial inflation have the expected sign, transport costs and differential in GDP growth have the opposite sign to what is expected, proxies to scale economies at the plant level are generally not significant[19], and the *per capita* income differential and advertising and R&D expenditures are not robust.

6. Conclusions

We have chosen the predictions of models about horizontally integrated multinationals to explain the determinants of FDI in the Spanish manufacturing industries. These models try to reproduce the flows of

[18] Brainard (1997) runs OLS regressions on positive values. I will not do that here because the dependent variable is different.

[19] And when they are significant they exhibit a tendency to have the opposite sign as what we would expect, indicating that when determining quantities the amount of investment increases with the scale of production.

FDI observed in OECD countries (in both ways and basically owing to access to new markets). As the results indicate, the Spanish data do not match the main conclusions of these models.

One of the key explanatory variables of these models, transport costs, has a clear positive effect on FDI flows in Spain, in the sense that firms engaging in investment in Spain and establishing a subsidiary try to avoid those costs by producing in Spain and not exporting to Spain from the home country. On the other hand, nominal protection has the opposite effect from the one predicted by theory, since by the same argument firms would establish in Spain to avoid that kind of trade barrier. It could be possible that had we used data on effective protection and measures of nontrade barriers, we might have found different and more encouraging results. The other key variable, scale economies at the plant level has only a partial predicted effect. Only at high levels of scale economies the advantage of concentration becomes important with respect to the advantage of proximity. Therefore, at high levels of economies of scale the effect of that variable is negative on the establishment of subsidiaries in Spain. Nevertheless, for intermediate levels of scale economies at the plant level, we find a positive effect, which contradicts theory, probably because of an effect of minimally efficient production size.

The exchange rate exhibits a clear effect: it has a positive impact on FDI. A depreciated peseta makes imports more expensive, making domestic production favorable. Moreover, it makes Spanish assets cheaper for foreign investors. The variables that proxy both the internalization advantage and the scale economies at the firm level have a mixed effect: advertising expenditures have a positive impact on FDI, showing also that there is an advantage inherent in establishing near consumers; on the other hand, R&D expenditures plus payments for technology abroad have the opposite sign to what is expected. However, it has been pointed out that it would be desirable to use data on the countries where headquarters are located. This result is, taking all these considerations into account, puzzling. It contradicts many empirical work on the field, and should be taken carefully.

Another key variable in my study is the differential of *per capita* income measured in PPP. The result suggests that there are more reasons than the horizontal expansion of firms to justify FDI. It reveals that a larger differential in the relative endowment of factors, being Spain a labor intensive country with respect to the countries with higher *per capita*

income, induces firms to establish in Spain in search of a lower price for labor[20]. Two main macroeconomics indicators, the differential in GDP growth and differential in industrial prices inflation, turned out to be non significant.

All of these effects are present when we study the determinants on the *probability* to observe an investment project in an industry coming from a foreign country. When we want to explain quantities, most of these effects have less explicative power. The different methods discussed to determine quantities give contradictory results. The only robust effects found are on the exchange rate and the R&D expenditures. A depreciated peseta affects positively the quantity, while FDI seems to be more important in industries with low R&D expenditures. Once again, this result is puzzling and contradicts empirical evidence.

Analyzing the results jointly, we can conclude that the behavior of multinational firms in Spain cannot be explained solely by a model of horizontal integration. In future investigations it would be desirable to introduce elements of vertical integration.

Appendix 1

A1. 1 Definition of the variables

· NPR_{ijt} is nominal protection against country i of industry j goods.

· TRC_{it} are transport costs from country i to Spain.

· SCE_j tries to measure scale economies at the plant level. We use two possible specifications:

– GAV_j is the gross added value at current cost per establishment, in industry j. We take the sample mean of the observations per industry between 1978-1992[21].

Or a sequence of dummy variables constructed by range of gross added value at current cost per establishment, also from the sample mean of the observations between 1978 and 1992:

[20] However, Bajo and López Pueyo (1996), in his own work and citing other work in the field, do not find a significant effect of labor costs on FDI.

[21] We said above that this variable does not take a time dimension, and that the ranking by industries does not change year after year, during the period 1978-1992. We use this procedure in order to use the sample period 1990-1995, since after 1992 the format of the Encuesta Industrial changed. From 1993 on, the *Encuesta Industrial* asks for the gross added value per firm and not per establishment, which makes data after 1993 useless for this study.

– $d1$ is a dummy variable that takes value 1 for the range 0-50 millions of pta. and 0 otherwise.

– $d2$ is a dummy variable that takes value 1 for the range 50-100 millions of pta. and 0 otherwise.

– $d3$ is a dummy variable that takes value 1 for the range 100-500 millions of pta. and 0 otherwise.

– $d4$ is a dummy variable that takes value 1 for the range 500-1000 millions of pta. and 0 otherwise[22].

· $R\&D_{jt}$ is the ratio of R&D activities plus payments for technology abroad, over sales, in industry j.

· ADV_{jt} is the ratio of advertising activities over sales, in industry j.

· $DPCI_{it}$ is the differential of per capita income adjusted by PPP between country i and Spain.

· $DGDP_{it}$ is the differential of GDP growth between country i and Spain.

· $D\Pi I_{it}$ is the differential of inflation in industrial prices between country i and Spain.

· E_{it} is the nominal exchange rate measured in pesetas per unit country i's currency.

· η_j is a dummy variable that takes value 1 for industry j, and 0 otherwise.

· ν_i is a dummy variable that takes value 1 for country i, and 0 otherwise.

· λ_t is a dummy variable that takes value 1 for year t, and 0 otherwise.

A1. 2 Data sources

The data on the dependent variable, foreign direct investment, have been obtained from Dirección General de Política Comercial e Inversiones Exteriores (DGPCIE), a department of the Ministerio de Economía y Hacienda (Spanish Ministry of Economy and Finance). Spanish regulation of foreign investments establishes that there is "effective influence on the managing or control of the company" and, therefore, a foreign direct investment, when the alien investor's holdings of the share capital of the company is equal to or larger than 10%. Additionally, when this percentage of 10% is not reached, it is also considered to be FDI if the investor belongs, directly or indirectly, to the company's board of directors. Direct investments can take place in a

[22] We leave as the range of more than 1000 millions of pta. as control to avoid multicollinearity.

number of ways, which are:

· Setting up a company.

· Partial or total acquisition of the shares or other equities of the company.

· Acquisition of the right to subscribe shares, bonds convertible to shares, or other similar securities which, owing to their nature, give the owner right to participate in the company's share capital.

· Setting up or increasing subsidiaries and establishments, as well as the concession of returnable advance payments.

· Concession of loans that have a weighted mean lifetime greater than five years, with the aim of establishing or keeping longlasting economic links.

Spanish regulation establishes that under several assumptions (amount of investment, country of origin, activity of recipient company, amount and composition of capital share of the recipient company) the investment projects have to be verified by DGPCIE. Therefore, we have data on verified projects that do not necessarily coincide with the actual data of investments coming from abroad during the same period. Nevertheless they are a good approximation of the real data. To obtain the series in 1990 constant pesetas, we have used the price index on equipment goods published in the Boletín Estadístico del Banco de España.

The data on nominal protection for the EU countries have been obtained from a study by Cañada and Carmena (1991), and the tariff reduction calendar has been applied. For the non-EU countries we have used data published by OECD. Ideally, one would like to have data on effective protection, but its elaboration is not straightforward since the coefficients of the input-output tables should be used on a yearly basis to infer the productive structure, and hence the tariff structure of a concrete industry. It would also have been interesting to use data on nontariff barriers, but the sources we looked at had too few industrial disaggregations, observations for too few years and/or countries, or they were incomplete. For these reasons they are not included in the analysis.

Data on nominal exchange rates, taken in means per period, and of GDP growth have been obtained through IMF's International Financial Statistics. Data on industrial price inflation were obtained through OECD's Main Economic Indicators. Data on per capita income corrected by PPP were obtained through the Penn World Tables database and OECD's Main Economic Indicators.

The construction of the transport costs variable has not been too satisfactory. Ideally we would like to obtain the transport cost for a given country and a given industry. However, such disaggregated data was not available, so we have calculated the transport cost as follows:

$$TCR_{it} = \frac{MCIF_{it} - XFOB_{it}}{XFOB_{it}}$$

where $MCIF_{it}$ is CIF imports of country i's products in Spain and $XFOB_{it}$ is FOB exports from country i to Spain. This gives us a measure of the transport and freight costs as a percentage of FOB exports to Spain. Since we do not have an industrial dimension, we will have to assume unsatisfactorily that this measure of transport costs is the same for all industries in the transit from one country to another. The data on bilateral trade were obtained through IMF's Yearbook of Trade Statistics.

The data on advertising expenditures over sales, R&D expenditures over sales, and payments for technology abroad were obtained from Encuesta Sobre Estrategias Empresariales (Survey on Managerial Strategies), which is elaborated by Fundación Empresa Pública. This data set is constructed to be a representative sample for each industry. Given that we use percentages over sales and not total values, we assume that these data are representative and valid. To approximate scale economies at the plant level, we use data on mean gross added value measured at current cost per establishment, from Encuesta Industrial, also obtained through Fundación Empresa Pública.

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Abstract

Este artículo utiliza las predicciones de un modelo sobre multinacionales con integración horizontal para explicar los determinantes de la inversión extranjera directa en España. El periodo analizado comprende los años 1990-1995. Las variables explicativas clave son costes de transporte y economías de escala a nivel de empresa y de planta de producción. Los resultados son mixtos: los costes de transporte tienen un efecto positivo sobre la inversión extranjera directa, mientras que las economías de escala a nivel de planta de producción tienen un efecto no monotónico, primero creciente y después decreciente, lo que contradice el signo negativo esperado en las regresiones. Estos efectos son más importantes cuando intentamos explicar la probabilidad de que un proyecto de inversión se materialice.

Palabras clave: Inversión extranjera directa, integración horizontal.

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