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TRANSPORT INFRASTRUCTURE, SUNK COSTS AND FIRMS' EXPORT BEHAVIOR*

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Abstract

Transport infrastructure investment reduces the cost of distance and enables firms to establish contacts over larger distances. We study the impact of transport-cost reductions on firms' export behaviour, accounting for the role of entry costs and other firms' characteristics. Using Spanish data we estimate dynamic probability models controlling for firms' unobserved heterogeneity and for the simultaneity of firms' export and location decisions. Our results provide support for a positive effect of domestic transport improvements on firms' exporting probability for small and medium sized firms. We find a strong effect of previous export experience, suggesting high entry costs into export markets.

Keywords: export decision; transport infrastructure; accessibility; dynamic panel data.

JEL: F14, R1, R4

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1. INTRODUCTION

During the last decades, world trade grew at an average annual rate of about 5.2 percent (World Trade Organization, International Trade Statistics, 2007). With increasing globalisation and international competition, a strong domestic export base is of high priority among policy makers and economists. The European Commission has considered as a key policy issue to increase the competitiveness of the European economy.

Modern efficient transport networks are considered essential for international competitiveness. In Europe, transport investment receives important financial resources. Total investment on transport infrastructure, for example, amounted to € 738 billion over the period 2000-2006 including national government expenditures.[1] Transport infrastructure development reduces the costs of doing business over distance and improves the capacity of firms to compete in global markets.

In this paper, we study the impact of domestic transport infrastructure development on firms' export behaviour. There exists very limited research on the contribution of transport investment on international trade in general, and on firms' export behaviour in particular. We follow the recent micro-econometric literature and control for the effect of sunk costs and firms' characteristics on export behaviour (see, for instance, Bernard and Jensen, 2004).

We perform the analysis using Spanish data. Spain stands out as an interesting case given that more than 10,000 kilometres of new motorways have been built since the 1980s. These improvements have been rather general across Spanish regions. Therefore, Spain represents an ideal context since we can use these widespread improvements as a source of exogenous variation to identify the effect of transportation cost reductions on export behaviour.

Two sources of data have been used. On the one hand, we use a rich data set of Spanish manufacturing firms, the Encuesta sobre Estrategias Empresariales (ESEE), for the period 1990-2005. This survey is rather unique since it provides information on firms' location in addition to a

[1] http://ec.europa.eu/transport/infrastructure/index_en.htm

wide range of other firms' characteristics and on their export behaviour. On the other hand, firms' level data are combined with a measure of the cost of access to export markets constructed using Geographic Information Systems (GIS) and the real road network. Contrary to most studies in the international trade literature, we do not use great circle distances. These are crude proxies of transport costs, but most importantly, great circle distances cannot pick up on transport cost variations over time (see Combes and Lafourcade, 2005).

Our empirical strategy exploits the panel structure of the data. We estimate several linear and non-linear models to address a number of econometric issues and, thus, to obtain causal effects of the variables of interest. We test for the presence of sunk entry costs in exportation markets by including previous export behaviour of the firm among the explanatory variables. In line with Bernard and Jensen (2004) we also control for time invariant unobserved firm heterogeneity in order to obtain the unbiased effect of the explanatory variables potentially correlated with them. This is particularly important in our case given that these unobserved factors are correlated with the initial location decision by the firm. Then firms with more favourable unobserved characteristics to compete in international markets may be attracted to regions that offer more suitable conditions for exporting.

The paper is organised as follows. In the next section, we provide a review of the related literature regarding determinants of firms' export behaviour. In Section 3 we describe the data set for our analysis and present some descriptive statistics. In Section 4 we present our empirical model and estimation strategy. Section 5 presents the results, and Section 6 concludes.

2. RELATED LITERATURE

Two strands of the literature are relevant for us. On the one hand, we follow the empirical research that studies the determinants of export behaviour at the firm level. On the other hand, we are also

interested in the effect of reductions in transportation costs. Traditionally this has been studied using aggregate data, but we address this issue from a micro-econometric perspective.

2.1. Exports and firm-level characteristics

Starting with the work of Bernard and Jensen (1995, 1999) and Aw and Hwang (1995), a number of recent studies have shown the importance of firm-specific influences on exporting. These micro-level studies emphasise how firm heterogeneity affects participation in international markets. A set of stylised facts about exporting firms has been established in this literature. Greenaway and Kneller (2007) and Wagner (2007) provide recent surveys of this literature.

Entry costs in the export markets are found to be a significant determinant of the probability of exporting. Roberts and Tybout (1997) and Bernard and Jensen (2004) test for the possible presence of entry costs by looking at the effect of past exports on current exports. They find strong effects of past export experience on the propensity of exporting.

Export activity has been also related to firm size in a number of studies (see, for example Wagner, 1995). In general export activity is found to be more common among large firms. Larger firms have more resources to access international markets. Given the higher entry cost in international than in the domestic market, this is argued to make them more likely to be exporters.

Additional determinants of export behaviour are foreign ownership (Roberts and Tybout, 1997; Aitken et al., 1997), age and technological factors, such as R&D expenditure, innovation, or investment in skilled labour (Braunerhjelm, 1996, Becker and Egger, 2007). Productivity has also received particular attention in empirical studies, which usually find a positive relationship between firm-level productivity and export participation (see, for example, Bernard and Jensen, 1995, Girma et al., 2004). Various factors can account for this. First, higher productivity firms are more likely to be able to absorb the sunk costs associated with foreign market entry. At the same time, competition in international markets could be fiercer than in home markets, thus only allowing the most efficient

firms to participate (Melitz, 2003, Bernard et al., 2006, 2007). Alternatively, it has been argued that learning effects associated to exporting could imply that exporting itself makes firms more productive.

2.2. Exports and transport costs

Building on Melitz (2003), Bernard et al. (2006) show in a theoretical model of international trade how falls in trade costs make high-productivity non-exporters more likely to start exporting and existing exporters to increase their exports. An important part of trade costs are transport costs. So far, however, transport costs have been largely ignored by the empirical literature on the export decision of firms. Yet, from the trade literature we know that transport costs matters for international trade. Studies based on the familiar gravity model indicate how volumes of trade between countries rapidly decline with distance (for a recent review, see, Disdier and Head, 2008).

As argued by Hummels (1999), distance matters because of transportation costs. Limao and Venables (2001) estimate the elasticity of trade to transport costs and find that a 10-percentage point increase in transport costs reduces trade volumes by approximately 20%. Distance has also an important effect on the time cost of trade. Anderson and van Wincoop (2004) point out that trade costs are still large even among highly integrated economies and in the absence of informal barriers to trade. They calculate a transportation cost mark-up over production costs of 21% for the U.S. Time in transit is increasingly important for modern time-based competitive strategies such as just-in-time production and quick response delivery. Hummels (2001) finds that each day of increased ocean transit time between two countries reduces the probability of trade by 1 to 1.5 percent.

Transport costs are not only determined by distance. What also matters is the quality of infrastructure. Bougheas et al. (1999) develop a bilateral trade model with transport costs depending on the level of infrastructure. Infrastructure is shown to raise the volume of trade. Limao and Venables (2001) find that a deterioration of infrastructure from the median to the 75th percentile

raises transport costs by 12% and reduces traded volumes by 28%. Using data for Sub-Saharan Africa, Redding and Venables (2003) find that poor external geography, poor internal geography, and poor institutional quality contribute in approximately equal terms to export performance. Francois and Manchin (2007) show that infrastructure and institutional quality are significant determinants not only of export levels, but also of the likelihood that exports take place, and that they are more important than variations in tariffs.

Limao and Venables (2001) argue that poor domestic transport infrastructure can inhibit a country's participation in global production networks. However, the literature has largely ignored national transport costs. Moreover, some locations will be better locations for exporters, because of better international market access (Hummels 1999, 2001).

Some indirect supporting evidence on the role of domestic differences in access to export markets is provided in Nicolini (2003). Using a gravity model approach for aggregate trade among European regions, she finds that distance reduces trade while the density of local transport infrastructure positively affects export flows. Costa-Campi and Viladecans-Marsal (1999) study the propensity to export among Spanish municipalities. They find some evidence of a negative effect of distance to the European border and a positive effect for the presence of an international seaport in some sectors. At the firm level, Sterlacchini (2001) and Basile (2001) find for Italian manufacturing firms that being located in southern Italy reduces export probability and intensity.

In summary, few empirical studies have specifically addressed the importance of export market access in affecting firms' probability of entry into exporting. These studies have, however, not explicitly considered the effect of transport cost reductions derived from domestic infrastructure improvements, nor have these studies taken into account unobserved heterogeneity among firms, dynamic effects, and potential problems of self-selection of location.

3. DATA AND DESCRIPTIVE STATISTICS

3.1 The Data

The data for the analysis come from two sources. First, we use a rich data set of Spanish manufacturing firms, the Encuesta sobre Estrategias Empresariales (ESEE). These firms' level data are combined with information on transport improvements calculated using spatially georeferenced data of the Spanish road network and information on the time of opening of new motorways.

The ESSE, published by the Fundación Empresa Pública, provides a wide range of information on a sample of 4,357 Spanish manufacturing firms including information on exporting. The survey is undertaken annually since 1990 and constitutes an unbalanced panel. The sample of firms includes the universe of Spanish manufacturing firms with at least 200 employees in 1990 and a stratified sample representative of the population of manufacturing firms with more than 10, but less than 200 employees (for more details on the survey, see, for example, Fariñas and Jaumandreu, 1999). We use data for the period from 1990 to 2005. We have dropped those firms for which relevant information is missing and those firms affected, in the corresponding year, by some process of absorption, merger or split. Our final sample consists of an unbalanced panel of 4,177 firms. In Table 1 we provide information on the distribution of firms by year and size in our sample.

Second, we use detailed information from the Ministry of Public Works (Ministerio de Fomento) regarding the opening to traffic of new road segments, which provides the year a particular link was finished and opened to traffic. This information has been combined with the annual official roadmaps published by the Ministry of Public Works to construct GIS time series information based on the real evolution of the actual transport networks. Next, we have related the transport network data to spatially geo-referenced municipality data in order to calculate an accessibility indicator at the fine-grained geographical level. This accessibility indicator is based on the shortest path road travel time to the closest international border (Portugal or France) or main sea port.[2]

[2] Transport statistics show that road and sea transport account for up to 94% of international goods transport in Spain in terms of quantity and over 80% in terms of value. Alternatively, we have also tested measures of accessibility to main airports of freight transport. This could presumably be more important for high-value or highly perishable goods.

Our accessibility measure, based on travel time, is a proxy for generalized transport costs. What transport infrastructure improvements do foremost is lowering travel times. As argued in Combes and Lafourcade (2005) transport cost reductions over the last decades have also been driven by transport technology and market structure. Nonetheless, these factors are largely invariant across regions. Thus, the main factor that accounts for spatial variations in transport cost reductions are infrastructure improvements.

Ideally we would like to have information on the exact location of each firm in the ESEE, but for reasons of confidentiality, such detailed information is not provided. The ESEE only provides location information at the regional level (Autonomous Community), as well as the size (5 size categories) of the municipality where the firms' main establishment is located.[3] In order to link each ESEE firm with the corresponding accessibility data[4] we have calculated the weighted average of accessibility levels for each of the municipality-size categories in each region.

Table I in the Appendix shows the definition of the main variables for our study and Table II offers information about how industries are classified in our data set. Firm's size has been considered a major source of heterogeneity in export market participation. Moreover, firm size may condition the effect of other variables. In particular, improvements in export market accessibility may make exporting more feasible for small firms. We thus control for such size effects by analysing the coefficients of small (less than 50 employees), medium (between 51 and 200 employees), and large firms (more than 200 employees) in separate regressions. To delimit the large size firm category, the choice of threshold is based on the ESEE sampling criteria that differ from the EU classification

[3] Firms could also export from their other establishments. The percentage of multi-plant firms is, however, relatively small in our sample. Less than 15% report more than one establishment. Moreover, more than half of these multi-establishments have their presence only in one region.

[4] Firm relocation could also affect the accurateness of our accessibility measure. Relocation is however not a common phenomenon. 97% of our sample firms stayed in the same region over the entire period of analysis, while 93% also stayed in the same municipality.

which defined larger firms as those with more than 250 employees. We follow the EU guidelines for the lower threshold of less than 50 employees.

3.2 Descriptive Analysis

Figure 1 shows the percentage of firms, by size, engaged in exporting from 1990 to 2005 in our sample. As documented in the literature, export activity is more common among large firms: compared to firms with less than 50 employees, the proportion of exporting firms is more than twice among firms with more than 200. The rationale is that larger firms may have more resources to access international markets. Given the higher entry cost in international than in the domestic market, this is argued to make them more likely to be exporters. Overall, the number of exporting firms has increased during this period (from 51% in 1990 to 63.8% in 2005). This increase is sharper among smaller and medium sized firms: in particular, the percentage of exporting firms among small firms grew from 26.5% in 1990 to 40.4% in 2005. Export participation growth was especially intense for all types of firms up to 1998 (and since then it has remained rather stable). It is worth noting that this coincides with the completion of the primary motorway network in Spain. Road infrastructure investment since then has continued the extension of the motorway network through the provision of a complementary finer mesh network.

Table 2 provides transition rates into and out of exporting for the firms in our sample. Column 1 indicates the initial export status, column 2 shows export status in the following year. For example, in the first row we see that around 90% of firms that did not export in a given year either did so in the following year, while only a small percentage started exporting. Similarly for firms that exported, more than 93% of them continued to export in the following year. This shows a high level of persistence in export participation.

Table 3 provides further descriptive statistics of some key characteristics of exporting firms in our three size categories. Compared to non-exporters, exporters have more employees, are on average

older (except among the larger firms) and have a greater degree of foreign capital participation. Exporters in our sample have also more skilled employees, spend more on R&D and are more productive (again with the only exception of firms with more than 200 employees). These descriptive statistics are in line with the previous literature. Finally, exporters are on average closer to export markets than non-exporters and this is true for small, medium and large firms.

Table 4 reflects the geographical pattern of export propensity among Spanish manufacturing firms. Average exporting propensity in the peripheral regions is lower than in the areas that concentrate most economic activity. However, all regions experienced an increase in the percentage of exporting firms over the period analysed, and the increases in the periphery have been larger bringing them closer to the percentage of exporting firms observed in the core-areas.

Table 5 shows the percentage of exporters according to several accessibility indicators for 1990 and 2005. On average, exporters are closer to the French border and closer to main seaports. However, areas closer to the Portuguese border show fewer exporters than those further away. Mean difference tests also confirm that exporters are on average closer to the French border and to main seaports, however at a greater mean distance from the Portuguese border than non-exporters.

Table 6 reports the average changes in accessibility that exporters and non-exporters experienced. In general, export market access improved significantly more for locations with traditionally more non-exporters than exporters, except for access to the Portuguese border. This is consistent with Table 4 and 5. Non-exporters have been to a greater degree in the peripheral areas. As these are areas in general further away from the French border and main seaports, these are also the areas that gained more in terms of export market access.

4. EMPIRICAL MODEL AND ECONOMETRIC ISSUES

4.1 The Model

Our theoretical framework is based on a simple model of optimization for a firm facing the export decision. A profit maximising firm makes its decision based on expected profits from exporting, now and in the future, taking into account the fixed costs of entering the new market, and other variable costs.

Thus, the export status of the firm *i* in period *t* is denoted by the binary indicator E_{it}, so

$$E_{it} = \begin{cases} 1, & \text{if } \Pi_{it} \geq S \cdot (1 - E_{it-1}) \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

where Π_{it} is the firm's profit and S reflects any sunk costs of entry, which depends on previous export behaviour (see Roberts and Tybout, 1997).

Given this theoretical setting, we empirically model firm's export behaviour as a dynamic model with unobserved heterogeneity. On the one hand, it is important to account for dynamic effects since, as explained before, export decisions depend on past export behaviour due to the existence of sunk cost when entering new markets. On the other hand, export decisions are also affected by a number of time invariant firm-specific characteristics (for instance, quality of the products or managerial ability) that cannot be directly observed. Lack of control for these unobserved characteristics is known to lead to a "spurious" state dependence in dynamic models (see Heckman, 1991) and therefore to obtain biased estimates of any explanatory variable potentially correlated with it. Moreover, it is worth noting that transportation costs can also be correlated with time-invariant unobserved heterogeneity through the location decision originally made by the firm. In particular, the firm is likely to take into account geographical advantages of a certain location when planning to engage in exporting.[5] Since our measure of accessibility depends on location, it is potentially correlated with unobserved heterogeneity and, therefore, can be regarded as endogenous.[6]

[5] This issue can also be viewed as a typical initial conditions problem.

[6] Moreover, there are additional sources of endogeneity: for instance, productivity is also likely to be endogenous.

We characterise the probability of exporting by using the following empirical model:

$$\Pr\left(E_{it}=1 \mid X_{it}, Z_t, E_{it-1}, \eta_i\right) = F\left(\alpha + \beta X_{it} + \delta Z_t + \theta E_{it-1} + \eta_i\right), \tag{2}$$

where η_i is a time invariant firm-specific component, X_{it} is a vector of observable variables including accessibility, and Z_t captures the effect of macroeconomic conditions. $F(\cdot)$ is a given function, typically a cumulative distribution function (cdf).

One particular choice of functional form is $F(z)=z$, in which case we obtain the so called "linear probability model" (LPM):

$$E_{it} = \alpha + \beta X_{it} + \delta Z_t + \theta E_{it-1} + \eta_i + \varepsilon_{it}, \tag{3}$$

where ε_{it} is the error term of the model.

For linear models, it is relatively easy to deal with dynamics, with time invariant unobserved heterogeneity potentially correlated with the explanatory variables, and with the presence of endogenous variables.[7] However, this model presents some drawbacks when the dependent variable is discrete: in particular, it does not restrict the predicted values to lie within the $(0,1)$ interval.

To deal with this we specify $F(\cdot)$ as the cdf of a normal distribution $N(0,1)$, which is bounded between 0 and 1 (probit model). However, given the non-linearity, it is more difficult to account for the previously mentioned econometric issues. Moreover, within the non-linear context, one needs to control for the so called "initial conditions problem". The idea is that the initial period of observation does not correspond with the first period the firm is in the market. The beginning of the process is unobserved for the econometrician and possibly correlated with the unobserved effects. This problem does not appear in the linear case, since the unobserved effects can be ruled out by using a simple transformation of the model. However, no general transformation is known to eliminate the unobserved effects in non-linear models.

[7] This type of LPM is estimated by Bernard and Jensen (2004).

4.2 Estimation Strategy

We follow a progressive estimation strategy, in the sense that we estimate a sequence of linear and non-linear models to address in different steps the pertinent econometric issues.

Our analysis begins with the estimation of models that treat all explanatory variables as strictly exogenous and neglect both unobserved heterogeneity and endogeneity issues. We estimate a pooled linear model by Ordinary Least Squares (OLS) and a pooled probit model. These estimates are likely to be biased and the results should only be taken as a benchmark since it is difficult to infer causal effects from them.

Unobserved Heterogeneity

We exploit the longitudinal information in our data to control for firms' unobserved heterogeneity potentially correlated with the explanatory variables. We apply the within groups (WG) transformation in order to get rid of the unobserved effects in equation (3). Notice that, once the permanent firm-specific component has been removed, the endogeneity problem of our accessibility measure has been solved.

However, it is well known that in dynamic models WG estimates also produce inconsistent estimates of the parameters, given the correlation between the lagged dependent variable and the error term of the transformed model. We account for this issue in the next step.

In the non-linear framework it is harder to deal with the unobserved heterogeneity, since this cannot be easily dropped out. We first estimate a correlated random effects probit model,[8] which can be regarded as "analogous" to the WG estimation. We follow the approach proposed by Chamberlain (1980) to static probit models with unobserved effects. Specifically, we assume a reduced form for

[8] One can also follows a random effects approach (RE Probit), which assumes that the firm effects are uncorrelated with the explanatory variables. Nonetheless this assumption is quite likely violated in our export decision model, as plant characteristics are correlated with unobserved product attributes, managerial ability, technology, and other unobserved plant effects that may affect firms' export participation decision.

the unobserved heterogeneity as a function of time average of all the explanatory variables (except the lagged endogenous variable):

$$\eta_i = \pi \overline{X}_i + \zeta_i , \tag{4}$$

where ζ_i is normally distributed and, by definition, independent from X_{it} and ε_{it}. Then, this reduced form can be plugged into equation (2) to carry out a standard random effects probit.

Nonetheless, similarly to the WG estimation for the linear model, this produces inconsistent estimates of the parameters of the model since we do not account for the correlation between the lagged export decision and the unobserved effects.

Dynamic effects and endogeneity issues

In a next step we try to account for the fact that the lagged export decision can not be considered as strictly exogenous and for the endogeneity of other explanatory variables. We estimate the linear model using the Generalized Methods of Moments (GMM). Thus, we apply first differences to the equation (3) and estimate it using lagged values of the variables in levels as instruments (see Anderson and Hsiao, 1982). Nonetheless, once first differences are taken, we do not have enough time variation in some variables to identify their effect on the exportation decision. Arellano and Bover (1995) propose to use additional orthogonality conditions given by the lack of correlation between the variables in differences and the errors in levels. For instance, we exploit the fact that, although transportation costs are correlated with the unobserved heterogeneity through firm's location, changes in transportation costs can be regarded as exogenous to firm's export decision and, therefore, independent of the errors in the equation in levels.[9] This estimator that combines information for the equation in levels and in first differences is called System GMM.

[9] This seems plausible since improvements in road infrastructures during the 1990s in Spain were rather general and primarily guided by the principal trunk roads that already existed to connect the major cities of the country. Those improvements were not particularly geared toward areas with high export participation (see Tables 5 and 6).

In the case of the non-linear model it is more difficult to deal with endogeneity. In this paper, we account for the endogeneity of the past export behavior, E_{it-1}, but leave the control for the endogeneity of other explanatory variables (in particular, productivity) for future research.

Contrary to the linear model, there is no general transformation that drops out the individual effect η_i in non-linear models. Therefore, we need to specify a model that accounts for the correlation between E_{it-1} and η_i. Using the recursive nature of the exportation decision, this leads to specifying a model for η_i as a function of E_{i0}. Unless this is taken into account, we would face the so called "initial conditions problem".

In this paper we follow Wooldridge's (2005) approach and model the unobserved heterogeneity conditional on the initial condition, E_{i0}, and the exogenous variables. The likelihood of interest has the same structure as in the Chamberlain's approach to static models, except that the reduced form for the unobserved heterogeneity also includes the initial observation of the dependent variable:

$$\eta_i = \gamma \overline{X}_i + \varphi E_{i0} + \xi_i \tag{5}$$

An alternative approach consists in specifying the joint distribution of all outcomes -including that in the initial time period- conditional on unobserved heterogeneity. But the main complication with this approach is specifying the distribution of the initial condition given unobserved heterogeneity. For the dynamic probit model with covariates, Heckman (1981) proposed approximating the conditional distribution of the initial condition. This avoids the practical problem of not being able to find the conditional distribution of the initial value. But this approach is computationally cumbersome.

5. RESULTS

In this section we report the estimates from the different models described in the previous section. Three sets of results, by firm size, are presented. The first set reports the results from pooled linear

and non linear models. The second set of results examines the importance of accounting for panel data issues. Specifically, we present linear and non linear estimates that account for the presence of unobserved heterogeneity and for the endogeneity of the lagged export decision. All other explanatory variables in these estimates are treated as strictly exogenous. Finally, we present the results from linear probability models that also account for the potential endogeneity of other explanatory variables, like productivity. All specifications include time-dummies to control for the business cycle and any other common time trend affecting the export behaviour. Notice that during our sample period there has been a general increase in exports due to the higher openness of the Spanish economy to international markets. Therefore, lack of control for aggregate conditions could be spuriously captured by some other variable, in particular our measure for infrastructure improvements.

Pooled Estimates

Table 7 shows the estimation results from pooled linear (OLS) and pooled probit models. In these estimates lagged export status is treated as exogenous. Similarly to previous studies, we find that state dependence is very important in the exportation decision: the parameter for previous export experience is strongly positive and significant in all our estimates. The same type of qualitative results is obtained from linear and non-linear models. In Table 10, we report the marginal effect of lagged export status for non-linear probit models. We find that for small and medium sized firms the probability of exporting increases around 80% if the firm was exporting the previous year and around 70% for large firms. Although this effect is improbably large in these estimates, this finding supports the hypothesis that there are significant sunk costs involved in entering export markets. As expected, sunk costs are smaller for larger firms.

On the other hand, we find that the effect of accessibility on export participation is different for firms of different size. Specifically, it is significant for small firms, only marginally significant for medium sized firms and insignificant at the standard levels for larger firms. In terms of the marginal

effect, Table 10 shows that a reduction of 30 minutes in accessibility time increases the probability of exporting by around 1% and 0.7% for small and medium sized firms, respectively.

Other firm characteristics have, in general, the expected effect on the probability of exporting, although their significance varies on the model considered. For instance, firms that carry out R&D activities are more prompt to export. Productivity also increases the probability of exporting, but we find that this effect is only significant for small firms. Similarly, the skill composition of the work force turns out only significant for small firms. Our results also show the usual inverted U-shaped relationship between the size of the firm and its export participation. Firms' age, foreign ownership of the company, as well as spillovers in the export decision stemming from the presence of other domestic or multinational exporters show no significant effect.

Control for Unobserved Heterogeneity and Dynamics

The first three columns of Table 8 present estimates that control for unobserved heterogeneity in the linear model (Within Group estimates, WG) for firms in our three size categories. Notice that in these estimates lagged export status is still treated as exogenous. As expected, the WG coefficient on lagged export status is reduced to approximately one half of the pooled coefficient. This result is partly due to well known small-sample bias of the WG estimator. Regarding the accessibility measure, we do not find any significant effect for any firm size. Since WG estimates exploit variability over time of firms' characteristics, it could be the case that for the accessibility measure this variability is not large enough to provide sufficient accuracy of the estimated effect.

The corresponding results for the non-linear model are shown in Table 9. The first three columns present the estimates from correlated random effects probit which treat lagged export behaviour as exogenous (Chamberlain's approach). Estimated coefficients for lagged export status and accessibility are similar to those obtained in the pooled model. Once we control for the endogeneity of past export behaviour and estimate the CRE probit model with initial conditions (columns 4 to 6)

the marginal effect of this variable is reduced: specifically, exporting in the previous year increases the probability of exporting this year by around 60% for small and medium sized firms and 40% for larger firms (Table 10). Regarding the effect of accessibility, again we find no significant effect for larger firms, being the marginal effect for the smaller ones around 1.5%.

In order to control for the endogeneity of past export behavior in the linear model, we perform GMM estimations. Results are presented in columns 4 to 6 in Table 8 (GMM1). The coefficient for state dependence is identified using the firm's export behavior in $t-2$ and before as an instrument for the past export behavior in differences. In this case, we obtain a significant effect for all firm's size, being similar in magnitude (between 60% and 70%)[10] to the marginal effect for the CRE Probit with initial conditions.[11] In addition, we exploit information in levels of accessibility to accurately estimate its effect. In particular, we use changes in accessibility (in $t-1$) as an instrument for the current accessibility. In line with previous estimates, we obtain a significant effect of improvements in accessibility for small and medium sized firms. Specifically, the effect for those firms with 50 employees or less is 0.7% and for firms between 51 and 200 employees is 0.5%.

Robustness Checks

We have performed several additional estimates to check if our results are robust to changes in the sample, definition of some variables, and other econometric issues.

First of all, we perform an additional set of GMM estimates that accounts for the potential endogeneity of several explanatory variables in the linear model: R&D expenditure by firm, firm's productivity and skills of the employees (see Table 11). The first differences of these variables have been instrumented with their lagged values in period $t-2$ and before. The estimated value neither of lagged export decision nor of these endogenous explanatory variables has been affected once

[10] These estimates are in line with those obtained by Bernard and Jensen (2004).

[11] Notice that the GMM estimated coefficients are in between the pooled OLS and the WG estimates, as expected.

endogeneity has been controlled for. Regarding accessibility, our previous result that infrastructure improvements increase the likelihood of exporting is reinforced. In particular, smaller firms for which the time is reduced by half an hour increase their probability of exporting by 1.6%.

The inclusion of time dummies in our current specification already accounts for the effect of exchange rates, allowing also for some firm heterogeneity since we perform separate regressions by size. Nonetheless, following the literature we considered specifications which include exchange rates instead of time dummies. We constructed individual exchange rates taking into account specific export destinations for each firm. We did not find any significant effect of this variable. This result could be driven by the fact that the EU is by large the most important destination of almost all exporting firms in our sample. Moreover, the exchange rate with the EU has remained basically fixed since 1993.

Basically, our main results remain unchanged to other robustness checks. We now discuss them briefly being the detailed results available upon request. One potential problem with GMM estimates comes from the so-called "weakness of instruments" when using too many lags of the endogenous variables as instruments. In order to check if our results are sensitive to this problem we have also performed GMM estimates that use lagged values in period $t-2$ only (but not before) as instruments. This type of estimates follows Anderson and Hsiao (1982).

All the estimates have been performed, not only using value added per worker as a measure of productivity, but also using an alternative definition: sales per worker. It is well-known that in the period considered there has been a spread in the use of outsourcing by many firms. Value added might be contaminated to the extent that this outsourcing process affects not all industries and firms in the same way. Our results show that the definition of productivity based on sales is not biased by this issue.[12]

[12] We also check if our results are affected by the fact that we use an unbalanced panel. This concern mainly applies to the non-linear estimates since the CRE methods were originally developed for balanced panels. However, our sample

6. CONCLUSIONS

In this paper we have analyzed firms' export behaviour by focusing on the role of transport-cost reductions, accounting also for the effect of sunk costs and other firms' characteristics. While trade costs are central to trade theory, the specific role of domestic transport costs in firms' exporting decision has not been analysed in the empirical microeconomic trade literature.

We have followed a progressive estimation strategy trying to account for different econometric problems which could prevent us from obtaining a true causal effect of the variables of interest. Our preferred estimates are those that account for unobserved heterogeneity, initial conditions, lack of exogeneity of past export behaviour, and other endogeneity issues.

In line with the previous literature entry costs are found to play an important role in the exportation decision. Our results point out that there are differences in thresholds to export market entry by firm's size. Although trade models have typically abstracted from transport costs as barrier to export, we also find a significant effect on the probability of exporting. In particular, when accessibility time to international markets is reduced by 30 minutes the probability of exporting increases between 0.5% and 1.5% for smaller firms (those with less than 200 employees).

To put these figures into perspective we have carried out some back of the envelope calculations based on our preferred model. Transport infrastructure improvements from 1990 to 2005 have contributed approximately 3% of the total increase in the proportion of small exporting firms over this period and approximately 1% in the case of the medium sized firms. Although this might not seem large, it is worth noting that this period is characterized by an important increase in the openness of the Spanish economy. Moreover, these figures must be seen as a lower bound since our model accounts for the time trend, which may capture part of the effect.

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size is reduced dramatically when restricted to a balanced panel. This produces very imprecise estimates of the parameters of the model.

As the international environment is becoming more competitive and fast paced, issues of access are likely to become more important. With increasing fragmentation and globalisation of production, poor domestic transportation can constitute an important obstacle to participate in global production networks which rely heavily on speed across global space. Our results might have interesting policy implications. While others have found no effect of state export promotions expenditures on the probability of exporting (see Bernard and Jensen, 2004; Görg et al., 2008), our findings suggest that infrastructure improvements may be more successful in helping at least small and medium sized firms to start exporting. Our results could be particularly relevant for developing countries seeking to promote trade as they typically face poor domestic transportation infrastructure and are also far from international key markets.

There are several directions for further research. First, impacts of road improvements could be destination-specific. While we do not have information on destinations of individual exports, the ESEE provides the relative share of European Union, OCDE, and rest of World exports. Nonetheless, this information is only available every four years. Moreover accounting for destination would require a different estimation strategy, since in that case the variable of interest is not only whether the firm exports or not, but also has to include the destination choice.

Second, so far we have concentrated on the probability of firms' exporting. Transport infrastructure improvements could however also increase the export value of firms already engaged in exporting by helping them to compete more effectively on the international market. Recent theoretical (Chaney, 2008) and empirical work (Crozet and Koenig, 2008) shows a distinctive effect of distance on the two.

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Table 1. Number of Firms, by Size and Year

	Size (number of employees)			Total
	0-50	**50-200**	**>200**	
Total Num. Firms	2,014	950	1,213	4,177
Total Num. Obs.	13,812	4,777	8,457	27,046
by Year				
1990	947	253	663	1,863
1991	1,016	268	725	2,009
1992	1,006	261	637	1,904
1993	964	267	507	1,738
1994	886	274	549	1,709
1995	835	274	514	1,623
1996	878	281	483	1,642
1997	967	358	486	1,811
1998	866	335	464	1,665
1999	873	356	453	1,682
2000	855	331	577	1,763
2001	801	309	496	1,606
2002	801	331	512	1,644
2003	633	255	423	1,311
2004	628	256	422	1,306
2005	856	368	546	1,770

Source: ESEE

Figure 1. Evolution of the Percentage of Exporting Firms, by Size (number of employees)

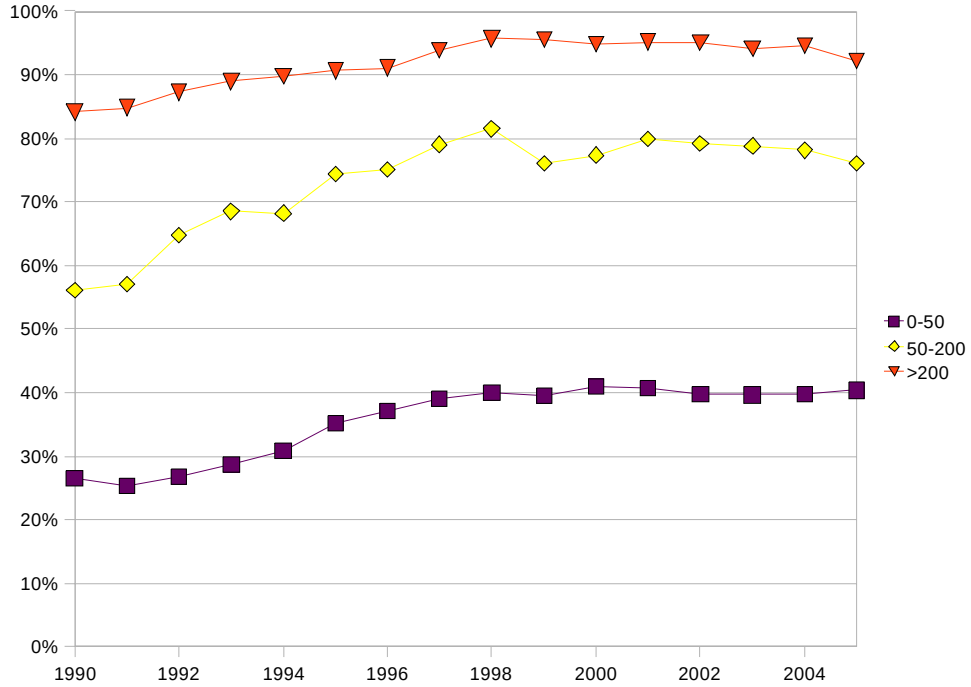

Table 2. Transitions in Export Behaviour of firms (in percentage), 1990-2005

Year t	Year t+1	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998
No exports	**No exports**	91.28	90.08	91.48	91.55	89.04	91.35	88.59	90.31
	Exports	8.72	9.92	8.52	8.45	10.96	8.65	11.41	9.69
Exports	**No exports**	7.31	4.71	6.42	6.31	3.1	3.74	4.28	4.6
	Exports	92.69	95.29	93.58	93.69	96.9	96.26	95.72	95.4

Year t	Year t+1	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005
No exports	**No exports**	91.34	92.17	94.5	92.78	93.06	97.13	94.27
	Exports	8.66	7.83	5.5	7.22	6.94	2.87	5.73
Exports	**No exports**	4.33	2.88	3.47	3.89	5.19	1.21	1.68
	Exports	95.67	97.12	96.53	96.11	94.81	98.79	98.32

Source: ESEE

Table 3. Key characteristics of exporting firms

	Small Firms (0-50 employees)			Medium-sized Firms (50-200 employees)			Large Firms (>200 employees)		
	Exporters	Non-exporters	P-value of differences	Exporters	Non-exporters	P-value of differences	Exporters	Non-exporters	P-value of differences
Mean number of employees	25.3	19.8	0.00	115.9	100.3	0.00	703.4	459.4	0.00
Mean company age (years)	22	17	0.00	32	28	0.00	39	38	0.49
Mean % of foreign capital	4.4%	1.0%	0.00	26.70%	9.50%	0.00	42.7%	22.3%	0.00
Average R&D expenditure (thousands)	7.6	1.8	0.00	61.1	11.5	0.00	1064.6	145.9	0.00
% of High Skill workers	3.3%	1.9%	0.00	4.20%	3.60%	0.02	5.2%	5.4%	0.65
% of Medium Skill workers	5.1%	3.2%	0.00	5.60%	3.90%	0.00	6.1%	4.0%	0.00
Average value added per employee (thousands)	35,344	24,449	0.00	43,578	33,307	0.00	50,819	51,310	0.77
Average general export market accessibility (time in 30 min.)	2.4	2.9	0.00	2.7	2.9	0.01	2.3	2.6	0.00

Source: ESEE

Table 4. Export behaviour by NUTS 1 Region

	Percentage of exporting firms				
NUTS 1 - region	**1990**	**1994**	**1998**	**2002**	**2005**
Industrial core-areas					
ES5 – East	51.8	61.7	67.9	70.1	68.5
ES2 – North East	62.7	65.2	71.4	71.5	69.4
ES3 - Madrid	45.8	54.6	61.2	60.2	58.8
Periphery					
ES1 - North West	42.4	46.3	61.8	66.9	64.4
ES4 - Centre	37.0	42.6	55.8	53.8	55.8
ES6 - South	35.7	40.3	53.6	56.7	48.8
National	48.7	55.6	64.0	64.9	63.4

Source: ESEE

Table 5. Percentage of exporting firms by accessibility level

	High accessibility areas*		Low accessibility areas*	
	1990	2005	1990	2005
Travel time to French border	55.3	68.5	42.5	56.6
Travel time to Portuguese border	40.3	57.0	54.2	68.3
Travel time to main seaports	51.7	66.4	40.9	57.3
Travel time to border/seaport	50.6	65.9	44.4	58.0

Source: ESEE, GIS own calculation

* High (Low) accessibility areas include those regions above (below) the national average accessibility that year.

Table 6. Change in accessibility for exporters versus non-exporters

	Exporters	Non-exporters	t-test of means difference	sig.
Last 15 years: 1990-2005				
Travel time to French border	-15.8	-21.4	-25.7	***
Travel time to Portuguese border	-23.6	-23.5	0.32	
Travel time to seaports	-9.4	-11.7	-16.4	***
Travel time to seaports and border	-6.5	-8.4	-23.6	***
Last 25 years: 1980-2005				
Travel time to French border	-23.2	-32.4	-26.3	***
Travel time to Portuguese border	-38.4	-37.2	4.90	
Travel time to seaports	-13.1	-16.1	-15.0	***
Travel time to seaports and border	-9.4	-11.9	-21.8	***

Source: ESEE; Note: *** significant at the 1% level

Table 7. Estimation Results of Linear and Non-Linear Pooled Models, by Size

	POOLED OLS			POOLED PROBIT		
	0-50	**50-200**	**>200**	**0-50**	**50-200**	**>200**
EXPORT(-1)	0.8088***	0.8107***	0.7570***	2.7204***	2.8596***	3.0460***
	(0.0059)	(0.0095)	(0.0078)	(0.0394)	(0.0775)	(0.0973)
ACCESIBILITY	-0.0042***	-0.0030	0.0007	-0.0324***	-0.0366*	0.0078
	(0.0014)	(0.0019)	(0.0010)	(0.0101)	(0.0189)	(0.0231)
ID(-1)	0.0256***	0.0251***	0.0033	0.1868***	0.2623***	0.0720
	(0.0079)	(0.0084)	(0.0047)	(0.0566)	(0.0870)	(0.0958)
PRODUCTIVITY(-1)/10^6	0.9620***	-0.0532	-0.0062	7.1159***	-0.4048	-0.0965
	(0.1432)	(0.1555)	(0.0236)	(1.0713)	(1.6820)	(0.3645)
HIGH_SKILL(-1)	0.0012**	0.0001	-0.0003	0.0084**	0.0024	-0.0029
	(0.0005)	(0.0007)	(0.0003)	(0.0035)	(0.0080)	(0.0063)
MED_SKILL(-1)	0.0006*	-0.0005	0.0004	0.0047*	-0.0039	0.0122
	(0.0004)	(0.0006)	(0.0003)	(0.0026)	(0.0071)	(0.0084)
AGE/10	0.0008	0.0048	0.0026	0.0085	0.0603	0.0682
	(0.0032)	(0.0038)	(0.0020)	(0.0245)	(0.0369)	(0.0430)
AGE2/100	0.0002	-0.0003	-0.0001	0.0014	-0.0032	-0.0025
	(0.0003)	(0.0003)	(0.0002)	(0.0024)	(0.0028)	(0.0033)
SIZE/100	0.4031***	-0.0145	0.0004	3.0776***	-0.3527	0.0231
	(0.1029)	(0.0533)	(0.0003)	(0.7707)	(0.5379)	(0.0206)
SIZE2/10000	-0.4065**	0.0150	-0.0000	-3.2049**	0.2487	-0.0001
	(0.1968)	(0.0219)	(0.0000)	(1.4675)	(0.2276)	(0.0006)
FOREIGN(-1)	0.0000	0.0001	0.0000	-0.0002	0.0018	0.0018
	(0.0002)	(0.0001)	(0.0000)	(0.0014)	(0.0011)	(0.0011)
SPILLOVER (DOM.)	0.0047	-0.0006	0.0072	0.0391	-0.0020	0.2144
	(0.0098)	(0.0134)	(0.0072)	(0.0715)	(0.1362)	(0.1754)
SPILLOVER (MUL.)	-0.0015	-0.0077	0.0136	0.0237	-0.0816	0.4228
	(0.0308)	(0.0440)	(0.0227)	(0.2258)	(0.4495)	(0.5003)
TIME DUMMIES	yes	yes	yes	yes	yes	yes
INDUSTRY DUMMIES	yes	yes	yes	yes	yes	yes

Note: Robust Standard Errors in parenthesis. Significant coefficients are indicated by ***, **, *, for significance at the 1%, 5% and 10% level, respectively.

Table 8. Estimation Results of Linear Models with Unobserved Firm Effects, by Size

	WG			GMM1		
	0-50	**50-200**	**>200**	**0-50**	**50-200**	**>200**
EXPORT(-1)	0.3856***	0.3342***	0.4520***	0.6378***	0.7079***	0.6071***
	(0.0097)	(0.0171)	(0.0117)	(0.0808)	(0.0921)	(0.0992)
ACCESIBILITY	0.0138	0.0104	-0.0076	-0.0069**	-0.0047*	-0.0005
	(0.0152)	(0.0175)	(0.0056)	(0.0028)	(0.0026)	(0.0015)
ID(-1)	0.0112	0.0031	-0.0016	0.0492***	0.0345**	0.0154
	(0.0106)	(0.0122)	(0.0068)	(0.0156)	(0.0135)	(0.0094)
PRODUCTIVITY(-1)/10^6	0.6033***	-0.1249	-0.0078	1.4917***	0.0997	-0.0091
	(0.1957)	(0.2282)	(0.0232)	(0.2954)	(0.1751)	(0.0141)
HIGH_SKILL(-1)	0.0002	-0.0000	0.0005	0.0017**	-0.0002	-0.0007
	(0.0008)	(0.0013)	(0.0005)	(0.0009)	(0.0008)	(0.0005)
MED_SKILL(-1)	0.0002	-0.0003	0.0002	0.0014**	0.0002	0.0006*
	(0.0005)	(0.0009)	(0.0004)	(0.0005)	(0.0007)	(0.0003)
AGE/10	-2.5969	0.0707***	0.0007	0.0041	0.0092	0.0012
	(1.8381)	(0.0242)	(0.0126)	(0.0056)	(0.0073)	(0.0033)
AGE2/100	-0.0006	-0.0038	0.0008	0.0003	-0.0006	0.0001
	(0.0020)	(0.0023)	(0.0011)	(0.0005)	(0.0007)	(0.0003)
SIZE/100	0.6388***	-0.1084	0.0033***	0.5409***	0.0273	0.0004
	(0.1724)	(0.0866)	(0.0010)	(0.1447)	(0.0477)	(0.0003)
SIZE2/10000	-0.6119**	0.0468	-0.0000**	-0.4173	0.0017	-0.0000
	(0.3061)	(0.0335)	(0.0000)	(0.3228)	(0.0198)	(0.0000)
FOREIGN(-1)	-0.0017***	-0.0007**	0.0001	0.0005	0.0003*	0.0001
	(0.0006)	(0.0003)	(0.0001)	(0.0004)	(0.0001)	(0.0001)
SPILLOVER (DOM.)	-0.0002	0.0102	0.0104	0.0129	0.0003	0.0113
	(0.0094)	(0.0133)	(0.0071)	(0.0102)	(0.0126)	(0.0069)
SPILLOVER (MUL.)	0.0061	0.0280	0.0222	0.0159	0.0016	0.0270
	(0.0299)	(0.0448)	(0.0230)	(0.0308)	(0.0417)	(0.0245)
TIME DUMMIES	yes	yes	yes	yes	yes	yes
INDUSTRY DUMMIES	yes	yes	yes	yes	yes	yes

Note: Robust Standard Errors in parenthesis. Significant coefficients are indicated by ***, **, *, for significance at the 1%, 5% and 10% level, respectively.

In the GMM1 estimates, we use the following instruments: export behavior lagged $t-2$ and before in the first-differenced equation, and changes in accessibility dated $t-1$ for the equation in levels. All the remaining variables are regarded as of exogenous.

Table 9. Estimation Results of Non-linear Models with Unobserved Firm Effects, by Size

	CRE PROBIT			CRE PROBIT with IC		
	0-50	**50-200**	**>200**	**0-50**	**50-200**	**>200**
EXPORT(-1)	2.6031***	2.8417***	3.0887***	1.9762***	2.2612***	2.6805***
	(0.0567)	(0.0786)	(0.1017)	(0.0668)	(0.1164)	(0.1291)
ACCESIBILITY	-0.0200	-0.0829**	0.0382	-0.0587	-0.1117**	-0.0068
	(0.0285)	(0.0391)	(0.0524)	(0.0411)	(0.0503)	(0.0628)
ID(-1)	0.2132***	0.2585***	0.0592	0.2074***	0.2888***	-0.0398
	(0.0642)	(0.0879)	(0.0987)	(0.0791)	(0.1079)	(0.1148)
PRODUCTIVITY(-1)/10^6	7.7889***	-0.4597	-0.0978	8.5533***	-1.2021	-0.1627
	(1.2267)	(1.7147)	(0.3525)	(1.5023)	(2.0567)	(0.3599)
HIGH_SKILL(-1)	0.0105***	0.0034	-0.0025	0.0095*	-0.0008	0.0001
	(0.0040)	(0.0081)	(0.0065)	(0.0052)	(0.0103)	(0.0074)
MED_SKILL(-1)	0.0063**	-0.0033	0.0114	0.0086**	-0.0017	0.0102
	(0.0030)	(0.0073)	(0.0088)	(0.0036)	(0.0090)	(0.0095)
AGE/10	0.0119	0.0570	0.0637	0.0499	0.0597	0.0496
	(0.0296)	(0.0381)	(0.0458)	(0.0441)	(0.0510)	(0.0538)
AGE2/100	0.0017	-0.0029	-0.0021	-0.0024	-0.0038	-0.0021
	(0.0029)	(0.0029)	(0.0035)	(0.0044)	(0.0039)	(0.0042)
SIZE/100	3.7231***	-0.3149	0.0220	4.8481***	-0.4945	0.0261
	(0.9070)	(0.5441)	(0.0208)	(1.1734)	(0.6618)	(0.0161)
SIZE2/10000	-3.7513**	0.2398	-0.0001	-4.6534**	0.3279	-0.0001
	(1.6852)	(0.2297)	(0.0005)	(2.1773)	(0.2792)	(0.0001)
FOREIGN(-1)	0.0008	0.0013	0.0013	0.0006	-0.0002	0.0013
	(0.0017)	(0.0011)	(0.0012)	(0.0024)	(0.0014)	(0.0014)
TIME DUMMIES	yes	yes	yes	yes	yes	yes
INDUSTRY DUMMIES	yes	yes	yes	yes	yes	yes

Note: Robust Standard Errors in parenthesis. Significant coefficients are indicated by ***, **, *, for significance at the 1%, 5% and 10% level, respectively.
Spillover effects have been dropped in these estimates due to multicollinearity.

Table 10. Estimated Marginal Effects from Non-linear Models

	POOLED PROBIT			CRE PROBIT			CRE PROBIT with IC		
	0-50	**50-200**	**>200**	**0-50**	**50-200**	**>200**	**0-50**	**50-200**	**>200**
EXPORT(-1)	0.8238***	0.8037***	0.6980***	0.8018***	0.7985***	0.6637	0.6508***	0.5934***	0.4324
	(0.0067)	(0.0155)	(0.0335)	(0.0110)	(0.0163)	(2117.1000)	(0.0199)	(0.0494)	(54.8910)
ACCESIBILITY(-1)	-0.0115***	-0.0072*	0.0002	-0.0070	-0.0161**	0.0008	-0.0195	-0.0166**	-0.0001
	(0.0036)	(0.0037)	(0.0007)	(0.0100)	(0.0076)	(11.7380)	(0.0137)	(0.0075)	(0.0307)

Note: Robust Standard Errors in parenthesis. Significant coefficients are indicated by ***, **, *, for significance at the 1%, 5% and 10% level, respectively.

Table 11. Other GMM Estimation Results of Linear Models, by Size

	0-50	**50-200**	**>200**
EXPORT(-1)	0.5980***	0.7170***	0.5544***
	(0.0293)	(0.0298)	(0.0538)
ACCESIBILITY	-0.0159***	-0.0061**	0.0019
	(0.0034)	(0.0028)	(0.0023)
ID(-1)	0.0059	0.0390**	-0.0011
	(0.0201)	(0.0177)	(0.0151)
PRODUCTIVITY(-1)/10^6	1.4794***	0.3219	0.0029
	(0.3715)	(0.3173)	(0.0054)
HIGH_SKILL(-1)	0.0015	0.0019	-0.0006
	(0.0020)	(0.0014)	(0.0007)
MED_SKILL(-1)	0.0032**	-0.0020	0.0004
	(0.0014)	(0.0012)	(0.0005)
AGE/10	0.0039	0.0095*	0.0050
	(0.0059)	(0.0055)	(0.0037)
AGE2/100	0.0003	-0.0006	-0.0002
	(0.0005)	(0.0005)	(0.0003)
SIZE/100	0.3811***	0.0017	0.0006*
	(0.0677)	(0.0473)	(0.0003)
SIZE2/10000	-0.0209	0.0124	-0.0000
	(0.0787)	(0.0182)	(0.0000)
FOREIGN(-1)	0.0006	0.0002*	0.0001**
	(0.0004)	(0.0001)	(0.0001)
SPILLOVER (DOM.)	0.0110	0.0002	0.0123*
	(0.0096)	(0.0130)	(0.0068)
SPILLOVER (MUL.)	0.0127	-0.0101	0.0232
	(0.0300)	(0.0417)	(0.0266)
TIME DUMMIES	yes	yes	yes
INDUSTRY DUMMIES	yes	yes	yes

Note: Robust Standard Errors in parenthesis. Significant coefficients are indicated by ***, **, *, for significance at the 1%, 5% and 10% level, respectively.
We use the following instruments: export behavior, R&D expenditure, productivity and labor skills lagged $t-2$ and before in the first-differenced equation, and changes in accessibility dated $t-1$ for the equation in levels. All the remaining variables are regarded as of exogenous.

APPENDIX

Table I. Definition of Variables

Variable	*Definition*
EXPORT	Indicator for firm's export activity (=1 if firm exports)
ACCESIBILTY	Shortest travel time to nearest international border or main seaports (time in 30 minutes)
ID	Indicator for firm's R&D activity (=1 if firm hires or carries out R&D activities)
PRODUCTIVITY	Value Added over number of employees
HIGH SKILL	Percentage of workers with a University degree
MED. SKILL	Percentage of workers with a High School degree
AGE	Years since firm's foundation
SIZE	Total number of employees
FOREIGN	Percentage of foreign shareholding
SPILLOVER (DOM.)	(Exports by domestic firms in sector j / total exports in j) / (total exports by domestic firms/total exports)
SPILLOVER (MUL.)	Same as above for multinational firms

Table II. Classification of Industries in ESEE

(1) Meat products
(2) Other food products and tobacco
(3) Beverages
(4) Textiles
(5) Leather and leather products/footware
(6) Wood
(7) Paper
(8) Printing products
(9) Chemical products
(10) Rubber and plastic products
(11) Non-metallic mineral products
(12) Basic metals
(13) Fabricated metal products
(14) Machinery and mechanical equipment
(15) Office equipment, precision, optical equipment
(16) Electrical equipment
(17) Other manufacturing
(18) Other transport equipment
(19) Furniture
(20) Other manufacturing