EXPORTING AND ECONOMIC PERFORMANCE: FIRM-LEVEL EVIDENCE FOR SPANISH MANUFACTURING

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Abstract:

This paper measures differences in economic performance between exporters and non-exporters on the basis of an unbalanced panel of Spanish manufacturing firms over the period 1990-1999. We also investigate total factor productivity differences between exporters and non-exporters. We estimate production functions following the GMM approach proposed by Blundell and Bond (1999). After controlling for unobserved heterogeneity and simultaneity bias produced by the effect of productivity of the firm itself on output decisions, the results we obtain indicate that exporters exhibit greater economic performance and they do self-select.

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1. Introduction

One of the factors that are thought to be important to make some firms more productive than others is exporting. Bartelsman and Doms (2000) survey of the literature on productivity that uses longitudinal micro-level data sets points out to the link between productivity and exporting as one of the factors this literature has focused on (the rest of factors are regulation, management/ownership, technology and human capital). Studies by Aw and Hwang (1995) on Taiwan; Bernard and Jensen (1995) (1999) on the US; Bernard and Wanger (1997) on Germany; Clerides, Lach and Tybout (1998) on Colombia, Mexico and Marocco; Aw, Chung and Roberts (2000) on Taiwan and South Korea; Girma, Greenaway and Kneller (2002) on the UK, provide evidence on the fact that export-oriented firms are more productive than non-exporters.

Sunk costs are the main argument outlined to explain why exporters are more efficient than non-exporters, in particular the existence of higher sunk entry costs for exporters with respect to non-exporters. The argument comes from models of industry dynamics – Jovanovic (1982) and Hopenhayn (1992)- and applies also to entry and exit to export markets as suggested by Aw, Chen and Roberts (1997). According to this argument, differences in sunk entry costs can explain productivity differences between exporters and domestic-oriented firms. Building on these ideas Roberts and Tybout (1997), Clerides, Lach and Tybout (1998) and Bernard and Jensen (2001) have developed models of the decision to export. The result that firm’s previous export status is a determinant of the decision to export is interpreted, in term of these models, as a favorable evidence to the existence of sunk entry cost in the export market.

In a previous paper, Delgado, Fariñas and Ruano (2002) measure total factor productivity differences between exporters and non-exporters on the basis of a sample of Spanish manufacturing firms. The empirical analysis confirms higher levels of productivity for exporting firms relative to non-exporting firms. With respect to the relative merits of the selection and the learning hypotheses proposed to explain the greater productivity of exporters, the paper finds evidence favorable to the self-selection of more productive firms into the export market. It was much harder to find evidence in favor of learning effects in the data set. For the whole sample of manufacturing firms we do not find any systematic evidence consistent to learning-by-exporting. However, restricting the sample to the group of younger firms we observe that post-entry productivity growth is greater for young entering exporters than for young entering domestic firms without contact to the export market. With the exception of the latter result, our empirical findings are very much in line with those reported in the literature -Bernard and Jensen (1999).

The first purpose of this paper is to investigate further economic performance differences between exporters and non-exporters. We explore systematically the magnitude of these differences for various performance measures such as labor productivity, investment, wages, the composition of labor force, R&D activities, etc. Estimates of export premia are reported after controlling for time, industry, size, age and other characteristics of exporting and non-exporting firms. Furthermore, we explore if firms with different trajectories between the export and the domestic market i.e. entering, exiting firms, show systematic *ex-ante* differences in the level of performance and *ex-post* differences in their evolution.

The second purpose of this paper is to measure total factor productivity differences between exporters and non-exporters, measuring these productivity differences by the estimation of production functions. Productivity shocks are assumed to be an unobserved firm-specific effect that can be recovered as the difference between actual and predicted output and that are allowed to take a very general form. Two advantages can be identified from using this approach. The first one refers to the set of assumptions that is required to get unbiased estimates of total factor productivity when using index numbers. Some of them, as the assumption of constant returns to scale, may be relevant for measuring correctly productivity differences between exporters and non-exporters. The estimation of production functions do no require some of these assumptions. The second advantage refers to the benefits that can be derived from the application of GMM estimators that we use. In particular, these estimators permit to control two likely sources of bias in the OLS results: 1) the elimination of unobserved firm heterogeneity that is time invariant and 2) the use of lagged instruments to correct for simultaneity bias produced by the effect of productivity of the firm itself on the input decisions. The paper estimates productivity differences for exporters and non-exporters using an unbalanced panel of Spanish manufacturing firms over the period 1990-1999. We apply estimators developed in Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). An illustration of these procedures in the context of the estimation of production functions can be found in Blundell and Bond (1999) and Bond (2002). Griffith (1999) contains a similar application to the analysis of productivity differences between foreign and domestic owned establishments.

The rest of the paper is organized as follows. Section 2 describes some characteristics of the data set used in the analysis and presents some basic evidence on the magnitude of performance differences between exporters and non-exporters. Section 3 discusses the method used and presents the econometric estimates of production functions for the whole sample of firms and three industries; textiles and clothing; wooden products and furniture; and food industry. Conclusions are placed in section 4.

2. Firm performance and export markets

This section contains three parts. In the first part we describe the main characteristics of the data set used in the analysis and we also provide some basic descriptive evidence on the magnitude of performance differences between exporters and non-exporters. The second part of the section reports estimates of export premia after controlling for time, industry, size, age and other characteristics of exporting and non-exporting firms. In the third part we explore if firms with different trajectories between the export and the domestic market, i.e. firms entering, exiting and continuing in and out of the export market, show systematic patterns in their economic performance consistent to the hypothesis of selection.

2.1. Patterns of economic performance for exporters and non-exporters

The data set we employ is a longitudinal survey of Spanish manufacturing firms that comes from the Encuesta sobre Estrategias Empresariales. This database contains a longitudinal sample of firms from 1990 to 1999 where the information collected for each firm every year is consistent to previous years. Therefore, the set of firms is an unbalanced panel containing 10,145 observations that correspond to 1,403 firms. The sample of firm is representative of the population of Spanish manufacturing firms with 10 or more employees. As firms participating in the survey where chosen according to a selective sampling scheme, we distinguish between the group of firms employing between 10 and 200 employees (small firms) and the group of manufacturing firms with more than 200 employees (large firms)

The sample allows a classification of firms according to their trajectories with respect to the export market over the period 1990-1999. From the point of view of export market participation, the set of firms can be classified into five groups: continuing exporters, non-exporters, entering exporters, exiting exporters and switching exporters. Firms exporting over the entire period define the group of continuing exporters. The group of non-exporters corresponds to firms not selling abroad along the time period. Entry and exit in the export market define two additional groups of firms: entering exporters that correspond to firms becoming exporters during the period without further changes in the rest of the period; and exiting exporters that correspond to firms ceasing to export and not re-switching. Finally, we define a special group of firms switching their export status more than once along the period.

Table 1 reports the distribution of firms by industry along the period. The group of continuing exporters represents 39.6% of the population and the group of non-exporting firms over the entire period represents 30.7% of the population. Two features should be noted with respect to entry and exit in the export market. First, the fraction of firms entering and exiting the export market implies a high mobility rate. The average rate is 10.2% for entry and 3.9% for exits from the export market. Therefore, on average over the period 1990-1999 a 14.1% of the population of manufacturing firms enter and exit from the export market over the period. Second, during the period the average rate of entry is significantly higher than the exit rate. The difference indicates that the export boom that the Spanish economy experiences after accession to the EU in the late eighties and during the nineties has been partly due to a significant increase in the proportion of exporting firms. Finally, the fraction of firms switching their export status more than once along the period is 15.6%. It is not easy to interpret appropriately the exact nature of this group of firms. In some cases switchers may identify firms selling abroad intermittently or simply indicate that the firm is leaving the export market into various steps.

There are significant differences in the distribution of exporters and non-exporters by industry. For the industry classification NACE-CLIO R44, three industries have the highest fraction of exporters: motor vehicles, offices and data processing machines and agricultural and industrial machinery. In these three industries the fraction of firms exporting at some point during the period (this includes continuing, entering, exiting and switching firms) is higher than 90%. Others industries where the breath of exporting is less substantial is the food industry (55.9% of firms with no contact to the export market); timber, wooden products and furniture; and paper and printing products.

Table 2 reports mean values for a variety of firm characteristics. The comparison considers all firms and two size groups of small and large firms both in 1990 and 1999. Given the procedure used to select firms participating in the survey, the samples of small and large firms can be considered as random samples that permits the estimation of population parameters such as the mean for both groups of firms. Exporters are defined as the sum of two groups of firms: continuing exporters and entering exporters over the period 1990-1999. Differences between exporters and non-exporters do not change when exporters are defined as firms exporting at t, independently of the rest of periods[1].

Size differentials between exporters and non-exporters are substantial. This is probably the most striking difference between exporters and non-exporters. The size disparity between these two groups of firms is substantial in terms of production, employment and capital stock. On average, exporters are 6.5 times larger than non-

[1] Results obtained using this alternative definition of exporting firms are not reported in the text.

exporters in terms of output measured by the value of production in year 1999. In terms of employment and capital stock the difference is slightly lower than for output. Within size categories, exporters are significantly larger than non-exporters. The difference between exporters and non-exporters is larger in the group of small firms. In 1999, exporters are more than three times larger than non-exporters in terms of output and capital and more than two times larger in terms of employment. Size differences between exporters and non-exporters are much lower for the group of large firms.

Exporting firms are also more productive than non-exporting firms. Measured either in terms of labor productivity or total factor productivity, exporters have higher productivity. On average for 1990 and 1999, the difference in labor productivity is 38.5% and for total factor productivity is 11%. These differences hold within each size category, both for the group of small and large firms. Over time the gap in labor productivity between exporters and non-exporters actually widened. The gap for total factor productivity showed no clear pattern during the period.

Capital inputs also differ for exporters and non-exporters. Capital per hour is higher for exporting firms. Within the size categories of small and large firms, exporters are more capital intensive than non-exporters, particularly in small firms where the capital-labor ratio is 40% greater in 1999.

Exporting firms show higher levels of wage per hour. Average wages per hour are between 25% and 35% higher for exporters. Wage differentials between exporters and non-exporters are substantially higher for the group of small firms. In addition, the composition of employment differs across firm size and export status. Small firms have a lower proportion of qualified workers than large firms and exporting firms, within each size category, employ more qualified workers in relative terms than non-exporting firms.

Looking at R&D activities, we again observe systematic differences between exporters and non-exporters. The average proportion of exporters that carry out R&D activities in 1999 is 53.7% and for non-exporters is 14.4%. After controlling for size differences between firms, exporters are more likely performers of R&D activities than non-exporters. Similarly, exporters have a higher R&D effort measured by the ratio of R&D expenditure to sales. R&D effort is almost four times greater for exporters relative to non-exporters in 1999.

The age of firms and the degree of foreign ownership are two additional characteristics where we also find differences between exporters and non-exporters. Exporters are older than non-exporters and the average age difference is ten years. With respect to foreign ownership, the involvement of foreign owned companies is significant in the population of Spanish manufacturing firms. The ratio of firms participated (majority owned) by foreign capitals is greater in the group of exporting firms with more than 20% of the firms within this group having 50% or more of equity foreign owned, whereas in the group of non-exporters the rate of participation is around 5%.

Table 3 shows that performance differences between exporters and non-exporters are observed across industries. Labor productivity is greater for exporters for the 18 reported NACE-CLIO R44 manufacturing industries. With the exceptions of agricultural and industrial machinery, other transport equipment and rubber and plastic products, in the rest of industries total factor productivity of exporters is greater than for non-exporters.

2.2. Estimates of export premia

To estimate the difference between exporters and non-exporters more precisely, we calculate the average difference between both groups of firms after controlling simultaneously for time, size, industry and other firm characteristics correlated with productivity. Using a similar specification as in Bernard and Jensen (1997) (1999), export premia are estimated from a regression of the form:

$$lnX_{it} = a + b\ Export_{it} + \sum_{s} l_{s} Size_{it} + \sum_{I} g_{I} Industry_{i} + \sum_{T} d_{T} Year_{t} + mYoung_{i} + rForeign_{it} + e_{it} \quad (1)$$

where X_{it} is some characteristic of firm i at time t; $Export_i$ is a dummy variable indicating the export status of firm i; $Size_{it}$ is a set of 6 size dummies that assign a size category, defined in terms of the number of workers, to each firm i at time t; $Industry_i$ is a set of 18 NACE-CLIO (R-44) industry dummies; $Year_t$ is a collection of 10 year dummies; $Young_i$ is a dummy variable identifying young firms of five or less years old at the beginning of the period; $Foreign_{it}$ is a dummy indicating majority foreign ownership with 50% or more of equity foreign owned; and ε_{it} is a random error. The omitted categories for size, industry and year are small firms of 10-20 employees, Ferrous and non-ferrous metals industry and year 1990.

Table 4 reports results from specification (1). The export status of firms is defined taking into account the entire sequence of export activity for each firm. In particular, the dummy variable $Export_i$ identifies exporting firms with the groups of continuing exporters and entering exporters. Wald tests of joint significance for the size, industry and time dummy sets are also included in Table 4. After controlling for these variables and for age and foreign ownership effects, the sign of the estimated coefficient β indicates that exporting is positively and significantly correlated with various measures of business performance. One of the largest differences is found in the size of exporters. Exporters are larger than non-exporters. Taking the value of production as a measure of size, exporters have an average size 43% higher than non-exporters[2]. Bernard and Jensen (1997), Bernard and Wanger (1997) and Girma, Greenaway and Kneller (2002) have found a similar pattern for other countries.

Labor productivity is also significantly higher for exporters. We find that value added per hour of work is 17% higher for exporters. A part of this difference is the result of a higher capital intensity, as exporters use a stock of capital per unit of labor 31% higher than non-exporters. Total factor productivity is also higher for exporters.

[2] The log approximation underestimates the difference: for the coefficient β, $\exp(\beta)-1$ gives approximately the proportional difference between exporters and non-exporters.

Export premia are also present in other labor market indicators. Workers in exporting firms benefit from higher wages than non-exporter workers. On average, wages are 6% higher for exporters relative to non-exporters. The mean wage differential is smaller than the mean productivity difference between exporters and non-exporters. Part of the wage gap is due to differences in the composition of workforce across the two types of firms. The share of qualified workers in total employment is two percentage points higher for exporting firms.

Export premia for other characteristics as the decision to undertake research and development activities are significant. The probability of firm's decision to undertake R&D activities is higher for exporters relative to non-exporters. We find that the probability is 13% higher for exporters. Similar results are obtained for R&D effort. Exporting firms invest in R&D, in relative terms, more heavily than non-exporting firms. R&D effort is on average 2.9 points higher for exporting firms.

Table 5 reports results from specification (1) when the dummy variable $Export_i$ identifies exporting firms according to the current export status. With this specification exporters may include continuing exports and some parts of the longitudinal information corresponding to entering, exiting and switching firms. For this specification the results are very similar to those showed in Table 4. Overall, the results presented in this section confirm the existence of substantial differences between exporters and non-exporters. Many indicators of economic performance as productivity, size, wages and other firm characteristics, are greater at exporting firms.

2.3. Entry and exit in the export market and economic performance

In explaining the nature of the performance advantage of exporting firms we take into consideration models of industry dynamics –Jovanovic (1982), Hopenhayn (1992) and Ericson and Pakes (1995). These models suggest the existence of a systematic relationship between patterns of entry and exit in the market and productivity differences at the firm level. Therefore, we can explore whether or not the higher performance of exporters, in particular their productivity levels, reflects selection forces at work, i.e. export markets selecting the most productive firms. The selection mechanism can work both for firms entering in the export market and for firms exiting the export market. On the entry side selection implies that firms with higher productivity should enter the market. On the exit side selection implies that firms with lower productivity should leave the market. In this section we compare productivity levels for firms with different transition patterns with respect to the export market.

We begin the analysis by examining the magnitude of productivity differentials between entering exporters and non-exporters. Table 6 reports ex-ante productivity levels for entering exporters and non-exporters. The first column reports 1990 productivity levels for the cohort of firms entering in the export market in 1991 and for the group of non-exporters remaining out of the export market in 1991. Table 6 reports also productivity levels for the cohorts of entering exporters along the period 1992-1999 and the corresponding samples of non-entering exporters.

The *ex-ante* average productivity of labor for entering exporters is higher than the productivity of non-exporters continuing out of the export market. Similarly for all cohorts of entering exporters, their average total factor productivity is higher than TFP levels of non-exporters. Although the size of the samples of entering exporters is rather small, productivity differences are statistically significant at the 5% or 10% for more than half of the cohorts of entering firms. Polling together the observations and testing for the difference in average productivity permits the rejection of the null hypothesis of the equality of sample means at any significance level. Therefore, the higher performance found in exporters is also found in entering exporters before they begin exporting.

Next we examine productivity differences in the exit side of the export market. Table 7 compares the ex-ante productivity of exiting exporters and the productivity of exporters continuing active in the export market next period. Each column of Table 7 corresponds to a different cohort of exiting firms and continuing exporters. Labor productivity is lower for all cohorts of exiting exporters relative to continuing exporters.

These differences are statistically significant at the 5% for five different cohorts of exiting exporters and also for the sample of firms corresponding to the entire period. TFP productivity differences also favor continuing exporters relative to exiting firms but the differences are not significant. Therefore, on the exit side of the market we also find evidence consistent to the selection of more productive firms.

To further explore the magnitude of productivity differences between firms with different transition patterns between the export and the domestic markets, we run regressions similar to the specification of equation (1). Now, in the specification we define the export status for each firm in terms of the five groups describing the export position of firms along the period (continuing, entering, exiting, switching exporters and non-exporters). According to the selection hypothesis the ranking of productivity differences should be consistent to the export status of firms. In particular, after controlling for size, industry, time, age and ownership the average productivity of continuing exporters should be greater than the productivity of exiting exporters and the productivity of entering exporters greater than the productivity of non-exporters. We can interpret the β coefficients as approximation of ex-ante performance differences between groups of firms with different transition patterns in the export market. Table 8 reports the results for two dependent variables: labor productivity (first row) and total factor productivity (second row). Non-exporters are the omitted group of firms. Relative to non-exporters the labor productivities of continuing exporters and entering exporters are significantly higher. The average productivity of exiting exporters is not significantly different with respect to the group of non-exporters. Therefore, the ranking of labor productivities confirms that continuing exporters have a higher productivity than exiting exporters and entering exporters have a higher productivity than non-exporters remaining out of the export market. Similar results are obtained for total factor productivity.

Finally, Table 8 reports regressions of the change in two performance measures, labor productivity and TFP, on the export status along the period controlling for size, industry, time, age and type of ownership. On average, there are no significant differences for productivity growth (both labor and total factor productivity) between the five groups of firms with different transition patterns in the export market. Particularly, the productivity growth of entering exporters is not significantly different than the productivity growth of non-exporters remaining out of the export market. Therefore, differences between productivity levels for exporting firms and non-exporting firms do not significantly change after entry in the export market. These results are very similar to those reported by Clerides, Lach and Tybout (1998), Bernard and Jensen (1999), Aw, Chung and Roberts (2000) and Delgado, Fariñas and Ruano (2002).

3. Estimating productivity differences between exporters and non-exporters

This section presents estimations of total factor productivity differences between exporters and non-exporters. The approach we use is based on the estimation of production functions where the emphasis is placed on allowing the productivity shocks to take a very general form.

Among methods of calculating total factor productivity the most popular alternative is the choice of an index number approach. Either bilateral or multilateral indexes have been proposed to perform comparisons among groups of firms (i.e. Caves, Christensen and Diewert, 1982; Good, Nadiri and Sickles, 1996). For productivity comparisons between exporters and non-exporters, index numbers have been applied among others by Aw, Chen and Roberts (1997); Aw, Chung and Roberts (2000); Delgado, Fariñas and Ruano (2002). However, the use of index numbers requires the imposition of a set of assumptions to get unbiased measures of total factor productivity. These assumptions include constant returns to scale technology, full utilization of all inputs or instantaneous input adjustment to their desired demand levels.

This section presents measures of total factor productivity based on the estimation of production functions. The main advantage coming from this approach is that assumptions such as constant return to scale technology or instantaneous adjustment of all inputs are not required. Furthermore, there are additional gains from the GMM approach we use to estimate production functions: first, we control for firm-specific unobserved heterogeneity; second, the estimation approach permits to control for simultaneity bias produced by the influence of productivity on input decision; and third, we use the system estimator proposed by Blundell and Bond (1999) that provides better instruments when explanatory variables are persistent over time. Therefore, we want to see if productivity differences between exporters and non-exporters, as those reported in section 2, are robust to the control of the indicated elements. In the following section we define the methodology used for the estimation of production functions.

3.1 Methodology

Our purpose is to measure TFP level differences between exporters and non-exporters. To investigate the magnitude of these differences, we consider the estimation of a production function with productivity shocks that are allowed to take a very general form. The estimation is performed using a large panel of manufacturing firms. We follow the estimation method proposed by Blundell and Bond (1999). Next, we briefly summarize the approach.

Consider that firm i produce at time t according to a Cobb-Douglas production function that in linear form can be expressed as:

$$y_{it} = a\, l_{it} + b\, m_{it} + g\, k_{it} + a_{it}$$

where y_{it} is log of output, l_{it} is log of labor input, m_{it} is log of intermediate inputs and k_{it} is log of capital input; a, b and g are the elasticities of the output with respect to labor, intermediate inputs and capital respectively. If $a + b + g = 1$ the production technology presents constant return to scale. The term a_{it} can be interpreted as the level of TFP that can be decomposed in three components:

$$a_{it} = h_i + h_t + u_{it},$$

where h_i is an individual effect that captures firm-specific differences in productivity which are fixed over time, h_t captures macroeconomic shocks in productivity which are common to all firms, and u_{it} picks up idiosyncratic productivity shocks. The static representation of the production function can either be estimated or, alternatively, the idiosyncratic shock, u_{it}, may adopt an autorregresive form capturing factors such as omitted characteristics that persist or non-instantaneous adjustment. Adopting this autorregresive form, u_{it} can be expressed as

$$u_{it} = r\, u_{it-1} + e_{it}$$

where e_{it} is an idiosyncratic error term. The later assumption permits the following dynamic representation of the production function:

$$y_{it} = d_1 y_{it-1} + d_2 l_{it} + d_3 l_{it-1} + d_4 m_{it} + d_5 m_{it-1} + d_6 k_{it} + d_7 k_{it-1} + d_8 (h_i + h_t) + e_{it} \quad (2)$$

where the parameters to be estimated are:

$$d_1 = r,\ d_2 = a,\ d_3 = -r a,\ d_4 = b,\ d_5 = -r b,\ d_6 = g,\ d_7 = -r g,\ d_8 = 1 - r\ .$$

This set of parameters implies three common factor restrictions:

$$d_3 = -d_2;\ d_5 = -d_4; d_7 = -d_6$$

which can be tested and/or imposed for the estimation of the parameter vector (α, β, γ, ρ).

The estimation of equation (2) permits to measure productivity differences between exporters and non-exporters through the average difference of η_i across both groups of firms. Therefore, parameterizing the firm-specific component η_i by a dummy variable equal to one for the group of exporters and zero otherwise we test for the average difference of total factor productivity between exporters and non-exporters. Exporting firms are identified with the groups of continuing exporters and entering exporters. Griffith (1999) has previously used this approach to measure differences between foreign-owned and domestic-owned firms.

3.2 Production function estimates

The issues of unobserved heterogeneity and potential simultaneity in the estimation of production functions of the form of (2) have been addressed using the GMM first-differenced estimator (Arellano and Bond, 1991). An statistical shortcoming with this approach has been recently suggested by Blundell and Bond (1999) who argue that when the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regression equation in differences. Company variables from micro panel data sets such as sales, production, employment, capital, hours, etc. tend to present the statistical property of being highly persistent as documented in Blundell and Bond (1999), Griffith (1999) and Bond (2002). Therefore, in the estimation of equations of the form (2) the instrument weakness has negative consequences on both the asymptotic efficiency and the small-sample bias of the difference estimator.

Arellano and Bover (1995) and Blundell and Bond (1998) have proposed an alternative system estimator that reduces the biases associated with the standard difference estimator. This estimator combines in a system the regression in differences with the regression in levels. The instruments for the regression in differences are the lagged levels of variables consistent with the moment conditions. For the other component of the system, the equation in levels, the instruments are given by the lagged differences of the variables. This latter part of the system requires additional moment conditions that are only valid under the assumption of no correlation between the variables in differences and the fixed effect, although there may be correlation between the right-hand side variables in levels and the firm specific effect. This assumption results from the stationary condition: $E\lfloor X_{i,t+p} \cdot \eta_i \rfloor = E\lfloor X_{i,t+q} \cdot \eta_i \rfloor$, for all p and q, where X is the set of explanatory variables in the moment conditions.

Tables 9-12 report the results for the whole set of firms and for three industries: textiles and clothing; timber, wooden products and furniture; and the food industry. The reported results correspond to estimations of equation (2) using OLS, first-differenced and the system estimator. While there are a number of similarities among the various estimates, our preferred estimation method uses the GMM system estimator.

Table 9 presents the results for the whole sample of firms. This aggregate estimation is complemented by industry estimations that are presented in Tables 10 to 12. In the aggregate estimations a complete set of year dummies and industry dummies are included in all columns to control for aggregate common productivity shocks to all firms and for industry shocks. The OLS estimates of column (1) indicate that exporters have, on average, higher total factor productivity levels than non-exporters. The OLS coefficients are biased if unobserved specific firm effects are correlated with the explanatory variables. Column (2) and (3) present first-difference GMM estimates and system GMM estimates, respectively. In column (2) levels of output, intermediate and labor inputs dated (t-3), (t-4) and (t-5); capital input dated (t-3) and earlier; are used as instruments for the difference equation. Column (3), for the system estimator, uses the same level instruments as in column (2) plus differences of output, intermediate, capital and labor inputs dated (t-2).

The consistency of the GMM estimators depends on whether lagged values of the explanatory variables are valid instruments in the production function equation. To address this issue four specification tests are reported (Arellano and Bond, 1998). The Sargan test fails to reject the validity of the instruments at the 5% level, although in the limit, but it does at the 10% level. The second test is the Sargan-Differences test, which examines the null hypothesis that the lagged differences are uncorrelated with the residuals. The Sargan-difference test statistic does not reject the validity of the additional restrictions imposed in the system estimator. Even with uncorrelated original error term, first-order serial correlation of the differenced error is expected and confirmed by test statistics. Finally, the test fails to reject the null hypothesis of absence of second-order serial correlation, although not for the system GMM. Overall, the reported specification tests indicate the validity of the moment conditions used in the system GMM.

Although the pattern of signs on current and lagged regressors in the estimations is consistent with the AR(1) error specification, the common factor restrictions test are rejected for the OLS estimator. It also rejects constant returns to scale. The common factor restrictions are easily accepted in the GMM results, and constant returns to scale is also rejected for the first-difference and system estimates.

All columns indicate a high degree of persistence, with a coefficient on the lagged dependent variable significant and equal to 0.67 with the system estimator. The results in the system-GMM indicate that exporters have a permanently higher level of total factor productivity than non-exporters. The magnitude of the coefficient indicates that after conditioning on inputs, exporters have about 5.8% higher output than non-exporters.

As we are able to observe some additional characteristics of exporting firms, we estimate total factor productivity differences for these additional characteristics as we have done for exporting firms. Table 9 reports the coefficients obtained for dummy variables capturing these additional characteristics for the group of exporting firms. The coefficients are obtained when the dummy variable $Exporters_i$ in specification (2) is substituted by the new set of dummies. The rest of coefficients and specification tests are not reported since they are practically the same as those obtained when the specification includes the dummy variable $Exporters_i$.

The first characteristic included distinguish between early exporters and non-early exporters, i.e. firms that began exporting within a period no longer than five years after beginning operations ($early\ exporters_i$) and the rest of exporters ($non\text{-}early\ exporters_i$). Therefore, we define the group of early exporters as those exporters that either began as exporters or made the transition to exporting in their early life cycle. Up to 20% of the firms that were exporters in our sample began exporting within five years of beginning operations.

Hallward-Driemeier, Iarossi and Sokoloff (2002) have proposed to compare domestic firms that began as exporters with domestic firms that made the transition latter on. The authors argue that the comparison permits to take the choice of the orientation of firms as exogenous with respect to productivity and this allows to make appropriate inferences about the sources of productivity increases from the positive empirical association between productivity and exporting. Higher levels of productivity for firms that began as exporters relative to non-exporters indicate evidence favorable to self-selection of exporting firms in world markets.

The estimated coefficients for early and non-early exporters reported in Table 9 indicate that early exporters have on average about 4.5% higher total factor productivity than non-exporters. For non-early exporters the magnitude of the difference in total factor productivity is quite similar, 6.4%. We conclude that there are no significant productivity differences between early and non-early exporters, implying that higher productivity is also observed for firms that choose their export orientation exogeneously with respect to productivity.

The second characteristic considered refers to the height of sunk entry cost to the export market. Breaking into foreign markets involves significant sunk start-up costs and the evidence suggests that firm's cost of retooling to export is significant –see, for example, Roberts and Tybout (1997) and Campa (2002). Our data set contains information about the mechanism firms declare to use to have access to foreign markets. On the basis of this information we classify firms in two groups: firms that have established their own distribution channels in foreign markets that we consider as firms with high sunk start-up costs; and firms using external services such as agent and distributors to enter into export markets that we consider as firms with low sunk start-up costs. In our sample 76% of exporters invest in their own distribution channels to break into foreign markets. The estimated coefficients that are reported in Table 9 confirm the existence of a positive relationship between the level of productivity and the height of entry costs into the export market. On average, total factor productivity for high cost firms is 3.2 points greater than for low cost firms.

Finally, Table 9 reports the coefficients estimated for two additional characteristics of exporters. The first characteristic is the geographical distribution of firm's exports. We can classify exporters in two groups: the group of firms selling 50% or more of their exports to OECD countries and the group of firms selling more than 50% of their exports to the rest of the world. More than 77% of exporting firms belong to the first group of exporters selling mainly to the OECD countries, which confirm the high association between the level of bilateral trade flows and the physical proximity of trading partners (most of them are EU countries) as predicted by the gravity model literature (see, for example, Deardorff (1984)). The second characteristic of exporters that we consider is export intensity defined by the share of exports to total sales. Average export intensity reaches 27% within the group of exporting firms. We use this level to define two groups: firms with export intensity equal or greater than the average (high export intensity_i) and firms with a lower level than the average (low export intensity_i). According to the coefficients reported in Table 9, firms selling a high share of their exports in OECD markets have greater productivity than firms with the rest of the world as the main destination of their exports. Both groups of firms have greater productivity than non-exporters, and OECD exporters have an average productivity that is 3.2 points greater than the productivity of firms exporting more intensely to the rest of the world. With respect to export intensity, the estimated coefficients indicate that total factor productivity increases as firm-level exporting activity becomes more intense. The average difference in productivity between high and low export intensity firms is 2.3 percentage points. Thus the relationship between exporting and productivity gets stronger with the degree of exposure to export markets. When the effect of export intensity is specified through its level a positive coefficient is obtained. The association estimated implies that for an average exporter that double its export intensity the productivity level increases by a percentage point.

We present additional results from the estimation of the dynamic Cobb-Douglas production function for three sectors: textiles and clothing; wooden products and furniture; and the food industry. Two of these industries (textiles and clothing and the food industry) have the largest number of available observations, 1,248 and 1,125 respectively, and have been estimated for this reason. Wooden products and furniture industry, with a smaller number of observations (707), has been also selected. Interestingly, this industry has shown during the period a continuos increase in the proportion of exporters, going from around

18% in 1990 to 50% in 1999. We have also examined two additional industries, manufactures of metal products and motor vehicles. Specification tests do not confirm the validity of the GMM estimators and results on both industries are not reported.

Tables 10 to 12 report results for the three additional sectors: textiles and clothing; timber, wooden products and furniture; and food industry. We do not comment on the results for each sector separately but indicate some general patterns. The specification tests shown for the three industries indicate that the validity of instruments cannot be rejected. The comparison of coefficients from first-differenced and system equations are consistent with expectations of first-differenced coefficients to be biased downwards if the available instruments are weak (Blundell and Bond, 1999). The pattern of signs on current and lagged regressors is consistent with the assumed error specification and the common factor restriction is not rejected at the 10%. The hypothesis of constant returns is rejected for the wooden and furniture industry with the system GMM estimates. The coefficients of the lagged dependent variable are in line with the aggregate estimation with the exception of the wooden and furniture industry where the degree of persistence is slightly lower with a coefficient of 0.3.

The coefficients estimating the average difference between exporters and non-exporters indicate that these differences are significant in the system-GMM. In two sectors –textiles and clothing; and wooden products and furniture- exporters have an output (conditional on inputs) that is 10.6% and 3.3% higher than non-exporters, respectively. For the food industry the estimated difference is unfavorable to exporters, with an output 9.6% lower than non-exporters, after conditioning on inputs. Interestingly, the food industry is sector with the highest proportion of non-exporting firms in our sample. The share of no-exporting firms in the food industry is 55.9%, which almost double the average proportion in the whole sample of firms.

Finally, the type of relationship between exporters' characteristics and productivity for the entire sample of firms (Table 9) is rather heterogeneous by industry. In the textile and clothing industry early exporters have higher productivity than non-exporters, as in the whole sample of firms. The estimated coefficients for high and low sunk start-up costs to foreign markets are identical. Then we do not observe any systematic relationship between the height of entry costs to export markets and differences in firm productivity levels. Similar results are obtained for two additional characteristics of exporters: the composition of exports by country of destination and the degree of export intensity. In both cases, there are no significant differences among exporters. However, for wooden products and furniture, early exporters do not have higher productivity than non-exporters; firms with low start-up costs have higher productivity than firms with high start-up costs; firms exporting to the rest of the world have higher productivity than firms exporting to the OECD; and the relationship between the degree of exposure to export markets and productivity is negative.

4. Summary

The first part of the paper provides systematic evidence on the magnitude of performance differences between exporters and non-exporters for a panel of Spanish manufacturing firms. The reported export premia estimates control for time, industry, size, age and type of firm ownership. Overall, estimates presented confirm the existence of substantial differences between exporters and non-exporters. Many indicators of performance as productivity, size, wages, R&D activities as well as other firm characteristics are greater at exporting firms.

The paper further explores the magnitude of economic performance differences between firms with different transition patterns between the export market and the domestic market. First, we show that higher performance found in exporters is also found in entering exporters before they began exporting. Second, on the exit side of the export market we also find evidence consistent to the selection of more productive firms. Third, differences between productivity levels for exporting and non-exporting firms do no significantly change after entry in the export market.

The second part of the paper measures total factor productivity differences between exporters and non-exporters. This estimation is based on an unbalanced panel of Spanish manufacturing firms over the period 1990-1999. To compute these differences we consider the estimation of a Cobb-Douglas production functions with productivity shocks that are allowed to take a very general form. The estimation follows the GMM approach proposed by Blundell and Bond (1999) especially suitable to deal with models for moderately persistent series from short panels.

After controlling for unobserved heterogeneity and simultaneity, the results we obtain indicate higher average levels of productivity for exporters than for non-exporters for the whole sample of firms. In two of three estimated industries we also find that export-oriented firms are more productive than domestically oriented firms.

References

Arellano, M. and S. Bond (1991), "Some tests of specification for panel data MonteCarlo evidence and application to employment equations", *Review of Economics Studies* 58, 277-297.

Arellano, M. and S. Bond (1998), " Dynamic panel data estimation using DPD98 for GAUSS, mimeo, Institute for Fiscal Studies, London.

Arellano, M. and O. Bover (1995), "Another look at the instrumental-variable estimation of error components model", *Journal of Econometrics*, 68, pp. 29-52.

Aw, B. Y. and A. Hwang (1995), "Productivity and the export market: A firm level analysis", *Journal of Development Economics*, 47, pp. 313-332.

Aw, B. Y., X. Chen and M. J. Roberts (1997), "Firm level evidence on productivity differentials, turnover, and export in Taiwanese manufacturing", NBER Working Paper nº 6253.

Aw B. Y., S. Chung and M. Roberts (2000), "Productivity and the turnover in the export market: Micro-level evidence for the Republic of Korea and Taiwan (China)", *The World Bank Economic Review*, 14, pp. 313-332.

Bartelsman, E. J. and M. Doms (2000), "Understanding productivity: lessons from longitudinal micro databases", *Journal of Economic Literature*, vol. 38, nº 3.

Bernard, A. B. and J. B. Jensen (1995), "Exporters, jobs and wages in U.S. manufacturing, 1976-1987", *The Brooking Papers of Economic Activity: Microeconomics*, 1995, pp.67-112.

Bernard, A. B. and J. B. Jensen (1999), "Exceptional exporter performance: cause, effect or both?", *Journal of International Economics*, 47, pp. 1-25.

Bernard A. B. and J. B. Jensen (2001) Why some firms export?, NBER Working Paper W8349.

Bernard A. B. and J. Wanger (1997), "Exports and success in German manufacturing", *Weltwirstchaaftliches Archiv*, vol. 133(1), pp. 134-157.

Blundell, R. and S. Bond (1998), "Initial conditions and moment restrictions in dynamic panel data models", *Journal of Econometrics*, 87, pp. 115-143.

Blundell, R. and S. Bond (1999), "GMM estimation with persistent panel data: an application to production functions", IFS Working Paper nº W99/4.

Bond, S. (2002), “Dynamic panel data models: a guide to micro data methods and practice”. CEMMAP Working Paper CWP09/02.

Campa, J. M (2002), “Exchange rates and trade: how important is hysteresis in trade?”. *European Economic Review* (forthcoming)

Caves D. W., L. R. Christensen and E. Diewert (1982), “Multilateral comparisons of output, input, and productivity using superlative index numbers”, *The Economic Journal,* 92, pp. 73-86.

Clerides, S. K., S. Lach and J. R. Tybout (1998), “Is learning-by-exporting important? Micro-dynamic evidence from Colombia, Mexico and Morocco, *Quarterly Journal of Economics,* vol. CXIII, August, pp. 903-94

Delgado, M. A., J. C. Fariñas and S. Ruano (2002), "Firm productivity and export markets: a nonparametric approach", *Journal of International Economics*, 57, 397-422

Deardorff, A. V. (1984), “Testing trade theories and predicting trade flows”, in R. W. Jones and P. Kenen, eds. Handbook of International Economics, vol.1, pp. 467-517, Amsterdam, North-Holland.

Fariñas, J. C. y J. Jaumandreu (1999), “Diez años de Encuesta Sobre Estrategias Empresariales (ESEE)”, *Economía Industrial,* nº. 329, V, pp. 29-42.

Girma, S., D. Greenaway and R. Kneller (2002), “Does exporting lead to better performance? A microeconometric analysis of matched firms”. GEP Research Paper 02/09. University of Nottingham.

Good, D., M. I. Nadiri and R. Sickles (1996), “Index number and factor demand approaches to the estimation of productivity” NBER Working Paper 5790.

Griffith, R. (1999), “Using the ARD establishment level data to look at foreign ownership and productivity in the United Kingdom”, *The Economic Journal*, 109 (June), pp. F416-F442.

Hopenhayn H. (1992), “Entry, exit, and firm dynamics in long-run equilibrium”, *Econometrica* 60, 1127-1150.

Jovanovic, B. (1982), “Selection and evolution of industry”, *Econometrica,* 50, pp. 649-670.

Roberts M. and J. Tybout (1997), “The decision to export in Colombia: an empirical model of entry with sunk costs”, *American Economic Review*, 87(4), pp. 545-564.

Table 1
Distribution of observations by type of firm and industry

Industry classification NACE-CLIO R44	Type of firm (% of total number of observation by industry)					Total number of observ.
	Continuing exporters	Entering exporters	Exiting exporters	Switching exporters	Non-exporters	
1. Ferrous and non-ferrous metals	41.9	6.7	11.0	28.1	12.4	210
2. Non-metallic mineral products	35.2	7.5	5.6	11.7	40.0	735
3. Chemical products	56.3	7.5	5.7	9.5	21.0	666
4. Manufactures of metal products	38.5	9.9	3.4	19.0	29.3	1,100
5. Agricultural and industrial machinery	60.9	8.9	3.5	17.9	8.9	576
6. Office and data processing machines, etc.	69.7	-	16.7	6.1	7.6	66
7. Electrical goods	49.2	10.7	8.0	15.0	17.2	675
8. Motor vehicles	75.1	6.9	2.5	7.1	8.5	437
9. Other transport equipment	63.1	2.4	3.0	20.2	11.3	168
10. Meats, meat preparation and preserves	20.9	26.9	-	15.6	36.5	301
11. Food industry	24.3	8.0	1.5	10.3	55.9	1,125
12. Beverages	26.9	24.1	6.7	15.4	26.9	253
13. Textiles and clothing	40.2	10.5	3.4	9.9	36.0	1,248
14. Leathers, leather and skin goods, footwear	30.6	12.3	11.1	33.1	12.8	359
15. Timber, wooden products and furniture	18.4	9.6	2.7	23.3	46.0	707
16. Paper and printing products	24.1	10.3	0.9	21.1	43.6	759
17. Rubber and plastic products	40.3	18.6	-	20.5	20.5	521
18. Other manufacturing products	72.0	-	7.1	6.3	14.6	239
Total manufacturing	39.6	10.2	3.9	15.6	30.7	10,145

Table 2
Mean characteristics for exporters and non-exporters in 1990 and 1999.
(Exporters are defined as continuing and entering exporters over the period 1990-1999)

	All firms				Small firms				Large firms			
	1990		1999		1990		1999		1990		1999	
	Exporters	Non-Exporters	Exporters	Non-exporters	Exporters	Non-exporters	Exporters	Non-exporters	Exporters	Non-exporters	Exporters	Non-exporters
Production (000€)	23,983.8	6,584.4	37,724.0	5,800.8	3,466.1	1,800.5	9,438.9	2,883.2	43,609.5	36,131.7	70,812.1	38,896.7
Employment (number)	315	85	253	51	50	29	64	30	568	432	474	291
Capital stock (000€)	7,611.5	2,235.8	10,274.9	1,857.9	815.6	414.1	1,933.8	606.3	14,111.9	13,487.4	20,032.5	16,054.8
Labor productivity (€ per hour)	19.2	15.5	23.3	15.2	16.6	14.5	19.9	14.7	21.6	22.1	27.3	21.6
Total factor productivity	8.4	7.3	8.0	7.5	8.3	7.3	8.1	7.5	8.5	7.4	7.9	7.1
Capital per hour (€ per hour)	11.8	8.2	18.5	10.8	7.3	7.0	13.3	9.5	16.0	15.6	24.6	25.4
Machinery invest. / Sales (%)	4.8	7.1	4.5	4.0	3.6	6.0	4.1	3.9	6.1	14.3	4.9	5.9
Wage per hour (€ per hour)	9.9	7.9	14.6	10.8	8.2	7.4	12.3	10.3	11.5	11.2	17.3	16.8
Qualified workers / Total empl. (%)	8.7	5.3	10.7	6.6	8.2	4.8	10.2	6.2	9.2	8.7	11.3	11.1
R&D activities (% of firms)	54.4	17.2	53.7	14.4	33.0	9.5	34.3	11.6	75.0	64.7	76.4	46.9
R&D effort (%)	1.1	0.4	1.1	0.3	0.8	0.3	0.7	0.2	1.4	0.9	1.6	1.0
Age (years)	27	17	31	20	19	14	23	19	36	35	39	33
Foreign ownership (% of firms)	23.6	6.0	24.3	2.8	9.1	2.5	11.3	1.1	37.5	27.5	39.6	21.9

Table 3
Labor productivity, capital per hour and total factor productivity by industry in 1999: exporters vs. non-exporters
(Exporters are defined as continuing and entering exporters over the period 1990-1999)

	Labor productivity		Capital per hour		Total factor productivity	
Industry classification NACE-CLIO R44	Exporters	Non-exporters	Exporters	Non-exporters	Exporters	Non-exporters
1. Ferrous and non-ferrous metals	32.9	22.9	31.8	33.4	8.6	7.6
2. Non-metallic mineral products	26.1	23.0	20.9	15.4	8.3	8.0
3. Chemical products	30.4	21.0	26.5	16.8	8.8	7.4
4. Manufactures of metal products	24.1	17.6	18.7	5.0	8.5	8.4
5. Agricultural and industrial machinery	23.3	13.9	11.6	5.2	7.1	7.6
6. Office and data processing machines, etc.	17.1	9.8	10.4	4.2	8.2	7.0
7. Electrical goods	19.2	15.8	13.4	10.1	8.2	7.4
8. Motor vehicles	22.1	19.7	20.6	14.1	8.5	8.4
9. Other transport equipment	21.7	18.8	19.6	11.9	2.7	8.1
10. Meats, meat preparation and preserves	21.0	12.7	21.4	8.9	8.4	7.2
11. Food industry	28.3	13.4	23.4	14.6	8.2	6.9
12. Beverages	61.2	27.3	53.9	34.4	10.0	6.9
13. Textiles and clothing	18.1	9.7	14.0	6.6	7.9	6.9
14. Leathers, leather and skin goods, footwear	11.7	9.0	5.7	3.4	7.8	7.6
15. Timber, wooden products and furniture	14.6	11.2	5.7	6.0	8.2	7.2
16. Paper and printing products	24.9	15.8	25.3	12.5	7.8	7.0
17. Rubber and plastic products	19.8	16.0	17.2	11.4	7.4	7.9
18. Other manufacturing products	19.8	15.1	12.7	6.3	8.6	7.8
Total manufacturing	23.3	15.2	18.5	10.8	8.0	7.5

Table 4
The premium to exporting for various firm characteristics
(Exporters are defined as continuing and entering exporters over the period 1990-1999)

Dependent variable	Exporter dummy (T-statistic)	Other control variables: Size Wald test (p-value)	Industry Wald test (p-value)	Time Wald test (p-value)	Foreign Ownership (T-statistic)	Young (T-statistic)
Production	0.43	4355	231	475	0.29	-0.12
	(10.3)	(0.00)	(0.00)	(0.00)	(6.0)	(-2.9)
Employment	0.03	4113	224	434	0.02	-0.01
	(10.4)	(0.00)	(0.00)	(0.00)	(5.8)	(-3.0)
Capital stock	0.33	2471	238	213	0.43	-0.19
	(5.2)	(0.00)	(0.00)	(0.00)	(5.4)	(-3.1)
Labor productivity	0.17	58	310	75	0.20	-0.12
	(5.9)	(0.00)	(0.00)	(0.00)	(5.4)	(-4.1)
Total factor productivity	0.79	1	36	48	0.31	-0.46
	(3.5)	(0.92)	(0.00)	(0.00)	(0.6)	(-2.0)
Capital per hour	0.31	1801	243	227	0.42	-0.19
	(4.9)	(0.00)	(0.00)	(0.00)	(5.4)	(-3.0)
Wage per hour	0.06	233	565	1218	0.18	-0.12
	(3.1)	(0.00)	(0.00)	(0.00)	(8.4)	(-6.5)
Qualified workers/Total employment	1.96	4	254	77	2.90	0.40
	(4.2)	(0.55)	(0.00)	(0.00)	(4.1)	(0.8)
R&D activities	0.13	352	150	15	-0.07	-0.01
	(6.6)	(0.00)	(0.00)	(0.09)	(-2.3)	(-0.8)
R&D effort	2.9	39	120	12	-6.3	0.55
	(3.4)	(0.00)	(0.00)	(0.20)	(-3.7)	(0.6)

Note: Numbers in rows are coefficients and test values estimated from regressions as (1) in the text. For size, industry and time dummies we report the Wald test of joint significance for the sets of 5, 17 and 9 dummy variables, respectively (i.e. test of the null hypothesis that their estimated coefficients. Reported statistics are estimated with asymptotic variance matrices that are heteroskedasticity-consistent. All dependent variables are in logs except the *ratios* Qualified workers/total employment and R&D effort. The probability to undertake R&D activities is estimated by a linear probability model.

Table 5
The premium to exporting for various firm characteristics
(Exporters are defined as firms exporting at time t)

Dependent variable	Exporter dummy (T-statistic)	Other control variables: Size Wald test (p-value)	Industry Wald test (p-value)	Time Wald test (p-value)	Foreign Ownership (T-statistic)	Young (T-statistic)
Production	0.45	4494	240	425	0.28	-0.12
	(12.1)	(0.00)	(0.00)	(0.00)	(5.8)	(-3.0)
Employment	0.04	4277	235	388	0.02	-0.00
	(12.1)	(0.00)	(0.05)	(0.01)	(5.6)	(-3.0)
Capital stock	0.33	2531	248	198	0.42	-0.20
	(5.6)	(0.00)	(0.00)	(0.00)	(5.3)	(-3.1)
Labor productivity	0.15	60	314	71	0.19	-0.12
	(5.3)	(0.00)	(0.00)	(0.00)	(5.3)	(-4.2)
Total factor productivity	0.50	1	37	49	0.32	-0.50
	(2.1)	(0.97)	(0.00)	(0.00)	(0.6)	(-2.1)
Capital per hour	0.31	1850	253	211	0.42	-0.19
	(5.3)	(0.00)	(0.00)	(0.00)	(5.4)	(-3.0)
Wage per hour	0.04	248	565	1159	0.18	-0.12
	(2.5)	(0.00)	(0.00)	(0.00)	(8.4)	(-6.5)
Qualified workers/Total employment	2.03	3	256	78	2.82	0.39
	(5.0)	(0.63)	(0.00)	(0.00)	(4.0)	(0.8)
R&D activities	0.15	356	147	16	-0.07	-0.01
	(8.4)	(0.00)	(0.00)	(0.07)	(-2.4)	(-0.8)
R&D effort	3.13	30	112	13	-6.42	0.55
	(3.9)	(0.00)	(0.00)	(0.15)	(-3.7)	(0.6)

Note: Numbers in rows are coefficients and test values estimated from regressions as (1) in the text. For size, industry and time dummies we report the Wald test of joint significance for the sets of 5, 17 and 9 dummy variables, respectively (i.e. test of the null hypothesis that their estimated coefficients. Reported statistics are estimated with asymptotic variance matrices that are heteroskedasticity-consistent. All dependent variables are in logs except the *ratios* Qualified workers/total employment and R&D effort. The probability to undertake R&D activities is estimated by a linear probability model.

Table 6
Labor productivity and TFP ex-ante differences between entering exporters and non-exporters.*

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1990-98
Labor produc.										
Entering	19.4	27.6	17.1	21.6	17.9	17.5	14.5	15.9	20.8	18.7
Non-exporters	14.5	13.9	13.2	11.9	11.9	12.2	12.6	12.8	14.0	12.9
P-value	0.215	0.219	0.106	0.048	0.021	0.032	0.220	0.183	0.047	0.000
TFP										
Entering	8.5	8.9	7.8	7.8	7.5	8.1	8.0	7.8	8.8	8.1
Non-exporters	7.2	7.3	6.9	5.4	6.4	6.8	7.3	7.0	7.4	6.8
P-value	0.085	0.130	0.015	0.035	0.100	0.002	0.167	0.065	0.000	0.000
N. of entrants	7	11	15	13	14	11	18	14	11	114
N.of non-exporters	212	279	327	363	358	340	354	323	296	2,852

* The reported P-values correspond to the null hypothesis of the test of equality of means.

Table 7
Labor productivity and TFP ex–ante differences between exiting exporters and continuing exporters.*

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1990-98
Labor produc.										
Exiting	15.8	6.1	12.7	12.5	15.2	12.8	13.4	17.7	15.5	14.1
Continuing	19.7	18.7	18.9	19.0	19.8	21.7	22.2	22.2	23.6	20.7
P-value	0.195	0.000	0.156	0.002	0.306	0.001	0.005	0.222	0.028	0.000
TFP										
Exiting	2.7	5.6	7.7	6.9	0.6	7.1	7.6	8.0	7.5	5.7
Continuing	8.5	7.3	7.5	4.0	7.1	7.0	7.8	7.9	8.1	7.2
P-value	0.293	0.000	0.895	0.269	0.338	0.954	0.489	0.939	0.393	0.240
N. of exiting	8	2	5	8	7	5	6	5	7	53
N. of continuing	300	359	395	421	448	452	454	430	399	3,658

* The reported P-values correspond to the null hypothesis of the test of equality of means.

Table 8
Productivity performance by export status

Dependent variable	Continuing exporters (T-statistic)	Entering exporters (T-statistic)	Switching exporters (T-statistics)	Exiting exporters (T-statistic)	Other control variables: Size Wald test (p-value)	Industry Wald-test (p-value)	Time Wald-test (p-value)	Foreign Ownership (T-statistic)	Young (T-statistic)
Labor productivity (level)	0.17	0.19	0.11	0.03	45	72	93	0.00	-0.00
	(6.0)	(5.3)	(3.6)	(0.7)	(0.00)	(0.00)	(0.00)	(21.6)	(-3.6)
Total factor productivity (level)	0.58	0.79	-0.09	-0.00	3.8	25	42	0.00	-0.12
	(1.6)	(2.6)	(-0.27)	(-0.0)	(0.58)	(0.00)	(0.00)	(1.8)	(-0.3)
Labor productivity (growth)	0.02	0.02	-0.01	0.02	7.1	34	42	0.00	0.00
	(1.6)	(1.7)	(-0.7)	(0.8)	(0.21)	(0.00)	(0.00)	(2.8)	(0.6)
Total factor productivity (growth)	0.10	0.11	0.09	0.06	2.8	28	24	-0.00	0.08
	(0.5)	(1.0)	(0.6)	(0.3)	(0.00)	(0.00)	(0.00)	(-0.9)	(0.4)

Note: Numbers in rows are coefficients and test values estimated from regressions as (1) in the text, where the variable $Export_i$ is decomposed into four dummies: Continuing exporters, Entering exporters, Switching exporters and Exiting exporters. For size, industry and time dummies we report the Wald test of joint significance for the sets of 5, 17 and 9 dummy variables, respectively (i.e. test of the null hypothesis that their estimated coefficients. Reported statistics are estimated with asymptotic variance matrices that are heteroskedasticity-consistent. Dependent variables in levels are in logs.

Table 9
All industries
Production function: alternative estimators
(dependent variable: output y_{it})

	(1) OLS	(2) Differences GMM	(3) System GMM
y_{it-1}	0.675 (0.015)	0.504 (0.060)	0.671 (0.044)
l_{it}	0.276 (0.019)	0.114 (0.099)	0.206 (0.072)
l_{it-1}	-0.178 (0.019)	-0.081 (0.080)	-0.101 (0.063)
m_{it}	0.498 (0.018)	0.569 (0.043)	0.585 (0.033)
m_{it-1}	-0.281 (0.019)	-0.205 (0.049)	-0.360 (0.038)
k_{it}	0.036 (0.006)	0.043 (0.047)	0.009 (0.036)
k_{it-1}	-0.019 (0.006)	-0.022 (0.037)	-0.022 (0.034)
Exporters_i	0.012 (0.004)		0.058 (0.029)
Early exporters_i	0.013 (0.006)		0.045 (0.032)
$\text{Non-early exporters}_i$	0.011 (0.004)		0.064 (0.056)
$\text{High start-up costs}_i$	0.011 (0.004)		0.084 (0.034)
$\text{Low start-up costs}_i$	0.007 (0.006)		0.056 (0.023)
$\text{Exporters to OECD}_i$	0.012 (0.004)		0.078 (0.032)
$\text{Exporters to ROW}_i$	0.012 (0.005)		0.046 (0.022)
$\text{Low export intensity}_i$	0.011 (0.004)		0.052 (0.027)
$\text{High Export intensity}_i$	0.013 (0.005)		0.075 (0.033)
Instruments	-	t-3	t-3 and Δ(t-2)
Sargan (P-value)	-	0.037	0.051
Sargan-Difference (P-value)	-	-	0.392
m1 (P-value)	0.000	0.000	0.000
m2 (P-value)	0.004	0.153	0.001
Comfac (P-value)	0.026	0.480	0.114
CRS (P-value)	0.007	0.008	0.007
N. of observations (firms)	8,742 (1,403)	7,339 (1,403)	8,742 (1,403)

Notes: All regressions are estimated in DPD (see Arellano and Bond, 1998); a set of year dummies and a set od industry dummies are included in all models; numbers in parenthesis are two step robust standard errors; Sargan is the P-value from a test of over-identifying restrictions, which test the overall validity of instruments for the GMM estimators; Sargan-Difference is the P-value from a test of the validity of the additional restrictions imposed in the system estimator with respect to the difference estimator; m1 and m2 are the P-values from test of first and second order serial correlation; Comfac is the P-value from a test of the common factor restrictions; CRS is the P-value form a test of constant returns to scale; column (2) presents the results from a differences GMM estimator that uses as instruments $y_{it-3}...y_{it-5}$, $l_{it-3}..l_{it-5}$, m_{it-3} ..m_{it-5} and k_{it-3} and earlier; the results of column (3) are from a system GMM estimator with the same instruments as in column (2) plus instruments (y_{it-2}-y_{it-3}), (l_{it-2}-l_{it-3}), (m_{it-2}-m_{it-3}) and (k_{it-2}-k_{it-3}).

Table 10
Textiles and clothing
Production function: alternative estimators
(dependent variable: output y_{it})

	(1) OLS	(2) Differences GMM	(3) System GMM
y_{it-1}	0.774 (0.026)	0.551 (0.126)	0.618 (0.031)
l_{it}	0.345 (0.037)	0.497 (0.142)	0.535 (0.035)
l_{it-1}	-0.251 (0.035)	-0.060 (0.156)	-0.404 (0.034)
M_{it}	0.397 (0.032)	0.174 (0.063)	0.404 (0.021)
M_{it-1}	-0.272 (0.032)	-0.136 (0.085)	-0.232 (0.023)
k_{it}	0.067 (0.017)	0.006 (0.026)	0.056 (0.026)
k_{it-1}	-0.062 (0.015)	0.008 (0.024)	-0.004 (0.028)
$Exporters_i$	0.043 (0.012)		0.106 (0.021)
Early $exporters_i$	0.046 (0.020)		0.051 (0.022)
Non-early $exporters_i$	0.042 (0.011)		0.100 (0.022)
High start-up $costs_i$	0.038 (0.012)		0.100 (0.024)
Low start-up $costs_i$	0.057 (0.021)		0.100 (0.020)
Exporters to $OECD_i$	0.043 (0.012)		0.105 (0.024)
Exporters to ROW_i	0.045 (0.019)		0.117 (0.019)
Low export $intensity_i$	0.041 (0.013)		0.114 (0.022)
High Export $intensity_i$	0.047 (0.013)		0.105 (0.025)
Instruments	-	t-3	t-3 and Δ(t-2)
Sargan (P-value)	-	0.271	0.829
Sargan-Difference (P-value)	-	-	0.988
M1 (P-value)	0.024	0.000	0.000
M2 (P-value)	0.123	0.285	0.116
Comfac (P-value)	0.001	0.733	0.342
CRS (P-value)	0.000	0.021	0.651
N. of observations (firms)	1072 (172)	904 (172)	1072 (172)

Notes: All regressions are estimated in DPD (see Arellano and Bond, 1998); a set of year dummies is included in all models; numbers in parenthesis are two step robust standard errors; Sargan is the P-value from a test of over-identifying restrictions, which test the overall validity of instruments for the GMM estimators; Sargan-Difference is the P-value from a test of the validity of the additional restrictions imposed in the system estimator with respect to the difference estimator; m1 and m2 are the P-values from test of first and second order serial correlation; Comfac is the P-value from a test of the common factor restrictions; CRS is the P-value form a test of constant returns to scale; column (2) presents the results from a differences GMM estimator that uses as instruments $y_{it-3}...y_{it-5}$, $l_{it-3}..l_{it-5}$ and $m_{it-3}..m_{it-5}$; the results of column (3) are from a system GMM estimator with the same instruments as in column (2) plus instruments $(y_{it-2}-y_{it-3})$, $(l_{it-2}-l_{it-3})$ and $(m_{it-2}-m_{it-3})$.

Table 11
Wooden products and furniture
Production function: alternative estimators
(dependent variable: output y_{it})

	(1) OLS	(2) Differences GMM	(3) System GMM
y_{it-1}	0.539 (0.074)	0.187 (0.036)	0.322 (0.014)
l_{it}	0.232 (0.048)	0.056 (0.031)	0.125 (0.011)
l_{it-1}	-0.101 (0.046)	0.057 (0.030)	-0.040 (0.010)
m_{it}	0.580 (0.033)	0.571 (0.037)	0.609 (0.012)
m_{it-1}	-0.240 (0.055)	-0.071 (0.020)	-0.055 (0.010)
k_{it}	0.015 (0.012)	0.016 (0.017)	0.023 (0.006)
k_{it-1}	-0.009 (0.011)	-0.013 (0.007)	-0.005 (0.005)
Exporters$_i$	0.018 (0.015)		0.033 (0.006)
Early exporters$_i$	0.009 (0.023)		0.009 (0.007)
Non-early exporters$_i$	0.026 (0.016)		0.051 (0.008)
High start-up costs$_i$	0.012 (0.017)		0.023 (0.006)
Low start-up costs$_i$	0.021 (0.024)		0.042 (0.008)
Exporters to OECD$_i$	0.004 (0.019)		0.019 (0.011)
Exporters to ROW$_i$	0.037 (0.016)		0.048 (0.006)
Low export intensity$_i$	0.031 (0.004)		0.077 (0.008)
High Export intensity$_i$	-0.003 (0.005)		-0.027 (0.008)
Instruments	-	t-2	t-2 and Δ(t-1)
Sargan (P-value)	-	0.370	0.511
Sargan-Difference (P-value)	-	-	0.695
m1 (P-value)	0.212	0.000	0.000
m2 (P-value)	0.107	0.476	0.573
Comfac (P-value)	0.054	0.958	0.768
CRS (P-value)	0.000	0.000	0.002
N. of observations (firms)	605 (102)	503 (102)	605 (102)

Notes: All regressions are estimated in DPD (see Arellano and Bond, 1998); a set of year dummies is included in all models; numbers in parenthesis are two step robust standard errors; Sargan is the P-value from a test of over-identifying restrictions, which test the overall validity of instruments for the GMM estimators; Sargan-Difference is the P-value from a test of the validity of the additional restrictions imposed in the system estimator with respect to the difference estimator; m1 and m2 are the P-values from test of first and second order serial correlation; Comfac is the P-value from a test of the common factor restrictions; CRS is the P-value form a test of constant returns to scale; column (2) presents the results from a differences GMM estimator that uses as instruments $y_{it-2}...y_{it-4}$, $l_{it-2}..l_{it-4}$ and $m_{it-2}..m_{it-4}$; the results of column (3) are from a system GMM estimator with the same instruments as in column (2) plus instruments (y_{it-1}-y_{it-2}), (l_{it-1}-l_{it-2}) and (m_{it-1}-m_{it-2}).

Table 12
Food industry
Production function: alternative estimators
(dependent variable: output y_{it})

	(1) OLS	(2) Differences GMM	(3) System GMM
y_{it-1}	0.629 (0.041)	0.341 (0.052)	0.590 (0.034)
l_{it}	0.186 (0.042)	0.082 (0.039)	0.129 (0.022)
l_{it-1}	-0.120 (0.043)	0.032 (0.037)	-0.055 (0.021)
m_{it}	0.620 (0.064)	0.775 (0.031)	0.769 (0.018)
m_{it-1}	-0.333 (0.070)	-0.105 (0.046)	-0.350 (0.028)
k_{it}	0.031 (0.018)	0.069 (0.030)	0.030 (0.020)
k_{it-1}	-0.010 (0.017)	-0.097 (0.023)	-0.092 (0.018)
$Exporters_i$	-0.011 (0.017)		-0.096 (0.024)
Early $exporters_i$	0.001 (0.042)		-0.063 (0.027)
Non-early $exporters_i$	-0.013 (0.016)		-0.103 (0.024)
High start-up $costs_i$	-0.007 (0.016)		-0.097 (0.023)
Low start-up $costs_i$	-0.023 (0.025)		-0.084 (0.026)
Exporters to $OECD_i$	-0.020 (0.019)		-0.092 (0.025)
Exporters to ROW_i	0.015 (0.018)		-0.045 (0.028)
Low export $intensity_i$	0.009 (0.017)		-0.031 (0.031)
High Export $intensity_i$	-0.042 (0.025)		-0.131 (0.024)
Instruments	-	t-3	t-3 and Δ(t-2)
Sargan (P-value)	-	0.360	0.322
Sargan-Difference (P-value)	-	-	0.350
m1 (P-value)	0.051	0.000	0.000
m2 (P-value)	0.047	0.987	0.200
Comfac (P-value)	0.401	0.000	0.081
CRS (P-value)	0.011	0.747	0.597
N. of observations (firms)	972 (153)	819 (153)	972 (153)

Notes: All regressions are estimated in DPD (see Arellano and Bond, 1998); a set of year dummies is included in all models; numbers in parenthesis are two step robust standard errors; Sargan is the P-value from a test of over-identifying restrictions, which test the overall validity of instruments for the GMM estimators; Sargan-Difference is the P-value from a test of the validity of the additional restrictions imposed in the system estimator with respect to the difference estimator; m1 and m2 are the P-values from test of first and second order serial correlation; Comfac is the P-value from a test of the common factor restrictions; CRS is the P-value form a test of constant returns to scale; column (2) presents the results from a differences GMM estimator that uses as instruments $y_{it-3}...y_{it-5}$, $l_{it-3}..l_{it-5}$, $m_{it-3}..m_{it-5}$ and $k_{it-3}..k_{it-5}$; the results of column (3) are from a system GMM estimator with the same instruments as in column (2) plus instruments $(y_{it-2}-y_{it-3})$, $(l_{it-2}-l_{it-3})$, $(m_{it-2}-m_{it-3})$ and $(k_{it-2}-k_{it-3})$.