DOCUMENTOS DE ECONOMIA Y FINANZAS INTERNACIONALES

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September 2000

DEFI 00/03

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Domestic and foreign price-marginal cost margins:

an application to Spanish manufacturing firms

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Abstract

The objective of this paper is to analyse the differences in price-marginal cost margins of the export and domestic markets by the estimation of a multiproduct cost function. We apply this method to a panel of Spanish export manufacturing firms from the period 1990-1997. Some results emerge from the estimations. First, price-marginal cost margins in domestic markets are larger than foreign margins throughout the period. Second, price-marginal cost margins are procyclical in the domestic market but there is no evidence of this behaviour in the foreign markets. Third, there is no evidence that export firms used the devaluation of the currency to increase their margins. Finally, price-cost margins reveal some degree of heterogeneity across industries in both markets.

Keywords: Marginal cost, price-cost margins, translog cost function, export firm.
JEL Classifications: F12, L60, L13

Resumen

El objetivo del trabajo es analizar si existen diferencias en los márgenes precio-coste marginal en los mercados doméstico y exterior de las empresas manufactureras exportadoras españolas durante el período 1990-97. La estimación de una función de costes variables multiproducto permite obtener los costes marginales de las ventas dirigidas a cada destino y calcular los márgenes de ambos mercados. Los resultados que se derivan se resumen a continuación. En primer lugar, los costes marginales asociados a las exportaciones son mayores a los de las ventas dirigidas al mercado interior. Aunque existe una gran heterogeneidad entre empresas, los márgenes interiores son superiores a los del mercado de exportación. En segundo lugar, el margen doméstico es procíclico pero no existe evidencia de este comportamiento en el mercado exterior. En tercer lugar, las empresas exportadoras no han aprovechado las devaluaciones de la peseta en 1992 y 1993 para incrementar sus márgenes en los mercados de exportación. Por último, existe una gran heterogeneidad en los márgenes domésticos e interiores entre industrias.

I. Introduction

Some classical studies of Industrial Economics have analyzed the effect of import and export activities on the total profitability of industries. With respect to imports, if there is no relationship between domestic and foreign firms, import penetration (defined as imports over total sales) should have a negative effect on total profitability. Most empirical papers work with this assumption and find supporting evidence[1]. However, if collusive behavior between domestic and foreign firms is assumed, import penetration does not imply more competition. In this case, positive or ambiguous effects could be found[2].

The influence of exports on profitability and domestic competition is less straightforward. The overall effect depends on the conditions under which goods are traded in the world market relative to the domestic situation. One of the variables affecting relative margins is the demand elasticity of both markets. In the context of homogeneous products, it is normally assumed that world demand elasticity is bigger than domestic demand elasticity, supporting a larger domestic price-cost margin relative to the foreign margin. An extreme situation would be where producers are confronted with a perfectly elastic demand. In this case, international price equals export price (corrected by the exchange rate if it is invoiced in domestic currency). However, if differentiated products are assumed, it is possible to find that domestic exporters sell to specific fringe demands of foreign countries with demand less elastic than the domestic demand. If the domestic firm is not a price taker in the international

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[1] See, for example, Lyons (1981), Jacquemin (1982), Geroski (1982) and, for Spain, Mazón (1993). Stalhammar (1991) also finds empirical support that imports have a negative influence on the degree of implicit collusion on the domestic market.

[2] Fariñas and Huergo (1993) consider the possibility of collusive behavior between Spanish and foreign firms. In their estimates with Spanish data up to 1986, they found that import penetration of the OCDE positively affects profitability, while imports from the rest of the world affect it negatively. Pearce de Azevedo (1996 and 1998) finds similar results using data up to 1990. The import rate tends to depress the margins in more

markets, it is possible to find market power abroad as well as in the home market, and in this sense export profit can be higher than domestic profit. In addition to the differences in demand elasticities and competition environment, differences in marginal costs could justify different margins between both markets. Even in the context of a homogeneous product, variable (e.g., transport) or sunk (e.g., export channels) costs related to exports could easily justify such differences.

Empirical evidence of the effect of exports on profitability is inconclusive. Caves, Porter and Spence (1980) find that exports reduce the profitability of industry, while Geroski (1982) finds a positive effect of the export rate on the margin. For Swedish industry, Stalhammar (1991) obtains a non-significant effect of export rate on industry profitability. However, exports have a negative influence on the degree of implicit collusion in the domestic market. These inconclusive results also appear for the Spanish economy. In Maravall and Torres (1986), the export rate negatively affects profitability (measured as cash flow over sales), but it is non-significant. Pearce de Azevedo (1996 and 1998) finds a positive and significant effect of the export rate on profitability when macroeconomic effects and potential endogeneity are not considered. However, when both facts are considered, the variable is not significant and even ends up changing to negative.

An alternative line of work differing from previous empirical work in industrial economics was called New Industrial Economics by Bresnahan (1989). Instead of studying the determinants of industry profitability by the estimation of price-cost margin equations, it analyzes the price-cost margins directly from a structural econometric model. To do that, a

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concentrated industries, but the average impact of imports tends to be insignificant.

cost or production function together with margin equations are estimated. It also allows us to determine additional parameters like demand elasticity, pricing behavior and firm interdependence through conjectural elasticity[3].

Following that line, Bernstein and Mohnen (1991) and Bughin (1996) have estimated the price-cost margin in some industries, differentiating between export and domestic markets. Bernstein and Mohnen (1991) estimate a model for oligopolistic industries where firms distinguish between output sold domestically and exported. They work with sectoral data and their model is applied to Canadian non-electrical machinery, electrical products and chemical products industries. Departing from a multiproduct cost function, they estimate the degree of oligopoly power in each industry, as well as the elasticities of both demands, through the specification of the share of the labor cost to the variable cost, the foreign and domestic revenues over the cost, and the two inverse product demand functions. They find that the degree of oligopoly power differs between domestic and foreign markets.

Bughin (1996) works with firms' data and assumes monopolistic competence. The different price-cost margins are explained by the different demand elasticities in each market taking into account the possibility that short-run capacity restrictions affect pricing decisions. He applies his model to a panel of Belgian firms in the Chemical and Electrical and Electronic products, finding that monopoly power over export markets is small.

Following Bernstein and Mohen (1991) and Bughin (1996), our paper evaluates the

[3] The first papers worked in a static context (see, for example, Appelbaum (1982) and Roberts (1984)). Later, dynamic considerations were included (see, for example, Morrison (1988) and, for Spain, Huergo (1998) and Fariñas and Huergo (1999)).

domestic and foreign price-cost margins of Spanish export firms for the period 1990-97. That period was especially relevant for Spanish and other European economies, due to the turbulence in the EMS and strong changes in the economic cycle. Both circumstances should have affected the competitive position of export firms. Though some evidence exists that such events affect export margins (see, for example, Gordo and Sánchez Carretero (1997)), it is always based on macroeconomic data, mainly the evolution of aggregate price indexes, and not on firm data.

We are interested not only in testing the differences in margins related to export and domestic activities, but also analyzing how the evolution of domestic and foreign demand and the evolution of nominal exchange rate affect both margins. To answer these questions, we follow a two-step approach. Firstly, we estimate a multiproduct cost function, obtaining different marginal costs associated to products sold in domestic and export markets. Secondly, departing from these estimated marginal costs, we calculate the price-marginal cost margins separately for each market.

The rest of the paper is as follows: In section II, the theoretical framework is explained. In section III, we present the estimate of the multiproduct cost function and the foreign and domestic margins. Finally, section IV presents the conclusions.

The results obtained indicate that the average marginal costs of the production sold in export markets are greater than those of the production sold in domestic markets. At the same time, the price-marginal cost margin in the export market is smaller than in domestic markets. We found that price-cost margins are procyclical in the domestic market, but there is no evidence of this behaviour in the foreign markets. Additionally, the evolution of the nominal exchange rate presents the expected sign in the explanation of the domestic margin but it is non-significant. There is no evidence that firms used the devaluations of the peseta in 1992 and 1993 to increase the margins in export markets. Finally, price-cost margins reveal some degree of heterogeneity across industries in both markets but the margin is bigger in the domestic in the most industries.

II. Theoretical benchmark and econometric specification

We consider a firm selling a product in two different markets, home and foreign, characterised by imperfect product competition. The price-cost margins in both markets can be expressed, as usual, from[4]:

$$P_j\,(1-\mu_j) = C_j' \qquad j=d,x \qquad [1]$$

where C_j' is the marginal cost in each market, p_j is the price of sales in domestic (d) and foreign (x) markets and μ_j is the price-marginal cost margin in each market.

Of course, if μ_j is expressed in terms of the demand elasticity and conjectural variations of the firm, the expression [1] can be interpreted as the first order condition of the joint profits maximisation of a firm selling in domestic and foreign markets and without capacity restrictions. With perfect competition, μ_j is equal to zero and price is equal to marginal cost. If the firm faces monopolistic competition in each market, μ_j is equal to the inverse of demand elasticity. If the firms operate in an oligopolistic context, μ_j reflects not only demand elasticity but also strategic behaviour of firms. In this context, μ_j can be expressed as $\lambda_j^i/\varepsilon_j$, where $\lambda_j^i \left(= \partial \ln \sum_i y_j^i / \partial \ln y_j^i\right)$ is the conjectural elasticity of firm i in market j, and ε_j is the demand elasticity in that market. Bernstein and Mohnen (1991) assume that the firms work in an oligopolistic context and evaluate both parameters separately[5]. However, we do not assume any predetermined context of imperfect competence, so that the

[4] We omit the superscript about firms for simplicity.

parameter μ_j measures the market demand elasticity as well as the strategic behaviour of rival firms.

Information about marginal costs and the level of prices in each market are required to obtain specific margin (μ) for each j market in the expression [1]. The latest information is scarcely available. However, expression [1] can be rewritten as:

$$\frac{P_j Y_j}{C}(1-\mu_j) = \frac{\partial \ln C}{\partial \ln Y_j} \qquad j = d, x \qquad [2]$$

This identity has some advantages with respect to the identity [1]. To estimate the price-marginal cost in each market, the prices of sales in each market are not necessary; it is enough to have the real sales sold in each market. Therefore, only a market-specific index price is required[6].

To estimate the identity [2], it is necessary to obtain the elasticity of cost with respect to production sold in both markets. We assume a short-term context where capital stock is considered as a fixed factor. The variable cost function is defined as:

$$C = C\,(P_f, Y_j, K, t) \qquad [3]$$

[5] To do that, they include the inverse demand functions in the set of equations to estimate, identifying the price elasticity.
[6] The information given by the ESEE allows us to calculate prices index (see Appendix 1).

where Y_j is the vector of output sold in domestic (d) and foreign (x) markets[7], P_f is a vector of prices of the variable factors (labour (L) and intermediate inputs (M)), K is capital stock and t is a time trend approximating the technology state. All firms in the industry face the same variable factor prices. The cost function has the usual properties: it is increasing in variable factor prices and outputs, and it is also homogeneous of degree one in the factor prices.

Two outputs enter into the cost function because, even if they are physically alike, variable costs include some costs that can differ among the outputs. The most striking of these are transport costs, which are clearly related to distance and, therefore, assumed to be larger in sales in foreign markets. Accordingly, other costs, such as advertising costs, can be positively related to sales in non-domestic markets. However, no other variable costs associated to exports, such as sunk costs for establishing delivery channels in export markets, are considered in this short-term benchmark.

Following the usual line in this literature, a multiproduct translog function is specified[8]. As it is known, the translog function is a more flexible way to specify a cost function than other alternatives, such as a Cobb-Douglas function, and does not impose the restrictions of homotheticity and separability. The translog function is written as:

[7] We only have information about the total production of firms. Foreign production is approximated by exports. Domestic production is approximated by total sales minus exports.
[8] An alternative specification is the generalized translog function, which would permit us to work with observations equal to zero (Caves et al (1980)). However, our interest in this work lies in firms operating simultaneously in both markets.

$$\ln C^* = \ln\left(\frac{C}{P_M}\right) = \beta_0 + \sum \beta_{1j}\ln(Y_j) + \beta_2 \ln(w) + \beta_3 \ln(K) + \beta_4 \ln(Y_d)\ln(Y_x) +$$
$$\sum \beta_{5j}\ln(Y_j)\ln(w) + \sum \beta_{6j}\ln(Y_j)\ln(K) + \beta_7 \ln(w)\ln(K) + \frac{1}{2}\sum \beta_{8j}[\ln(Y_j)]^2 + \qquad [4]$$
$$\frac{1}{2}\beta_9[\ln(w)]^2 + \frac{1}{2}\beta_{10}[\ln(K)]^2 + \varepsilon$$

where w is the ratio P_L/P_M. In the previous specification, the restrictions corresponding to a degree one homogeneous cost function (in variable input prices, P_L and P_M) have been included. Such restrictions are:

$$\beta_2 + \beta_2^{'} = 1,\ \beta_{5d} + \beta_{5d}^{'} = 0,\ \beta_{5x} + \beta_{5x}^{'} = 0, \beta_7 + \beta_7^{'} = 0$$

where the parameters with and without tilde are associated, respectively, with variables $\ln(P_M)$ and $\ln(P_L)$ of a non-restricted cost function. Additionally, a time trend has been included in the estimations to get the technical progress.

The estimate of the translog cost function [4] permits us to obtain the elasticity of costs with respect to production sold in both markets as:

$$\frac{\partial \ln C^*}{\partial \ln Y_j} = \beta_{1j} + \beta_4 \ln(Y_j^{'}) + \beta_{5j}\ln(w) + \beta_{6j}\ln(K) + \beta_{8j}\ln(Y_j) \quad j = d, x \qquad [5]$$

In the works previously quoted, the equation set (cost function [4], the elasticity of the costs [5] and the margin equations [2]) was estimated as a complete system using the full information maximum likelihood estimator. In these cases it is usual to include an additional equation: the share of labour cost to variable cost.[9] Though the latter is not necessary to

[9]The share of labour cost to the variable costs can be estimated following Shepard's lemma:

identify the parameters, it is included in the set of equations for efficiency's sake. However, in this work a different perspective is used. Firstly, we estimate the variable cost function using instrumental variables. Taking these results, we calculate $\partial \ln C^* / \partial \ln Y_j$ for each firm in both markets. From the estimated elasticities, the identity [2] permits us to calculate the price-marginal cost margins in each market.

The estimations of cost functions produce additional results. We can obtain two measures of the effects of changes in factor prices on input demands: the substitution elasticity (Allen-Uzawa) between variable inputs and the own-price elasticity of input demand. Departing from translog cost function, both can be written as:

$$\sigma_{ML} = \sigma_{LM} = 1 - \frac{\beta_9}{S_L S_M}$$

$$\varepsilon_{LL} = \sigma_{LL} S_L = \frac{\beta_9 + S_L (S_L - 1)}{S_L^2} S_L$$

$$\varepsilon_{MM} = \sigma_{MM} S_M = \frac{\beta_9 + S_M (S_M - 1)}{S_M^2} S_M$$

where S_L and S_M are the share labour cost and intermediate inputs cost to variable costs. On the one hand, the own-price elasticities should be negative. On the other, the sign of substitution elasticities defines the character of inputs: complements (negative) or substitutes (positive).

$$S_L = \frac{\partial \ln C}{\partial \ln P_L} = \frac{P_L X_L}{C} = \beta_2 + \sum_j \beta_{5j} \ln(Y_j) + \beta_7 \ln(K) + \beta_9 \ln(w)$$

Finally, to evaluate the scale elasticity in a short-term context and a multiproduct function, we use, following Caves et al. (1981):

$$RS = \frac{1 - \partial \ln C^{*} / \partial \ln K}{\sum_{j} \partial \ln C^{*} / \partial \ln Y_{j}}$$

A value of RS equal (smaller, bigger than) to one reflects constant (decreasing, increasing) returns to scale.

III. Empirical results.

The sample used consists of a panel of Spanish manufacturing exporting firms for the period 1990-1997. The variables were obtained from the *Encuesta sobre Estrategias Empresariales* (ESEE, Survey on Business Strategies). This survey is carried out yearly by the Spanish Ministry of Industry and the Fundación Empresa Pública. The population considered in this survey is about 2000 manufacturing firms that have ten or more employees.

We work with a balanced panel of exporting firms in the period 1990-97. Forty percent of small firms (less than 200 employees) exported during this period. For larger firms, (more than 200 employees) this percentage surpasses 80%. We have excluded firms exporting less than 5% or more than 95% of their sales more than four years. Additionally, we lose some firms that do not give enough information to calculate the capital stock and price variations needed in order to obtain the price index of intermediate inputs and the price indexes of domestic and foreign markets. The number of available firms, after those with incomplete information were dropped, is 331. We do not have enough information to estimate the price-cost margins for specific industries, and for this reason we work with the overall industry. However, industry effects will be included in the estimations in order to capture cross-industry differences. Information about the main descriptive statistics is shown in Table A1 of Appendix 2.

Note that though some of the surveyed firms are integrated in foreign-owned groups, especially in the case of larger firms, we only pay attention to Spanish firms, not to the overall group of firms. Therefore, our cost measurement is not biased by the usual behavior of multinational firms that produce in several countries. Although the measurement of imported intermediate inputs would be affected if transfer pricing practices were important, it does not affect the differences in margins in both markets.

Table 1 shows the level estimations of the translog cost function [4] by instrumental variables. We assume that firms are price-takers in variable input markets, so variable input prices are considered exogenous. However, endogeneity in sales in both markets is assumed. To estimate this equation, we use the Generalised Method of Moments (GMM) procedure proposed by Arellano and Bond (1991). The estimation is carried out instrumenting the variables shown in Table 1 at t with their cross-section lagged values at t-2. The identification condition depends on whether lagged values of the endogenous variables are valid instruments. The Sargan test of overidentifying restrictions, a test of instrument validity, is presented at the bottom of the columns and the validity of instruments is accepted. The residual autocorrelation tests m_1 and m_2 denote correlation in the level estimate. We think that this correlation is caused by the existence of individual firm heterogeneity. When we produced a first difference estimate, the values of the m statistics denoted the presence of an MA(1) process, as we can expect after taking differences of uncorrelated residuals. Unfortunately, the marginal costs predicted by the first difference estimation produce unacceptable domestic and foreign margins.

Industrial dummies are included to try to capture some specific industry effects common of firms[10]. The Wald test at the bottom of Table 1 confirms their significance. The

[10] 18 manufacturing industries have been introduced.

estimation also includes a time trend[11], whose associated parameter can be seen as technical progress and, given that a cost function is being estimated, the expected sign is negative. The estimated value in Table 1 is –2.7.

Table 2 presents the Allen-Uzawa partial elasticities of substitution, the own-price elasticities of demand, returns to scale economies, and marginal costs derived from level estimations. We have used the sample average of the share of labour cost (S_L=0.31) and intermediate inputs (S_M=0.69) to total variable costs to calculate the elasticities. As can be seen, price elasticities are negative and the inputs (labour and intermediate materials) are substitutes. The scale elasticity value is one, so firms seem to operate under constant returns to scale.

The estimate of the translog cost function permits us to obtain individual predictions of the $\partial \ln C^*/\partial \ln Y_j$ (see expression [5]). More than eighty-four percent of the predictions are positive, while the majority of negative predictions are very near zero. Those negative predictions are from firms with a very low share of domestic sales or exports with respect to total sales, less than 10%. Insofar as this feature is more common in the case of sales in export markets than in domestic markets, there is a larger number of negative predictions of marginal costs linked to export activity.

The marginal costs for each firm have been evaluated as $\partial C/\partial Y_j = C\ \partial \ln C^* / Y_j\ \partial \ln Y_j$. Table 2 shows the predicted values for the subsample with positive predictions, and for the overall sample. The average marginal cost has been calculated in two ways. In the first one,

[11] Some authors include the time trend multiplied by explicative variables in translog functions. In our case

we calculated the sample average of the individual marginal cost for each firm. In the second one, the expression [5] is evaluated in the average of the variables. The predictions show, as was expected, a larger average marginal cost for sales in export markets**.** However, there is a non-linear relationship between the export ratio (proportion of output sold in the foreign market) and the differences in marginal costs. As can be seen in Table 3, firms who sell a similar proportion of their output in both markets present a larger average marginal cost in the export market. This does not happen, however, for firms which sell most of their output in one of the markets, and which represent a small proportion of the sample.

From expression [2] and the individual predictions of the elasticity of the cost with respect to the real sales in each market (expression [5]), it is possible to calculate the individual price-cost marginal. To do that, we have restricted the sample to the positive predictions of the marginal cost. Figure 1 shows the distributions of the average domestic and foreign margins for the period 1991-1997 for each firm. Both distributions are slightly skewed with a big proportion of firms on the right tail. Comparing the domestic and the foreign price-cost marginal margins, there is a bigger proportion of firms with positive margins in the domestic market. More than 65% of firms present a domestic margin between 0.1 and 0.3. However, there are some firms (about 7%) which present a higher foreign margin (more than 0.5) than domestic price-cost marginal margin.

Figure 2 shows the distribution of the average margin in both markets, weighting the foreign and the domestic margin for the export ratio (exports over sales) and domestic sales ratio (one minus export ratio) respectively. The distribution is skewed with almost all the firms on the right tail. Only 11% of individual firms' average margins fall below zero. The

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these variables are non-significant.

results are consistent with international studies that examine the price-marginal cost margin with firms' data (see, for example, Nishimira *et al.* (1999)).

Table 4 presents the sample average of the margins for the whole period and for each year. Although there is a huge heterogeneity between firms, the average price-cost margin of firms in foreign markets was smaller than the average price-cost margin in the domestic markets in the entire period. It seems that the domestic price-cost marginal margins are procyclical with the smallest value in 1992, but there is no evidence of this behaviour in the price-cost margins in the foreign market. This behaviour in the foreign market can be affected by the evolution of the nominal exchange rate. As can be seen in Figure 3, the average margin is procyclical with the smallest value in 1993.

The cyclicality of the margin has been intensely discussed in the literature. To give more information about that, Table 5 presents some estimations of the margin for both markets, considering only the positive predicted values of marginal costs. The margins have been parameterised in two alternative ways. In the first one, the parameterization takes into account the heterogeneity of firms over different activities, which also have a different behavior over the business cycle. These industry characteristics are related to demand elasticity.

$$\mu_{it}^{d} = \mu_{s}^{d} + \beta_{0}^{d}\ D_{it}^{d}, \qquad\qquad \mu_{it}^{x} = \mu_{s}^{x} + \beta_{0}^{x}\ D_{it}^{x} \qquad [6]$$

where μ_s are fourteen industry dummies and D_{it}^{d} and D_{it}^{x} are individual indicators of the business cycle for each firm in domestic and foreign markets respectively. An increase in these indicators means an improvement in the market conditions of firms. Table A2 of Appendix 2 presents the sample averages of these variables. The second parameterization also takes into account the possible effect of the variation of the nominal exchange rate in the price-marginal cost margin of the firms ($NERV_{it}$).

$$\mu_{it}^{d} = \mu_{s}^{d} + \beta_{0}^{d} \, D_{it}^{d} + \beta_{1}^{d} \, NERV_{it} \,, \qquad \mu_{it}^{x} = \mu_{s}^{x} + \beta_{0}^{x} \, D_{it}^{x} + \beta_{1}^{x} NERV_{it} \qquad [7]$$

where $NERV_{it}$ is an individual indicator of the evolution of the nominal exchange rate. An increase of this indicator means a devaluation (or depreciation) of our currency (see Table A2 of Appendix 2).

The second and third columns of Table 5 present the estimate using the first parameterisation[12]. As was said before, the average price-cost margin of firms in foreign markets was smaller than the price-cost margin in the domestic markets for the whole period. The coefficient for the individual indicator of the business cycle (D_{it}^{d}) presents the expected sign –positive- in the estimate of the domestic margin. However, it presents an unexpected sign in the estimate of foreign margin, although it is non-significant. It seems, therefore, that domestic price-marginal cost margins are clearly procyclical, but there is no evidence of this behaviour in the price-cost margins in foreign markets. Figure 4 plots the domestic (foreign) business cycle indicator and the predictions of both price-marginal cost margins for the estimate of Table 5. As can be seen, the behaviour of domestic price-cost margin follows the evolution of the domestic cycle indicator. With respect to the foreign market margin, it increased in 1992 and 1993 (the

[12] Table 5 presents pool estimates. We have also considered that the individual effects are correlated with the explanatory variables. The Haussman test cannot reject the null hypothesis of no correlation. The random effects estimation is quite similar to the pool estimation and for this reason we only present the latter.

years of the devaluation of the peseta) although the foreign cycle indicator decreased in these years.

Columns four and five of Table 5 present the estimate using the second parameterisation. As can be seen, the parameter associated to $NERV_{it}$ presents the expected sign (negative) in the estimate of domestic margin although it is non-significant. The depreciation of our currency increases the prices of imported inputs and reduces the domestic margin. However, it presents an unexpected sign in the estimate of the foreign margin although it is non-significant. These results seems to indicate that, at least in the long term, Spanish export firms did not use the devaluations of our currency in 1992 and 1993 to increase the margins in exports markets. It would indicate a high degree of exchange rate pass through to export price (in foreign currency) and/or that the effect of devaluations on imported intermediate input prices partially absorbed the positive short-term effect of devaluations on export prices. In that sense, this evidence is not so optimistic about the recovery of export margins after the devaluations of the peseta in 1992-1993 as the previous evidence, which had departed from an industry perspective (Gordo y Sánchez Carretero (1997)).

The parameterisation of margins allows us to obtain industry-specific effects, μ_s (see expression [6] and [7]). The parameters estimated from the industries' price-cost margins for estimation (1.2) of Table 5 are shown in Table 6. The estimates reveal some degree of heterogeneity in price-cost margins across different manufacturing industries, bigger in the domestic than in the foreign market. The domestic margin is significantly greater than zero in most industries, suggesting that firms possess significant domestic market power. The foreign margin is smaller than 0.1 in six of the fourteen industries, suggesting smaller foreign market power. Paper, printing and publishing and other manufacturing industries are the exceptions, a with smaller margin in the domestic market the entire period.

IV. Conclusions

It is usually assumed that the differences in the competitive environment or in the evolution of the demand among markets, added to the specific disturbing effect of exchange rate variations, could generate differences in the levels and evolution of the price-cost margins between domestic and foreign markets. However, an additional effect could be derived from the existence of different marginal costs associated to sales in distinct geographical markets. In this paper we calculate margins for each market, taking into account such differences. The method used is adapted to the information usually available in firm surveys.

The obtained results indicate that Spanish manufacturing export firms have larger average marginal costs for exports than for sales in domestic markets. In a short-term context, with fixed capital stock, such differences should be mainly due to the effect of transport costs, though other effects could play a role (e.g., differences in marketing costs associated to export markets). A more precise test would require some measurement of transport costs, data which is scarcely available[13].

Additionally, the estimated price-cost margins differentiated by markets show that the average margin in export markets was smaller than in domestic markets throughout the period. Besides, the evolution along the period was distinct. The domestic price-marginal cost margin is procyclical: the margin fell until 1993 and increased in the other years. At the end of the period, domestic margins were bigger than those in 1991. We do not find evidence of procyclical behaviour or a significant effect of nominal exchange rate variations on export margins. The result is a slight process of convergence between both margins until 1993. However, the domestic price-cost margin still continued behind the foreign margin in 1997, and the differences even increased. The average margin is procyclical, according to previous studies of the Spanish economy (see, for example, Fariñas y Huergo (1999)) and with international studies examining the cyclicality of margin with firms' data (see, Nishimira et al. (1999)).

These results complement those obtained in the context of "Pricing to Market" literature. In that case, non-complete exchange rate pass through and price stickiness (in local currency) suggest that export margins partially absorb the exchange rate fluctuations. However, as Golgberg and Knetter (1997) have pointed out, the difficulty in measuring marginal costs can bias the results. Though Knetter (1993) proposed a simple empirical way to avoid it, it is based on some crucial assumptions, such as homogenous variations of marginal costs across firms and industries, and is only valid for cross-sectorial comparisons of prices. The results of this paper confirm such variations in export margin, but suggest that the results in PTM literature could be overestimating the effects of exchange rate variations on export margins, as they do not properly consider the marginal costs variations.

[13] The evidence obtained by some authors points out the relevance of considering them in the case of some key prediction of industrial organisation literature (see Newmark (1998)).

Appendix 1: Variable definitions.

C (Variable costs): The sum of intermediate consumption (raw materials purchases, energy and fuel costs and other external services) plus labour costs minus the stock variation.

W (Cost per worker relative to price of intermediate inputs): P_L/P_M, where:

P_M (Price index for intermediate inputs): It is calculated as a Paasche index, weighting the price variations of raw materials, energy and services purchased of surveyed firms.

P_L (Cost per worker): Labour cost divided by the average workers of the firm during the year.

Y_x (Output sold on the export market): It is calculated deflating nominal exports by export price (P_x).

Y_d (Output sold on the domestic market): It is calculated deflating nominal domestic sales by domestic price (P_d). Domestic sales are the total sales of the firm minus its exports.

P_d and P_x (Domestic and foreign prices): The surveyed firms give annual information about markets served (up to five), identifying their relative importance (in percentage) in total sales of the firm. Additionally, each firm identifies the geographical area and the variation of price with respect to the previous year. This information allows us to calculate a price index for each market, using the proportions with respect to total sales as weighting.

K (Capital stock): It is net stock of capital for equipment in real terms. It is calculated using the perpetual inventory formula:

$$K = (1-d)K_{t-1}\frac{P_t}{P_{t-1}} + I_t$$

where P is the price index for equipment, d are the rates of depreciation, and I is the investment in equipment. For details about the elaboration of this variable, see Martín and Suárez (1996).

D_{it}^{d}, D_{it}^{x} (Individual indicator of business cycle for each firm in domestic and foreign market): In the ESEE survey, each firm identifies the behaviour of market demand during one year with respect to the previous years according to three different categories: expansion, stability and recession. A value of 1, 2 and 3 is assigned respectively to each category. The domestic and foreign indexes are constructed weighting the previous values over all domestic and foreign markets defined by the firm. The weights are the proportion of sales in each market with respect to total sales.

$NERV_{it}$: In the ESEE survey, export firms identify the export destiny. They distinguish between the European Union, the rest of the OCDE and the rest of the world. An individual nominal exchange rate has been calculated weighting the Spanish nominal exchange rate with respect to these areas. The weights are the proportion of exports sold in each area with respect to total exports.

Appendix 2

Table A1
Variable descriptive statistics
(Logarithm variations rates, 1991-1997)

	Average	**Standard deviation**
Output sold in domestic market (Y_d)	1.5	36.0
Real exports (Y_x)	13.0	52.1
Nominal output sold in domestic market (P_d Y_d)	3.0	36.3
Exports (P_x Y_x)	14.5	52.1
Total real sales	5.0	21.0
Cost per worker (P_L)	5.8	17.3
Price index for intermediate inputs (P_M)	3.6	5.7
Cost per worker relative to price of intermediate inputs (w)	2.2	18.1
Stock of real capital (K)	6.4	23.3
Variable costs (C)	6.8	21.9
Variable costs relative to the price index for intermediate inputs (C^*)	3.2	21.7

Table A2
Variable descriptive statistics
(Sample averages)

	1991	**1992**	**1992**	**1994**	**1995**	**1996**	**1997**
D_{it}^d	0.45	0.34	0.32	0.63	0.58	0.59	0.63
D_{it}^x	0.47	0.40	0.41	0.67	0.63	0.63	0.67
$NERV_{it}$	-0.006	0.026	0.114	0.069	0.012	-0.004	0.041

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Table 1
Cost function estimate
Dependent variable: $C^* = C / P_M$
Estimation method: Instrumental variables of the levels.

	Coefficients	t-statistics
β_0	3,789	(8,3)
β_{1d}	0,427	(2,9)
β_{1x}	0,077	(0,7)
β_2	0,489	(2,4)
β_3	-0,021	(-0,2)
β_4	-0,185	(-12,1)
β_{5d}	-0,040	(-0,9)
β_{5x}	-0,064	(-2,5)
β_{6d}	0,055	(2,7)
β_{6x}	-0,007	(-0,3)
β_7	0,067	(1,8)
β_{8d}	0,069	(5,1)
β_{8x}	0,114	(10,9)
β_9	0,101	(2,7)
β_{10}	-0,027	(-2,6)
T	-0,027	(-9,4)
MOV1	-0,020	(-0,2)
MOV2	-0,147	(-2,8)
Instruments	GMM (2,1): y_d, y_x, $y_d y_x$ y_d^2, y_x^2, $y_d w$, $y_x w$, $y_d k$, $y_x k$	
Sargan test	45,8 (48)	
Industrial dummies test	175,0 (17)	
Temporal dummies as instruments	Yes	
M_1	14,4	
M_2	13,0	
Number of firms	331	
Years	1991-97	
Number of observations	2317	

Note: T-statistics are robust to heterocedasticity. M_1 and M_2 are statistics of first and second correlation. We have used the general method of moments instruments (GMM). In the Sargan test and industrial dummies, freedom degrees are in brackets. Its detailed interpretation, as well as the meaning of the Sargan test, may be found in Arellano and Bond (1991).

Table 2
Elasticities, returns to scale and marginal cost

σ_{LM}	0,056
ε_{LL}	-0,038
ε_{MM}	-0,017
$\partial lnC/\partial lnk$	0,031
Returns to scale (RS)	1,031
MgC_d	
Firm's marginal cost average	0,910
Marginal cost evaluated at the average of the variables	0,856
MgC_x	
Firm's marginal cost average	0,974
Marginal cost evaluated at the average of the variables	1,012
Predictions of MgC>0	2004

Note: Calculus from the estimate of Table 1

Table 3
Marginal cost and export ratio

	(1)	
Export ratio	**MgC_d**	**MgC_x**
< 20%	0,871 (472)	0,780 (472)
20% - 60%	0,848 (1135)	1,050 (1135)
> 60 %	1,135 (397)	0,990 (397)

Note: Number of observations in brackets.

Table 4
Domestic and foreign price-cost margins
(Sample averages)

	1991-97	1991	1992	1993	1994	1995	1996	1997
μ^d	0,142 (0,205)	0,145 (0,232)	0,117 (0,236)	0,122 (0,223)	0,135 (0,201)	0,148 (0,186)	0,166 (0,181)	0,158 (0,172)
μ^x	0,080 (0,270)	0,090 (0,301)	0,088 (0,288)	0,089 (0,290)	0,068 (0,259)	0,071 (0,260)	0,090 (0,247)	0,068 (0,246)
μ	0,129 (0,140)	0,134 (0,159)	0,118 (0,152)	0,116 (0,159)	0,124 (0,143)	0,127 (0,128)	0,143 (0,122)	0,137 (0,118)
Number of obs.	2004	260	263	279	292	298	309	303

Note: Standard deviations in brackets.

Table 5
Estimates of domestic and foreign price-cost margins
Dependent variables: μ_{it}^{d}, μ_{it}^{x}

	(1.1)		(1.2)	
	Domestic (μ_{it}^{d})	**Foreign (μ_{it}^{x})**	**Domestic (μ_{it}^{d})**	**Foreign (μ_{it}^{x})**
μ	0,113 (11,8)	0,107 (8,5)	0,122 (12,7)	0,109 (7,9)
$\mathbf{D_{it}^{d}}$	0,058 (4,2)		0,055 (4,0)	
$\mathbf{D_{it}^{x}}$		-0,021 (1,2)		-0,022 (1,3)
$\mathbf{NERV_{it}}$			-0,207 (1,8)	-0,045 (0,3)
N. of observ.	2004	2004	2004	2004

Note: μ is the average of 14 industry dummies. t-statistics (in brackets) are robust to heterocedasticity.

Table 6
Parameter estimates for price-marginal cost margins
(Estimate 1.2 of Table 5)

Parameter estimates of μ_j:	μ^d	μ^x
1. Basic metal products	0,151 (9,6)	-0,066 (2,1)
2. Non-metal mineral products	0,148 (10,8)	0,175 (7,8)
3. Chemicals	0,127 (6,3)	0,137 (5,2)
4. Fabricated metal products	0,142 (10,5)	0,147 (7,5)
5. Industrial and agricultural equipment	0,169 (9,8)	0,097 (4,3)
6. Electrical engineering	0,113 (6,8)	0,058 (2,3)
7. Vehicles and other transportation materials	0,097 (6,5)	0,012 (0,6)
8. Food, tobacco and drinks industries	0,069 (3,2)	0,042 (1,7)
9. Textile and clothing	0,130 (11,7)	0,090 (4,4)
10. Leather, fur and footwear	0,183 (8,6)	0,070 (2,2)
11. Timber and furniture	0,186 (12,2)	0,186 (4,5)
12. Paper, printing and publishing	-0,065 (1,0)	0,177 (4,4)
13. Plastic and rubber products	0,139 (9,1)	0,148 (5,4)
14. Other manufacturing industries	0,117 (4,0)	0,254 (7,8)

Figure 1
Distribution of firms' margins

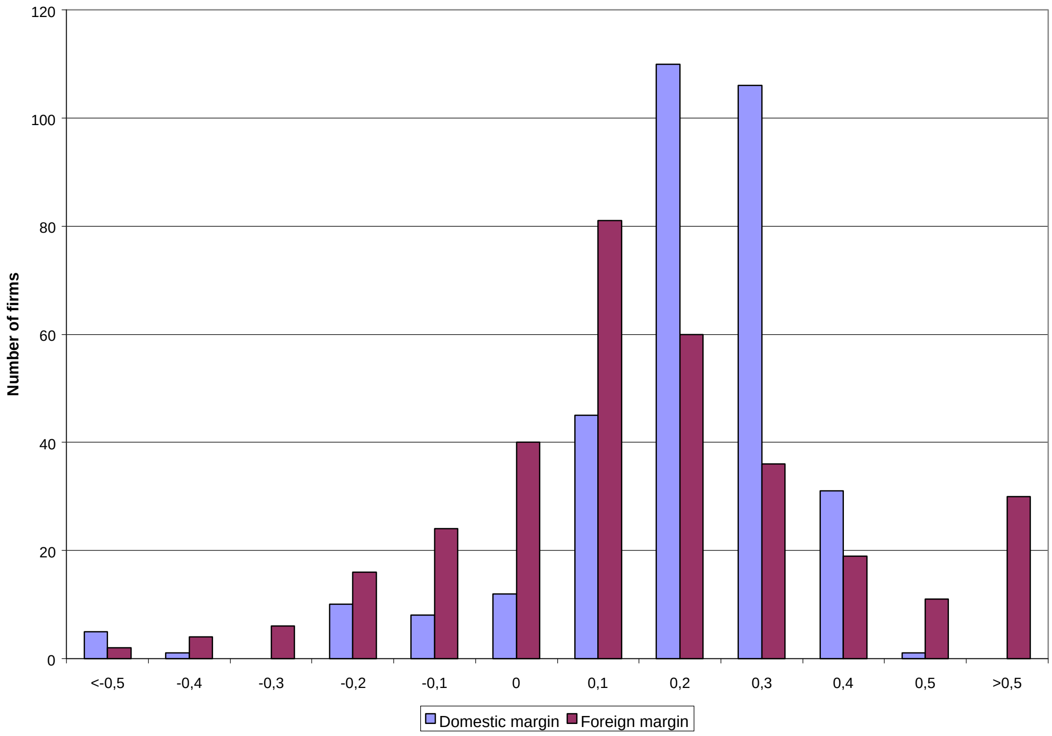

Figure 2
Distribution of average margin

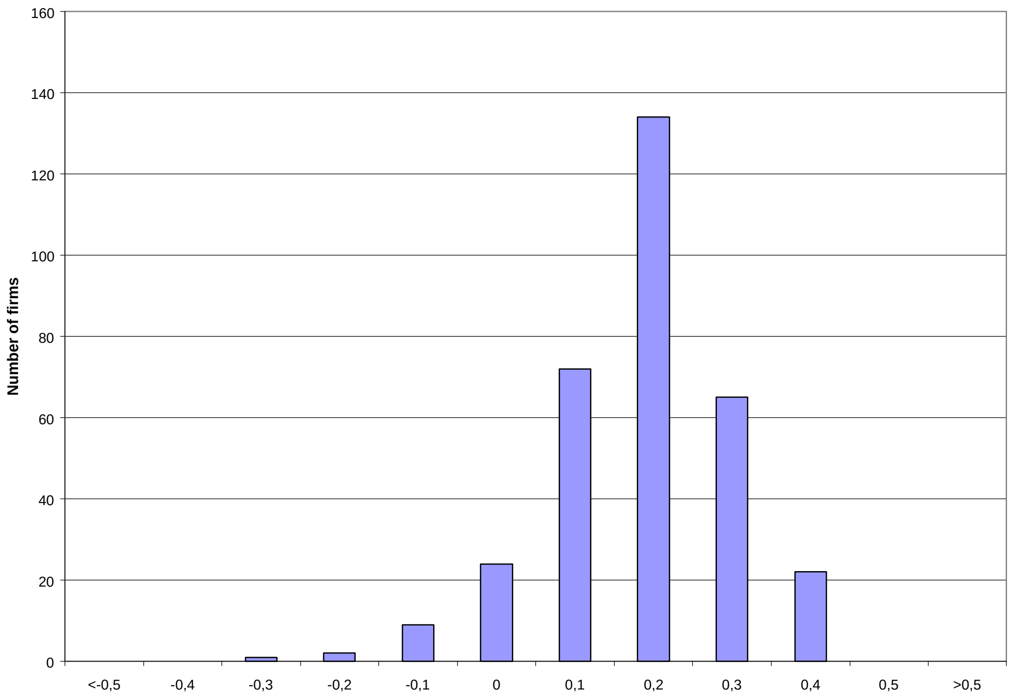

Figure 3

Price-cost marginal margins evolution

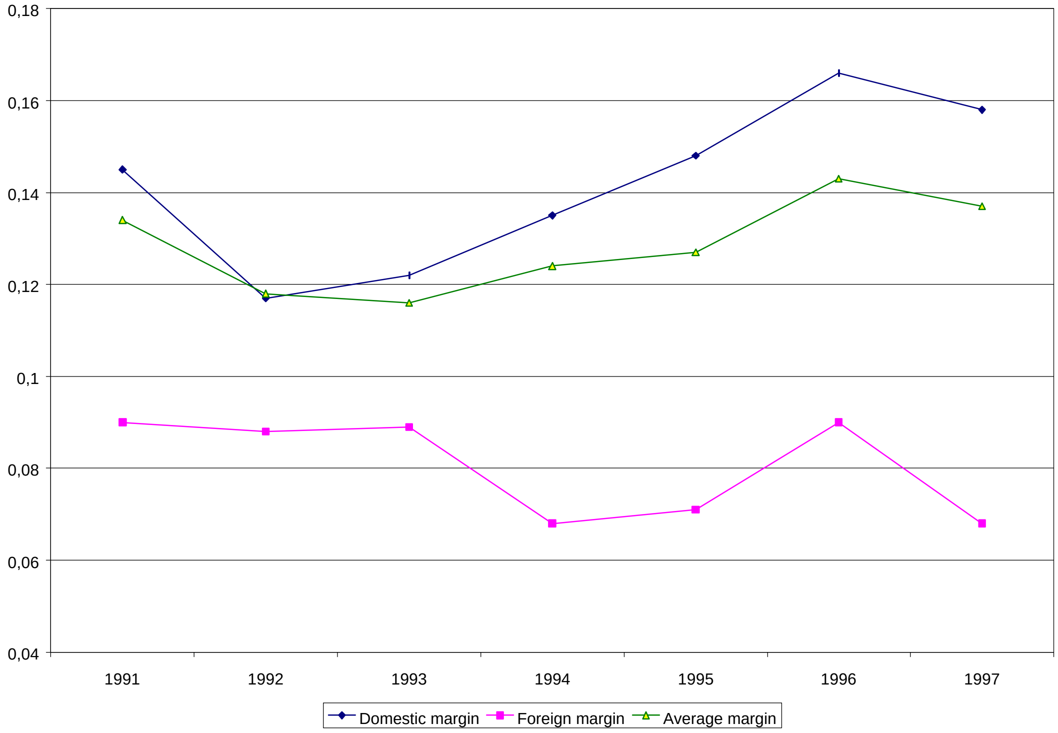

Figure 4

Price-cost marginal margins and business cycle indicators