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Domestic and Foreign Price-Marginal Cost Margins: An Application to Spanish Manufacturing Firms *

Lourdes Moreno
Diego Rodríguez

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LRH: Lourdes Moreno and Diego Rodriguez

Abstract
This paper investigates the differences in margins of export and domestic markets for Spanish manufacturing firms in the period 1990-1997. We estimate jointly a multiproduct cost function, a variable factor share equation and two price-marginal cost margin equations. The results obtained indicate that the marginal cost of production sold in export markets is slightly greater than in domestic markets. At the same time, the price-marginal cost margins in export markets are smaller than in domestic markets. We also find strong evidence that margins are procyclical in the domestic markets, but this evidence is less clear in the foreign markets.

* Moreno: Departamento de Fundamentos del Análisis Económico I, Universidad Complutense de Madrid, Campus de Somosaguas 28223, Madrid, Spain. Tel: +34-91 3942408, E-mail: lmoreno@ccee.ucm.es. Rodríguez: European Economy Group (UCM) and FEP, Departamento de Economía Aplicada II, Universidad Complutense de Madrid, Campus de Somosaguas 28223, Madrid, Spain. Tel: 34-91-3942471, E-mail: drodri@ccee.ucm.es. The authors gratefully acknowledge helpful comments from two anonymous referees. The paper has also benefited from the suggestions of participants at the 26th Annual EARIE Conference in Torino, and at the VI Jornadas de Economía Internacional in Valencia, and seminars in Warwick and Barcelona. This research has been partially funded by the projects SEC2000-0268 and SEC2000-0723.

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Address of Contact Author: Lourdes Moreno, Departamento de Fundamentos del Análisis Económico I, Facultad de Ciencias Económicas, Universidad Complutense de Madrid, Campus de Somosaguas 28223, Madrid, Spain. Tel: 34-91-3942408, Fax: 34-91-3942561. E-mail: lmoreno@ccee.ucm.es

1. Introduction

Some classical studies of Industrial Economics have analyzed the effect of import and export activities on the 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, so that there is a larger domestic price-cost margin relative to the foreign margin. An extreme situation would be one in which 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 may be that domestic exporters sell to specific fringe demands of foreign countries where demand is less elastic than the domestic demand. If the domestic firm is not a price taker in the international markets, it is possible to find market power abroad as well as in the home market, and in this sense profits related to sales in foreign market would be higher than domestic sales profit. In addition to the differences in demand elasticities and in the competitive environment, differences in marginal costs could explain different margins between both markets. Even in the context of an homogeneous product, variable (e.g., transport) or sunk costs (e.g., costs associated to sales networks) related to exports could 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 ratio on the margin. For Swedish industry, Stalhammar (1991) obtains a non-significant effect of the export ratio 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.

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 through the estimation of price-cost margin equations, it directly analyzes price-cost margins from a structural econometric model. To do that, a cost or production function together with margin equations are estimated. It also allows us to determine additional parameters such as demand elasticity, pricing behavior and firm interdependence through conjectural elasticity[3]. Using that method, 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 industrial data and their model is applied to Canadian non-electrical machinery, electrical products and chemical products industries. They estimate the degree of oligopoly power in each industry, as well as the elasticities of both demands, through the specification of a multiproduct cost function, the share of labor cost in variable cost, foreign and domestic revenues over costs, 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 data at firm level and assumes monopolistic competition. 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 Chemical and Electrical and Electronic products, and finds that monopoly power over export markets is small.

This paper evaluates the domestic and foreign price-cost margins of Spanish export firms for the period 1990-97 using information at firm level. That period was especially relevant for the Spanish and other European economies, due to the turbulence in the European Monetary System and strong changes in the economic cycle. Both circumstances should have affected the competitive position of export firms. Though some evidence suggests that such events influenced export margins (European Commission, 1995), it is always based on macroeconomic data, mainly the evolution of aggregate price indexes. The period of time analyzed, though short, covers a complete cycle: the expansive period of the late eighties and the early nineties (1990-1991), the short recession (1992-1993), and the economic recovery of the late nineties (1994-1997). In this context, we are interested not only in testing the differences in margins related to export and domestic activities, but also in analyzing how the market environment (evolution of domestic and foreign demand) and the evolution of the nominal exchange rate affected both margins. To answer these questions, we estimate jointly a multiproduct cost function, a variable factor share equation and two price-marginal cost margin equations.

The rest of the paper is as follows. In section II, the theoretical framework is explained. In section III, we present the joint estimate for the overall industry and some specific industries. Special attention is dedicated to distinguish between structural (differences in domestic vs. foreign cost structures) and business-cycle issues. Finally, section IV presents the conclusions.

The results obtained indicate that the marginal cost of production sold in export markets is slightly greater than the marginal cost of production sold in domestic markets. At the same time, the price-marginal cost margins in export markets are smaller than in domestic markets. We find strong evidence that margins are procyclical in the domestic market, but this evidence is less clear in the foreign markets. Additionally, the evolution of the nominal exchange rate presents the expected sign in the explanation of the domestic and foreign margins but it is non-significant in both cases, especially in the foreign margin equation. Although, in the industry as a whole there is not clear evidence that firms used the devaluations of the peseta in 1992 and 1993 to increase the margins in export markets, in some specific industries the evolution of the margin in 1992 and 1993 can be explained by the evolution of the exchange rate.

2. Theoretical Benchmark and Econometric Specification

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

$$P_j(1-\mu_j) = C_j' \qquad j = d, x \tag{1}$$

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 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 it operates in an oligopolistic context, μ_j reflects not only demand elasticity but also the strategic behavior of firms.

The product market equilibrium conditions (equation (1)) can also be written as:

$$(P_j Y_j / C)(1-\mu_j) = \partial \ln C / \partial \ln Y_j \qquad j = d, x \qquad (1b)$$

where Y_j is output sold in domestic (d) and foreign (x) markets, and C is the variable cost. To estimate the margin in each market from equation (1b), the ratio of nominal sales sold in each market related to variable cost on the left and output elasticities on the right side are required.

With respect to the cost of the firms, a short-term context is assumed where capital stock is considered as a fixed factor. In this context, the variable cost function is defined as follows:

$$C = C\,(P_f, Y_d, Y_x, K, t) \qquad (2)$$

where P_f is a vector of prices of variable factors (labor (X_L) and intermediate inputs (X_M)), K is capital stock and t is a time trend which represents the state of technology. We assume that 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 factor prices.

Shephard´s lemma can be used to derive the equilibrium conditions for input demand: $S_f = \partial ln C / \partial ln P_f$, where $S_f = P_f X_f / C$ is the variable cost share of inputs.

Two outputs enter into the cost function because, even if they are physically alike[5], variable costs include some costs that could 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. Other costs such as advertising costs, can be positively related to sales in non-domestic markets. However, sunk costs for establishing delivery channels in export markets would not be considered in this short-term benchmark. This approach implies imperfect product substitution in the production function between output sold in domestic and foreign markets. In another context, several works have used this assumption. For example, Bergstrand (1985) and Baier and Bergstrand (2001) model the technology of production by a constant-elasticity-of transformation (CET) production where the elasticity of transformation of supply between home and foreign markets differs. They also justify the not perfect international product substitutability in production because of the presence of different costs in distributing and marketing the output in each market.

A multiproduct translog function is specified, which is a common practice in empirical work in this field. An alternative specification is the generalized translog function, which would permit us to work with observations equal to zero (Caves et al., 1980). However, it should be noted that we are interested in firms operating simultaneously in both markets. In this way we can be sure that differences in margins between markets are not due to differences in the type of firms: export and non-export firms. It is the same idea that underlies some studies about the differences in prices across markets (Aw et al., 2001)[6], which highlight the use of firm level prices for a more accurate measurement of the law of one price.

Additionally, as 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 empirical specification of the translog function is:

$$\begin{aligned} ln C^{*} = ln\left(C / P_M\right) &= \beta_0 + \sum_j \beta_{1j} \, ln Y_j + \beta_2 \, ln w + \beta_3 \, ln K + \beta_4 \, ln Y_d \, ln Y_x + \sum_j \beta_{5j} \, ln Y_j \, ln w \\ &+ \sum_j \beta_{6j} \, ln Y_j \, ln K + \beta_7 \, ln w \, ln K + (1/2) \sum_j \beta_{8j} \left(ln Y_j\right)^2 + (1/2) \beta_9 \left(ln w\right)^2 + (1/2) \beta_{10} \left(ln K\right)^2 \\ &+ \beta_{11} t + (1/2) \beta_{12} t^2 + \sum_j \beta_{13j} t \, ln Y_j + \beta_{14} t \, ln w + \beta_{15} t \, ln K + \varepsilon \end{aligned} \tag{3}$$

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. Additionally, a time trend and multiplied terms have been added to measure technical progress.

From the cost function, the cost share of labor factor can be estimated as:

$$P_L X_L / C = \beta_2 + \sum_j \beta_{5j} \, ln Y_j + \beta_7 \, ln K + \beta_9 \, ln w + \beta_{14} t + \tau \tag{4}$$

Since the sum of the two variable inputs shares equals unity, the intermediate inputs share can be treated as a residual. Though the labor share is not necessary to identify the parameters, it is included in the set of equations for the sake of efficiency.

Additionally, the equilibrium conditions for the product markets (equation (1b)) can be rewritten as follow:

$$(P_jY_j / C)(1-\mu_j) = \beta_{1j} + \beta_4 \ln Y_{-j} + \beta_{5j} \ln w + \beta_{6j} \ln K + \beta_{8j} \ln Y_j + \beta_{13j} t + \xi_j \qquad j = d,x$$

(5a and 5b)

where (P_jY_j / C) is the ratio of revenue for each product to variable cost.

Following the previous empirical works the equations (3), (4), (5a) and (5b) are estimated jointly. The equation set of Bernstein and Mohnen (1991) also includes, as was noted previously, the inverse product demand function for both markets. It is therefore possible not only to identify the price elasticity of the product demand but also the conjectural elasticities because the price-marginal cost margins depend on both components. In our case, we do not include the demand function in the set of equations because we are working with individual data. Our objective is to estimate the magnitude of mark-ups in both markets[7], though we do not identify what part of the differences between both margins is due to price-elasticity of product demand and what part is due to oligopoly structure and conduct.

The joint estimation produces some 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 the translog cost function, both can be written as:

$$\sigma_{ML} = \sigma_{LM} = 1 - (\beta_9 / S_L S_M)$$
$$\varepsilon_{LL} = \sigma_{LL} S_L = ((\beta_9 + S_L(S_L - 1)) / S_L^2) S_L$$
$$\varepsilon_{MM} = \sigma_{MM} S_M = ((\beta_9 + S_M(S_M - 1)) / S_M^2) S_M$$

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

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

$$ES = (1 - \partial \ln C^* / \partial \ln K) / (\sum_j \partial \ln C^* / \partial \ln Y_j)$$

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

3. Empirical Results

The sample used consists of a balanced 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 sampling scheme is conducted for each manufacturing NACE class (two-digit) level. Companies employing between 10 and 200 employees are chosen by a random sampling scheme and the rate of participation is around 4%. For firms employing more than 200 employees, the rate of participation is about 60%. The sample considered is about 2000 manufacturing firms that have ten or more employees each year.

According to that survey, forty percent of small-medium firms (less than 200 employees) exported during this period. For larger firms (more than 200 employees) this percentage surpasses 80%. Foreign sales are measured by exports and domestic sales are approximated by total sales minus exports. The output (Y_d and Y_x) has been calculated by deflating nominal sales of both markets by two price indexes, using information about price variations in each market provided by the firms themselves (see Appendix).

We exclude firms exporting less than 5% or more than 95% of their sales for more than four years. Additionally, we lo se some firms that do not give enough information to calculate the capital stock and price variations 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 excluded, is 331. Information about the main descriptive statistics is shown in Table 7 of Appendix.

Though some of the surveyed firms are integrated in foreign-owned groups, especially in the case of larger firms, we only have information about domestic (Spanish) firms, not about the overall group of firms. We have not observed that firms integrated in multinational corporations had different pricing variations policies with respect to non integrated firms[8]. Additionally, 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.

Total Industry Estimate

The main focus in this paper is the behavior of margins. We are specifically interested in two different issues. Firstly, in analyzing differences in margins according to destiny markets. Such differences can be due to differences in marginal costs and in the competitive environment (specifically, the demand elasticity faced by firms). Secondly, in analyzing the time behavior of margins and specifically the cyclicality of margins. Domestic and export margins have been parameterised to obtain information about these issues. Firstly, to take into account the heterogeneity of firms over different activities, a set of industrial dummies have been included. These industry characteristics are related to demand elasticity. Secondly, to consider the different behavior of firms over the business cycle, a demand indicator for each market is included. Finally, the parameterization also takes into account the possible effect of the variation of the nominal exchange rate on the margin. Therefore, we parameterize the margin (μ) according to the following equation:

$$\mu_{it}^{j} = \mu_{s}^{j} + \gamma_{0}^{j} D_{it}^{j} + \gamma_{1}^{j} NERV_{it} \qquad j = d, x$$

where μ_s are fourteen industry dummies, D_{it}^{d} and D_{it}^{x} are firm indicators of the business cycle for each firm in domestic and foreign markets respectively, and $NERV_{it}$ is a firm indicator of the evolution of the nominal exchange rate. Though the business-cycle and the evolution of the exchange rate are macroeconomic variables, the proxies included in the parameterization of the margins are individual variables. They are calculated from the information given by firms about their market demand evolution and export destinations. An increase in the business cycle indicators means an improvement in market conditions of firms, while an increase in the exchange rate means a devaluation (or depreciation) of domestic currency. Table 8 of Appendix presents the sample averages of these variables.

Including this parameterization in equations (5a) and (5b), the econometric specification of the margin equations is now:

$$(P_jY_j / C)\left[1-(\mu_s^{j} + \gamma_0^{j} D^{j} + \gamma_1^{j} NERV)\right] = \beta_{1j} + \beta_4 lnY_{-j} + \beta_{5j} lnw + \beta_{6j} lnK + \beta_{8j} lnY_j + \beta_{13j} t + \xi_j \qquad j = d,x$$

(6a and 6b)

Table 1 shows the joint estimate of the translog cost function (equation (3)), the cost labor share (equation (4)) and the margin equations for each market (6a and 6b) by the Generalised Method of Moments (GMM). 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. The estimation is carried out by instrumenting the endogenous variables with their cross-section lagged values at t-2. The identification of the parameters 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.

As in the margins equations, industrial dummies are also included in the cost function to capture some specific industry effects common to all firms, related to inter-industry differences in technical conditions. As can be seen at the bottom of Table 1, the F-test confirms their significance[9]. The time trend in the estimate of the cost function, whose associated parameter can be seen as technical progress, presents the expected sign, negative. The estimated value in Table 1 is –4.2. Although the specification of the translog cost function also includes the time trend multiplied by some explicative variables, the latter are not significant in the estimate. These results suggest neutral technical progress in this period. However, they can be conditioned for the short period that is considered in the paper.

Two kinds of results can be derived from the estimate showed in Table 1. Firstly, structural issues concerning domestic versus foreign cost structures and profit margins. Secondly, business cycle issues associated with demand and exchange rate evolution. We follow this order in the presentation of the results.

The estimate of the translog cost function allows us to obtain predictions for output cost elasticities ($\partial lnC / \partial lnY_{j.}$). As can be seen in Table 2, more than ninety-three 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 linked to export activity.

The results presented in Table 2 show that output-cost elasticities differ between domestic and foreign output. The export elasticity of the variable cost was smaller than the domestic elasticity and the difference evaluated at the average of the variables is significant. A test was conducted to evaluate if domestic and export outputs are perfect substitutes in the cost function. Specifically, if $\beta_{1d}=\beta_{1x}, \beta_{5d}=\beta_{5x}, \beta_{6d}=\beta_{6x}, \beta_{8d}=\beta_{8x}, \beta_4=0$, the cost flexibilities for foreign and domestic production would be equal. As can be seen, the result of the test rejects the null hypothesis, suggesting that both outputs are not perfect substitutes in the cost function[10]. Additionally, given that coefficient β_4 is negative and significant there are cost complementarities between both productions: the percentage increase in variable cost due to one output decreases when the other output increases.

It is also possible to evaluate the marginal cost for each firm as $\partial C/\partial Y_j=C\partial lnC/Y_j\partial lnY_j$. Table 2 presents the sample average of these individual marginal costs for each output. As we expected, the marginal costs for output sold in foreign markets is larger than marginal costs associated to products sold in domestic markets. A test is also conducted to evaluate whether there are significant differences between marginal cost in each market. As can be seen, we find that marginal costs differ between domestic and foreign production.

Additionally, Table 3 shows the predicted marginal costs for the subsample with positive predictions according to export ratio (export over total sales). As can be seen, firms selling a small-medium proportion of their output in the foreign market present a larger average marginal cost in the export market. However, as is reasonable, for firms which sell most of their output in export markets, though they represent a small proportion of the sample, the foreign marginal cost is smaller than the domestic cost.

Other complementary results of the estimate of variable cost are presented in Table 2: the Allen-Uzawa partial elasticities of substitution, the own-price elasticities of demand, and returns to scale economies. The sample average of the share of labor cost (S_L=0.29) and intermediate inputs (S_M=0.71) to total variable costs have been used to calculate the elasticities. As can be seen, price elasticities are negative and the inputs (labor and intermediate materials) are substitutes. The scale elasticity value is one, so firms seem to operate under constant returns to scale.

With respect to the results obtained from margin equations estimates, they are presented in the second part of Table 1. Parameter μ_s^j is the average of fourteen industry dummies. As the significance of F-tests indicates, there are clear inter-industry differences in margins in each market. From this estimate, and using equations (6a and 6b), it is possible to calculate the predictions of margins in each market for each firm. We have done it restricting the sample to the positive predictions of marginal cost. Figure 1 shows the distributions of the average domestic and foreign margins for the period 1991-1997 for all firms. Both distributions are slightly skewed, with a large proportion of firms on the right tail. Comparing domestic and foreign margins, there is a bigger proportion of firms with positive margins in the domestic market. About 75% of firms present a domestic margin between 0 and 0.2, while for 56% of firms the foreign margin is in this range. These results are consistent with previous empirical research. Particularly, they are similar to Nishimura *et al.* (1999), who obtained modest deviation from perfect competition and strong differences in margins among firms. Such differences are even larger at intra-industry level than at inter-industry level.

Additionally, Figure 2 shows the distribution of the average margin, by weighting the foreign and domestic margins 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, and only 8.5% of individual firms' average margins fall below zero.

The last issue to be analyzed is the time behavior of both margins. The cyclicality of margins has been intensively discussed in the previous literature. There are theoretical reasons supporting counter-cyclical as well as procyclical behavior of margins (Rotemberg and Woodward, 1991). As some authors remark, this is basically an empirical question. But that analysis usually refers to the total margin, without any differentiation in terms of market destiny. As our previous results show, that distinction may be important.

The parameters of individual indicators of the evolution of demand (D_{it}^{d} and D_{it}^{x}) in Table 1 present the expected positive sign, suggesting a procyclical behavior of the mark-up in both markets. However, the foreign demand indicator is only significant at 92% and its effect on the margin is smaller than on the domestic margin. This suggests a less clear procyclical behavior of the margin in foreign market.

With respect to exchange rate variations ($NERV_{it}$), the negative coefficient in the estimate of the domestic margin suggests that the depreciation of national currency would have increased the prices of imported inputs, therefore pushing the domestic margin downwards. However, this parameter is only significant at 90%. The coefficient of the exchange rate evolution in the foreign margin also presents the expected sign (positive) but is non-significant. 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 input prices would have partially absorbed the positive short-term effect of devaluations on export prices. In that sense, this result is not so optimistic with regard to the recovery of export margins after the devaluations of the peseta in 1992-1993 as indicated by previous evidence, which had departed from an industry perspective (Gordo and Sánchez-Carretero, 1997).

Table 4 presents the sample average of the margins for the whole period and for each year, in each market separately and in both markets considered jointly. Although, as was previously noted, there is a huge heterogeneity among firms and industries, the average margin of firms in foreign markets was smaller than the average price-cost margin in the domestic markets in the entire period. Throughout the period 1991-1997 domestic margins were about one percentage point larger than export margins. The larger margins in domestic markets should not be interpreted as a barrier for firms to diversify sales across markets. In fact, as Pricing to Market literature emphasizes, the differences of margins across foreign markets are the result of a strategic behavior of firms. This difference does not only occur between domestic and export markets, but surely among domestic markets (i.e. regional markets), though in the latter case the observed differences may be lesser due to smaller trade costs. Additionally, the complementarities between domestic and foreign production found in the cost function could explain why firms export, even though the foreign margin might be smaller than the domestic margin.

The margins in the domestic market are clearly procyclical, with the smallest values in 1992-1993 and largest values at the end of the period. This behavior is consistent with the cycle of the Spanish (and European) economy, which experienced a short recession in those years. However, this behavior is less clear in margins in the foreign markets, which is in concordance with the estimated parameter coefficient of the evolution of foreign demand in Table 1. The latter increased (decreased) in 1993 (1994), even though the foreign cycle indicator decreased (increased). An explanation of this behavior can be the evolution of the exchange rate: the increase of the foreign margin in 1993 coincides with the year of the devaluation of the domestic currency. After 1994 there is a positive correlation between the foreign demand evolution and the foreign margin. When both markets are considered, the average margin is procyclical as most previous empirical evidence.

Industry Estimates

The cost and margins estimates for the industry as a whole have been presented in the previous section. Although the specification of the cost function includes industry dummies to control differences across industries, it has been estimated by imposing the restrictions that the relevant parameters are the same across all industries. In the parameterisation of margins the estimate of industry-specific effects (μ_s) revealed some degree of heterogeneity across industries.

In this section the empirical results for some industries are presented. We do not have enough information to estimate margins for all specific industries. Therefore we have chosen some of them on the basis of two criteria. First, that the selected industries had enough firms, in order to get sufficient degrees of freedom. Secondly, the relevance of selected industries, not only in the context of the Spanish economy, but also from the point of view of export activity altogether. The selected industries are Vehicles and other transportation materials, Chemicals, Electrical engineering and Textile, clothing, leather, fur and footwear (hereinafter referred to as Textile).

As in the industry as a whole, the equations for variable cost, labor share and domestic and foreign margins are jointly estimated by GMM. In the estimates presented, the parameterization of the margins does not include either individual indicators of the business cycle or the individual indicator of the evolution of the nominal exchange rate[11]. The results for the four industries are presented in Table 5. It is assumed again that sales are endogenous in both markets. The instrument set includes t-2 lagged values of the logarithms of domestic and foreign production and values of these variables interacted with the exogenous variables. The Sargan test does not reject the instrument set.

The results do not differ significatively across industries. The coefficients of the time trend, which approach technical progress, are very similar for the first three industries. The estimated values in Table 5 are around –4.0 for all of them[12]. The biggest value, above the industry mean, is for Vehicles and other transportation materials. However, the estimate value for Textile is surprising, statistically equal to zero. This implies no technical progress in this industry in these years.

Table 6 presents some additional results derived from the estimates of Table 5. The scale elasticity is statistically equal to one for all industries, so firms seem to operate under constant returns to scale. The marginal costs for each firm have again been calculated from the predictions of $\partial lnC / \partial lnY_j$. More than ninety percent of the predictions are positive. The results show a larger marginal cost for sales in the export markets, especially for Electrical engineering and Textile.

With respect to the margins, as can be seen in Table 5, the domestic margin was bigger than the margin of firms in foreign markets during the 1992-1997 period. Vehicles and Electrical engineering industries present the biggest margins in the domestic market. Furthermore, the coefficients of the foreign margins of the Electrical engineering and Textile industries are not significantly different from zero. This may indicate that firms in these industries are price-takers in the international markets. However, it is necessary to be careful with these results because of the small number of firms in the sample.

These results are similar to previous studies about margins in domestic and export markets. Bernstein and Mohnen (1991) estimated margins for Electrical product, Non-electrical machinery and Chemical products industries during the period 1962-83. They found that the domestic margins were bigger than the foreign margins in the last two industries. They also found that Canadian firms were price-takers in international markets of Chemical products because the conjectural elasticity in this market was not different from zero. In Bughin (1996), a pooled time-series (for 1981, 1983, 1985 and 1987) and cross-sectional panel of Belgian manufacturing firms was estimated to obtain margins for Chemical and Electrical and electronical products. For the first one, he found the same results as Bernstein and Mohnen, a foreign margin, which is almost zero. However he obtained the opposite result for Electrical and electronical products. Given the heterogeneity of sources of data employed, the periods of time considered and the differences in export distribution, it is difficult to infer any kind of pattern about margins in export markets (and degree of competition) at the international level.

Figure 3 shows the domestic and foreign business cycle indicator and the predictions of both margins for selected industries. As can be seen, most of the industries present a similar cycle to the overall industry. However, in the Textile industry the business cycle indicators reached the smallest figure in 1992, one year before the others. With the exception of that industry, the domestic margin follows the evolution of the domestic cycle indicator. As in the industry as a whole, it seems then that the domestic margins have a procyclical behavior. However, until 1995 the foreign margins present the opposite evolution with respect to the business-cycle indicator. Such behavior until that year may partially be explained by exchange rate variations.

4. Conclusions

The differences in the competitive environment, the evolution of demand among markets, added to the disturbing effect of exchange rate variations, could generate differences in the levels and evolution of the price-marginal cost margins between domestic and foreign markets. An additional effect could be due to the differences in marginal costs associated to sales in distinct geographical markets. In this paper we calculate specific margins for both markets, taking such differences into account.

The results obtained indicate that Spanish manufacturing export firms have larger marginal costs for exports than for sales in domestic markets. In a short-term context, with fixed capital stock, such differences may be due to the effect of transport costs. A test of that hypothesis would require some measurement of transport costs, data that is not available. Other effects related to marketing costs could also account for this difference. For example, attending international fairs, which constitutes the main way to enter foreign markets especially for small and medium firms.

Additionally, the estimated margins across markets show that the margin in export markets was smaller than in domestic markets throughout the period. Furthermore, the domestic margin is clearly procyclical, falling until 1993 and increasing later. At the end of the period, domestic margins were bigger than those observed in 1991. We do not find conclusive evidence of this procyclical behavior in the export market, which is probably conditioned by the evolution of the exchange rate. The result is a slight process of convergence between both margins until 1993, where the foreign margin is even bigger. The average margin when both markets are considered jointly is also procyclical. It is consistent with previous studies of the Spanish economy.

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 exchange rate fluctuations. However, as Goldberg and Knetter (1997) have pointed out, the difficulty in measuring marginal costs could 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 it is only valid for cross-industry comparisons of prices. The results of this paper confirm variations in the export margin, but suggest that the results in PTM literature could be overestimating the effects of exchange rate variations on export margins, since they do not properly consider the marginal costs differences.

Appendix: Variable definitions and descriptive statistics

C (Variable costs): The sum of intermediate consumption (raw materials purchases, energy and fuel costs and other external services) plus labor 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): Labor cost divided by the average workers of the firm during the year.

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

Y_d (Output sold on the domestic market): It is calculated by 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 by using the perpetual inventory formula:

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

where P is the price index for equipment, d are the rates of depreciation, and is the investment in equipment.

D_{it}^{d}, D_{it}^{x} (Individual indicator of the business cycle in the domestic and foreign markets): In the ESEE survey, each firm identifies the behavior of market demand during one year with respect

to the previous years according to three different categories: recession, stability and expansion. A value of 0, 0.5 and 1 is assigned respectively to each category. The domestic and foreign indices are constructed by weighting the previous values over all domestic and foreign markets defined by each firm. The weights are the proportion of sales in each market with respect to total sales.

$NERV_{it}$ (Nominal exchange rate variation): In the ESEE survey, 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 by 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.

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Notes

[1] See, for example, Geroski (1982), Jacquemin (1982), Lyons (1981) and, for Spain, Mazón (1993). Stalhammar (1991) also finds empirical support for the view 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, 1998) found similar results using data up to 1990. The import rate tends to depress the margins in more concentrated industries, but the average impact of imports tends to be insignificant.

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

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

[5] It is likely that products sold in export markets have small modifications with respect to those sold in home markets. Such differences could be due to packaging, labeling, or after-sales services. The evidence for the Spanish firms suggests that the adaptation for export markets is small.

[6] In that sense, Goldberg and Knetter (1997, p.1247) point out that "ideally, a test of Law of One Price would compose prices for two transactions in which the nationality of the buyers is the only difference in transaction characteristics. In practice, the identical goods assumption is almost surely violated to some degree in available data".

[7] The mark-up parameter can be identified with the rest of the set equation because price information is available for both markets.

[8] The coefficient of a dummy variable, related to belonging to a multinational group of firms, does not reveal any significant effect on variation prices in both markets.

[9] Two additional artificial dummies (*Mov1* and *Mov2*) have been included to control firms that have experienced mergers or scissions during the period.

[10] These results are consistent with others found in previous works in which imperfect substitutability between domestic and foreign production is assumed. Bergstrand (1985) found that the elasticity of transformation among export markets is greater than the elasticity between production for home and foreign markets and the latter is not infinite. Baier and Bergstrand (2001) found that the elasticity of transformation in production among markets is finite, which suggests that exports are imperfectly substitutable across national markets.

[11] We have also estimated the four equations with the parameterization of the last section and the results do not change. The estimates are available upon request.

[12] As in the total industry estimate, in complementary estimates the coefficients of the time trend multiplied by other explanatory variables are non-significant.