BANCO DE ESPAÑA

IS PROFITABILITY RELATED TO MARKET SHARE? AN INTRA-INDUSTRY STUDY IN SPANISH MANUFACTURING

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1. INTRODUCTION

This paper presents some evidence on the correlation between profits and market share in Spanish manufacturing firms, at the industry level. The interest of this correlation is that a broad class of oligopolistic models is consistent with a positive correlation between these two variables. Establishing the correlation as a stylized fact would be useful as a guide to theoretical work, and would allow some insight into market behaviour in Spanish manufacturing over the period considered.

Market share is one of the variables widely used in empirical studies of structure and performance to explain differences in profitability among firms. Schmalensee (1989) points out the mixed evidence on the correlation between these two variables. On the one hand, studies following Weiss (1974) include both industry concentration and firm market share in the same equation, and support the following:

> "In samples of US firms or business units that include many industries, market share is strongly correlated with profitability; the coefficient of concentration is generally negative or insignificant in regressions including market share" (Schmalensee (1989), page 984)

On the other hand, intra-industry studies by several authors support the view that:

> "Within particular manufacturing industries, profitability is not generally strongly related to market share" (Schmalensee (1989), page 984)

It has been suggested that these two facts are compatible if estimates supporting the positive correlation of market share and profitability are dominated by a small number of industries with a strong positive correlation. Heterogeneous behaviour among industries, on the other hand, should be expected since individual industry idiosyncrasies are likely to be important, as suggested by the new empirical industrial organization literature.

In Spanish manufacturing, Mazón (1993) found a positive correlation between profitability and market share, with a sample including many industries. The coefficient of concentration was positive and significant as opposed to US evidence.

In this paper, using an unbalanced panel covering 1,396 firms over the period 1983-89, from the "Central de Balances del Banco de España", estimation of a profit equation for each industry in the data is attempted, in order to verify if the second fact presented by Schmalensee is confirmed, and to draw some inferences about market behaviour in Spanish manufacturing.

The paper is organized as follows: section 2 presents the theoretical model; section 3 describes the data set used; section 4 discusses some econometric problems; section 5 presents the results; section 6 reports some additional experiments; and section 7 summarizes the main implications of this study.

2. THEORETICAL MODEL AND ECONOMETRIC SPECIFICATION

Following Cowling and Waterson (1976), consider an industry with N firms. Let p(X) be the inverse demand curve, where p is the market price and X the industry product, $X = x_1 + x_2 + \ldots + x_N$. Suppose that the industry is in long run equilibrium, and $C(x_i)$ is the cost for firm i of producing x_i. The economic profit of firm i is given by

$$\pi_i(x_i) = p(X)\, x_i - C(x_i) \tag{1}$$

and the first order condition implies

$$\frac{p - c_i}{p} = \frac{1}{\epsilon} (1 + \lambda_i) s_i \qquad (2)$$

where c_i is marginal cost, not necessarily constant; $\epsilon = -p(X)/(Xp'(X))$ is the absolute value of market elasticity; $\lambda_i = \partial X_{-i}/\partial x_i$ is the conjectural variation of firm i, showing how total output of all firms but i, X_{-i}, changes with output of firm i, x_i; and $s_i = x_i/X$ is firm i's market share.

In order to estimate equation (2), different approaches can be taken concerning two subjects. First of all, concerning the left hand term of equation (2), $(p-c_i)/p$, a measure of profitability; marginal cost and often prices are not observable and therefore they should be inferred from data or otherwise, an appropriate approximation should be used. Secondly, concerning conjectural variations; classical models of oligopoly correspond to certain values for λ_i, and could be considered as benchmarks. For example, Cournot, the non collusive equilibrium in quantities, implies $\lambda_i = 0$ for all i, and joint profit maximization, the collusive equilibrium that yields maximum joint profit, implies $\lambda_i = 1/s_i - 1$. But it is not clear what values of λ_i correspond to other collusive equilibria. Therefore λ_i should be estimated or and "ad hoc" characterization could be used. The choice between these two subjects usually distinguishes between studies belonging to the "new empirical industrial organization" and to "empirical studies of structure and performance".

A typical study in the new empirical industrial organization literature[1] would estimate both profitability and conjectural variations, proposing an econometric study of an industry. Individual industry idiosyncrasies would be taken into account, and would affect the optimal strategy to estimate equation (2). These studies consider one industry at a time, and are beyond the scope of this paper.

[1] See Bresnahan (1989) for a survey on this topic.

On the other hand, empirical studies of structure and performance[2] use accounting rates of return as a measure of profitability and an "ad hoc" characterization of conjectural variations. This is the strategy used in this paper, which limits the interpretation of results: they should be considered empirical regularities.

The approximation used for $(p-c_i)/p$, is firm i's price-cost margin, PCM_i, defined by Collins and Preston (1968, 1969) as revenue minus variable cost divided by revenue. In equation (2), variable cost is used to approximate marginal cost[3], and multiplying numerator and denominator by x_i, the left hand side of equation (2) is the price-cost margin. In addition, fixed costs are included; if firm i uses capital K_i and the rate of return on invested capital is ρ, equation (2) yields

$$PCM_i = \rho \frac{K_i}{VP_i} + \frac{1}{\epsilon} (1 + \lambda_i) s_i \qquad (3)$$

where we obtain an expression of firm i's price-cost margin.

Following Schmalensee (1987), the "ad hoc" characterization of conjectural variations used is

$$\lambda_i = \lambda + \gamma (s_i - \frac{1}{N}) \qquad (4)$$

where λ is the average of industry conjectural variations; γ is a constant; and N is the number of firms in the industry. The rationale for equation (4) is that it is consistent both with the Stigler (1964) hypothesis that small firms have lower conjectural variations than their larger rivals ($\gamma>0$), since they have a lower risk of detection than large firms when deviating from an implicit or explicit market agreement; and with the Clarke and Davies (1982) hypothesis that large firms have smaller

[2] See Schmalensee (1989) for a survey on this topic.

[3] This approximation is appropriate if there are constant returns to scale in the relevant range.

conjectural variations than their smaller rivals ($\gamma<0$), since they think that rivals do not have the capacity to respond to their changes in output[4].

Substituting equation (4) into equation (3) and including time subscripts yields

$$PCM_{it} = \rho\frac{K_{it}}{VP_{it}} + \frac{1}{\epsilon_t}(1+\lambda_t+\gamma(s_{it}-\frac{1}{N_t}))s_{it} + \alpha_i + \alpha_t + u_{it} \qquad (5)$$

where α_i is a firm specific effect[5], to capture time-invariant unobservable determinants of profits, such as management style; α_t are time dummy variables, to capture the effect of industry specific variables such as import penetration, advertising expenditures, R&D, etc., usually included in this type of regressions, plus economy wide variables that could be affecting the evolution of price-cost margins such as the introduction of VAT in 1986; and u_{it} is a white noise residual.

Equation (5) considers explicitly the fact that the demand elasticity, ϵ, and the mean conjectural variation, λ, could vary with time. Concerning demand elasticity, it is often assumed to be time invariant, but even if the demand curve does not change, movements along it would imply a variation on demand elasticity, unless constant elasticity is assumed. Concerning the mean conjectural variation, λ, traditional models of oligopoly would argue that it varies with industry concentration or import penetration; on the other hand, repeated game models of oligopoly behaviour such as Green and Porter (1984) and Rotemberg and Saloner (1986) are compatible with changes in conjectural variations over time, since they consider demand shocks that affect collusive agreements on the industry. The strategy used here is to capture variations on both demand elasticity and the mean conjectural variation using a time dummy variable α_t. Since information on the number of firms on the industry at time t, N_t,

[4] Note that $(s_i - 1/N)$ is positive if firm i is "big" and negative if firm i is "small".

[5] Cubbin and Geroski (1987), Scott and Pascoe (1986) and Kessides (1987) have detected significant firm-specific effects.

is not available, it would also be included in the time dummy. Rearranging equation (5), with $\alpha_t s_{it} = 1/\epsilon_t(1 + \lambda_t - \gamma/N_t)s_{it}$ and $\alpha_t s_{it}^2 = \gamma s_{it}^2/\epsilon_t$, yields

$$PCM_{it} = \rho \frac{K_{it}}{VP_{it}} + \alpha_t s_{it} + \alpha_t s_{it}^2 + \alpha_i + \alpha_t + u_{it} \qquad (6)$$

Equation (6) is estimated for each industry on the data. Since many "ad hoc" assumptions have been made, it should be clear that estimates of equation (6) will be interpreted only as empirical regularities. Note that if the set of variables $\alpha_t s_{it}^2$ is not jointly significant but s_{it}^2 is, it would imply that demand elasticity is constant over the period considered; therefore, if the set of variables $\alpha_t s_{it}$ is jointly significant, time changes in the coefficient on market share, s_{it}, would be due either to changes in the mean conjectural variations or to changes in the number of firms in the industry, N_t.

3. DATA EMPLOYED

The main data source for this study is an unbalanced panel covering 1,396 private manufacturing firms from the "Central de Balances del Banco de España" (CBBE), over the period 1983-89. CBBE is a yearly survey with balance sheet and complementary information, but its completion by firms is not compulsory. Industry data from the "Encuesta Industrial", by the "Instituto Nacional de Estadística" (INE) are also used. The data appendix details the selection of firms and variables construction.

From the original data, 1,111 firms were selected, belonging to 22 sectors with more than 20 firms. They account for nearly 80% of available firms. Table 1 presents a list of the sectors and a summary of statistics for selected variables.

4. ECONOMETRIC PROBLEMS

In order to estimate equation (6), first differences are used, since the firm-specific effect (α_i) is unobservable and correlated with the independent variables, and could be affecting profitability.

The main problem with the estimation of equation (6) is that pointed out by the critics of cross-section studies on structure and performance: all the variables included in the regression are endogenous, and there are no theoretically exogenous variables to be used as instruments; given the complexity of market structure, it is difficult to argue for the exclusion of any variable from the structural equation.

The use of panel data could be a solution to the problem: lagged independent variables could be used as instruments. Nevertheless, as pointed out by Schmalensee (1989), one should keep in mind that equation (6) is a long run equilibrium equation. Lagged independent variables would be appropriate instruments only if departures from long-run equilibrium are random; if not, residuals will be serially correlated and lagged variables would not be appropriate instruments.

It is difficult to argue that the Spanish manufacturing sector was in long-run equilibrium during the period considered, 1983-89. It is a well known fact that many industries were (and probably still are) undergoing structural change as a result, among other factors, of the increase in international competition due to the Spanish European Community membership. Nevertheless, and in the absence of a suitable model of disequilibrium, the strategy used is to estimate equation (6) with lagged independent variables as instruments, and use the standard tests to establish the validity of instruments.

The model is estimated using the General Method of Moments (GMM) procedure, proposed by Arellano and Bond (1991), and contained in their DPD package. The instruments used are t-2 lags of firm i's revenue (VP_i) and market share (s_i). Lagged values of firm i's capital (K_i) are not considered appropriate instruments due to measurement problems.

5. ECONOMETRIC RESULTS

Equations for 22 sectors with 20 or more firms were estimated. It should be pointed out that the data only include firms with a single corporate activity, since it is not clear how to treat multiproduct firms.

For each of the 22 industries, different versions of equation (6) were estimated in first differences, including time dummies interactively (i) with market share, to capture the effect of any industry variable affecting average conjectural variations, changes in demand elasticity, or changes in the number of firms; and (ii) with market share squared, to capture changes in demand elasticity. Different versions were obtained setting equal to zero one or more of the coefficients, when variables were not significant.

For twelve of the 22 industries, "acceptable" equations were estimated, meaning equations with first order serial correlation, without second order serial correlation and for which the Sargan test of overidentifying restrictions on the instruments is accepted. Table 2 presents one equation for each industry, the one for which the maximum number of variables is significant[6] and standard tests accepted at the 5% significance level.

Results show heterogeneous behaviour across industries, probably due to individual idiosyncrasies. The main findings are summarized in the following facts:

1) The coefficient on the capital-revenue ratio (K_{it}/VP_{it}) -the rate of return on invested capital-, though predicted to be positive and significant, only is so in two sectors, Meat Products and Leather. Four sectors, Industrial Machinery, Graphic Arts, Vegetable Products and Electronic Materials, have a negative and significant coefficient. This result is not new: as pointed out by Schmalensee (1989), significant negative estimates have been reported by a number of authors, i.e. Ornstein (1975), Liebowitz (1982) and Domowitz, Hubbard and Petersen

[6] Other than K_{it}/VP_{it}, which theoretically should be significant in all models.

(1986) with US data. Machin and Van Reenen (1991) also obtained a negative and significant coefficient in a panel data analysis of UK manufacturing firms. Measurement errors could explain this result.

2) Eight industries, Consumer Chemicals, Industrial Chemicals, Industrial Machinery, Graphic Arts, Meat Products, Vegetable Products, Leather and Footwear, show a positive correlation between market share (s_{it}) and profitability (PCM_{it}), and four of them, Metallic Products, Electronic Materials, Paper and Plastic and Rubbers, a negative one. Schmalensee (1987) found a positive correlation on 60% of industries for 1967, but only on 22.9% on 1972. Clarke, Davies and Waterson (1984) found a positive correlation for 40% of industries using data over 1971-77. These results are comparable to the 36.4% of industries with positive correlation found here.

3) The coefficient on market share squared (s_{it}^2) is significant in eleven industries. For two industries, Meat Products and Plastic and Rubbers, the coefficient changes over time, suggesting that demand elasticity changes over the period considered. For six industries, Consumer Chemicals, Industrial Machinery, Graphic Arts, Vegetable Products, Leather and Footwear, the coefficient is negative and therefore supports the Clarke and Davies hypothesis that large firms have smaller conjectural variations than their rivals. And for the three remaining industries, Metallic Products, Electronic Materials and Paper, the coefficient is positive, supporting the Stigler hypothesis that small firms have a lower risk of detection than larger firms when deviating from a market agreement, and lower conjectural variations.

4) For five of the twelve industries, Graphic Arts, Vegetable Products, Metallic Products, Electronic Materials and Paper, the coefficients on the set of variables $\alpha_t s_{it}$ are jointly significant at the 5% level, the coefficient on s_{it}^2 is significant but the coefficients on the set of variables $\alpha_t s_{it}^2$ are not. The fact that the coefficient on s_{it}^2 does not change over time suggests that demand elasticity is constant over the period considered. Therefore the variation over time of the coefficient on s_{it} is due either to changes in the number of firms in the industry, N_t, or to changes on average conjectural variations, λ_t, that could be

interpreted as a measure of market power. Changes in λ_t could be due to changes in industry concentration or import penetration, or due to shocks in demand that alter collusive behaviour as proposed by repeated game models. Since the number or firms in the industry, concentration and import penetration are variables that change smoothly over time, but estimated coefficients on s_{it} change abruptly for most of the sectors, the results suggest that shocks in demand could be altering collusive behaviour, as proposed by repeated game models.

5) For two of the twelve sectors, Meat Products and Plastic and Rubbers, both the coefficients on the set of variables $\alpha_t s_{it}$ and $\alpha_t s_{it}^2$ are significant at the 5% level. Therefore demand elasticity varies over the period considered, and it is not possible to conclude whether conjectural variations change over time.

6) For one sector, Industrial Chemicals, the coefficient on the set of variables $\alpha_t s_{it}$ are significant at the 5% level and neither s_{it}^2 nor $\alpha_t s_{it}^2$ are. Therefore variations on time of the coefficient on s_{it} could be due to changes on demand elasticity, the number of firms in the industry or mean conjectural variations.

Table 3 includes a list of the ten sectors for which it was not possible to obtain acceptable equations. For some of those sectors, heterogeneity could be the reason why it is not possible to do so: for example, "Motor Vehicles" includes not only automobile factories but also parts and accessories, but the "Encuesta Industrial" does not offer more disaggregated data. For others, such as "Textiles", it is clear they were not in long-run equilibrium over the period considered.

6. ADDITIONAL TESTS

6.1. Accounting rate of return on assets as the dependent variable

The dependent variable in this paper is the price-cost margin, a proxy for the return on sales. Several authors, including Schmalensee (1987), use the return on assets, multiplying equation (3) by revenue over capital (VP_i/K_i). Because of measurement errors on capital, the use of the return on assets implies that all variables in the regression present measurement problems, but only one does if return on sales is used.

Empirically, equations using the return on assets as a dependent variable fail to pass tests for serial correlation in all industries (except one or two, depending on variables included).

6.2. Estimation of λ_i for each firm in each industry

Assuming time invariant conjectural variations, an estimate of a firm specific coefficient on market share could be obtained. Following Holtz-Eakin et al. (1988), this could be done writing equation (3) in pseudodifferences, with a two-step procedure. Unfortunately, when this was tried, estimates of ρ, the key parameter to recover λ_i, were not acceptable for most of the industries (i.e., negative and significant values of ρ were obtained, when positive ones were expected[7]). These results could be due to measurement problems on capital, as well as to the fact that conjectural variations are not time invariant as assumed.

6.3. Inclusion of additional variables

Some additional variables were included in the basic regression, trying to obtain acceptable equations for sectors for which equation (6) is rejected. Inclusion of firms' exports over revenue in the estimated models made little difference: none of the equations with serial correlation problems improved as a result of the inclusion of the variable. The predominantly negative sign of the coefficient[8] should be highlighted, indicating lower profits for exporting firms. Lagged growth rates in revenue were also included, as Schmalensee (1989) points out that this variable almost always "works" statistically, but it was not significant in most of the sectors and it did not solve serial correlation problems.

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[7] Note that this result was also obtained in the model reported in section 5.

[8] The coeficient is negative and significant for two sectors without serial correlation problems, and for three sectors showing serial correlation.

6.4. Recovering λ_{it}

In equation (6),

$$\alpha_t \, s_{it} = (1 + \lambda_t - \frac{\gamma}{N_t}) \, s_{it} = B_t \, s_{it}$$

$$\alpha_t \, s_{it}^2 = \frac{\gamma}{\epsilon_t} \, s_{it}^2 = C_t \, s_{it}^2$$

Therefore,

$$\frac{1 + \lambda_{it}}{\epsilon_t} = \frac{1 + \lambda_t + \gamma \, (s_{it} - 1/N_t)}{\epsilon_t} = B_t + C_t \, s_{it}$$

and aggregating over firms in each sector,

$$\frac{1 + \lambda_t^m}{\epsilon_t} = B_t + C_t \, s_t^m \qquad (7)$$

where λ_t^m and s_t^m are time means for each sector.

Using equation (7) it is possible to recover estimated values for $(1 + \lambda_t^m)/\epsilon_t$. Since "ad hoc" approximations have been used, this should be considered as an exercise, since it is difficult to defend a structural interpretation of the estimated parameters. Following Bresnahan (1989), those estimates should be interpreted as a measure of average collusiveness of conduct in a given industry, since they capture what firms do as a result of expectations about rivals' reactions. Since collusion means a positive or null correlation between profits and market share, they are calculated for the eight industries that show a positive relation between those variables. Table 4 shows the mean estimated values of $(1 + \lambda_t^m)/\epsilon_t$, calculated using equation (7) for each year and then averaging over time[9]. Table 4 also shows, for demand elasticity equal to one[10], values of $(1 + \lambda_t^m)/\epsilon_t$ in the case of Cournot behaviour ($\lambda_{it} = 0$) and joint profit maximization ($\lambda_{it} = 1 - 1/s_{it}$), that should be considered as benchmarks. The fourth column of table 4 shows $(1 + \lambda_t^m)/\epsilon_t$ when joint profit maximization and Cournot are normalized to 100 and 1, respectively.

Table 4 shows that estimated values of the conjectural variation term are equal to or under 23 for all sectors when the joint profit maximization and Cournot are normalized to 100 and 1, respectively, indicating that the average collusiveness for Spanish firms is low over the period considered, since estimated conjectural variations are closer to Cournot than to joint profit maximization.

6.5 Inclusion of concentration and import penetration multiplying s_{it}

Concentration and import penetration multiplying s_{it} were introduced in addition to s_{it} and substituting multiplying time dummies into equation (6), since it is plausible that the mean conjectural variation, λ_t, changes with these variables.

Assuming that λ_t, the mean conjectural variation for the industry, can be expressed as

$$\lambda_t = a + b\ CR_t + c\ IMP_t$$

where CR_t is time t concentration and IMP_t is time t import penetration, equation (5) yields

[9] Two of the eight industries have a negative value of $(1+\lambda_{it})/\epsilon_t$ for one year. Those values are not included in the average.

[10] For the Spanish economy, only estimated elasticities for consumer demands are avalaible. For example, Briones, Estrada and Hernando (1993) estimate demand elasticity for twelve commodity groups, and it is less than one in absolute value for all of them. Possibly a higher disaggregation would imply higher demand elasticity.

$$PCM_{it} = \rho \frac{K_{it}}{VP_{it}} + ß_1 s_{it} + ß_2 s_{it} CR_t + ß_3 s_{it} IMP_t + \alpha_t s_{it}^2 + \alpha_i + \alpha_t + u_{it} \quad (8)$$

In equation (8), $ß_2$ is expected to be positive since an increase in concentration would facilitate collusive agreements, increasing conjectural variations; and $ß_3$ negative, since an increase in import penetration would increase competition, lowering conjectural variations.

When equation (8) is estimated, in first differences and using the same set of instruments reported on Table 2, three of the twelve sectors do not pass first order correlation tests on residuals; two sectors have neither concentration by market share nor import penetration by market share which are significant; and for the remaining seven sectors, one or both variables are significant. Four sectors evidence a significant coefficient on $CR_t s_{it}$, three with a negative sign and one with a positive sign; and four have a significant coefficient on $IMP_t s_{it}$, three with a positive sign and one with a negative sign. Therefore, only one sector (Industrial Machinery) has the positive expected sign on $CR_t s_{it}$ and another sector (Metallic Products) has the expected negative sign on $IMP_t s_{it}$. These could be due to problems on variables: concentration is constructed by the INE, using the "Encuesta Industrial", and the unit is the establishment instead of the firm; import penetration is not available for the disaggregation level used for the rest of the variables, but only at a more aggregate level.

6.6 Inclusion of import penetration instead of time dummy variables

When import penetration is introduced instead of time dummy variables, first order serial correlation decreases and second order correlation increases for most of the industries: the model needs the inclusion of time dummies. Four of the twelve sectors have acceptable equations. For one sector, Metallic Products, import penetration has a negative sign, indicating that profits are negatively related to import penetration: an increase in competition lowers the profits of domestic firms. For three sectors, Meat Products, Paper and Plastic and Rubbers, import penetration has a positive sign, indicating a positive correlation between profitability and import penetration; this fact could be indicating that high profits for domestic firms are attracting import penetration.

7. CONCLUDING REMARKS

This paper presents estimated profit equations for 22 Spanish manufacturing industries over the period 1985-1989. Oligopoly theory is used to propose empirical regularities for testing.

Results show heterogeneous behaviour across industries, due to individual idiosyncrasies. For some industries, static models of oligopoly are rejected by the data: a more complicated model is required to explain the determinants of firm-level margins.

For ten sectors it was not possible to obtain an empirically acceptable equation; that may be due to the industry being too heterogeneous, or not in the long-run equilibrium. Estimated models for the other twelve sectors suggest:

- Profitability is positively correlated with market share for 36.4% of industries, and negatively correlated for 18.2%. Therefore, within particular manufacturing industries, profitability is not positively correlated to market share, as observed with data from US and UK.

- The coefficient on market share changes over time in eight industries. For five of them, results suggest that demand elasticity is constant, so that changes in the coefficient could be a result of changes in the number of firms in the industry, concentration or import penetration, but it could be suggesting that a dynamic model is required to analyze firm-level profitability.

- Conjectural variations depend on market share in eleven sectors. Three of them support the Stigler hypothesis that small firms have lower risk of detection than large firms when deviating from a market agreement, and therefore lower conjectural variations, while six sectors support the Clarke and Davies hypothesis that large firms have smaller conjectural variations than their smaller rivals. For the remaining two sectors, the sign of the coefficients changes over time.

- The average collusiveness for Spanish industries is low over the period considered: estimated conjectural variations are closer to Cournot behaviour than to joint profit maximization.

The main drawbacks of this paper are, first, the proxy used for price-cost margins to measure profitability; while widely used in empirical studies of structure and performance, the new empirical industrial organization literature points out that price-cost margins are not observable, since economic marginal cost cannot be directly observed; and, further, the "ad hoc" specification used to proxy firm conjectural variations. The results presented in this paper should be considered only as empirical regularities of use for guiding theory construction and analysis of particular industries.

DATA APPENDIX

1. The data

This study uses data from the "Central de Balances del Banco de España" (CBBE), from the "Encuesta Industrial" (EI) and from the "Dirección General de Aduanas e Impuestos Especiales" (DGAIE). Variables are defined as follows.

- PCM_i = Price-cost margin

The price-cost margin is defined as

$$PCM_i = \frac{\text{Value of Production}_i - \text{Payroll}_i - \text{Costs of Materials}_i}{\text{Value of Production}_i}$$

where

Value of Production = Value of Sales +
+ Δ Final Products Inventories

Cost of Materials = Value of Acquisitions +
+ Δ Materials Inventories

Source: CBBE

- K_i / VP_i = Capital Output Ratio

The capital output ratio is defined as

$$\frac{K_i}{VP_i} = \frac{\text{Capital Stock}_i}{\text{Value of Production}_i}$$

Following Hernando and Vallés (1991) and Salinger and Summers (1983), replacement cost of capital K_t is defined as

$$K_t = I_t + (P_t / P_{t-1}) K_{t-1} (1 - \delta)$$

where

-I_t = Gross Investment on Property, Plant and Equipment

Source: CBBE

-P_i = Implicit Price Deflator of fixed capital

Source: "Contabilidad Nacional"

-δ = Depreciation Rate = 1 over useful life, L^*, defined as

$$L^* = \frac{1}{T}\left(\sum_{t=2}^{T} \frac{\text{Book Value Property, Plant, Equipment}_{t-1} + \text{Accumulated Amortization Book Value}_{t-1}}{\text{Book Depreciation}_t}\right)$$

where 1 is the first year available and T the last one.

Source= CBBE

Capital stock for 1983 is assumed to be equal to book value, given that a process of balance sheet revaluation was allowed in 1983. For firms whose data start after 1983, capital stock for the first year available (I) is obtained multiplying book value by the rate of inflation for capital goods between 1983 and I, if useful life is greater than I-1983.

- s_i = firm i's market share

Firm i's market share in industry j is defined as VP_i/VP_j, where

-VP_i = Firm i's Value of Production

Source: CBBE

-VP_j = Firm j's Value of production

Source: EI

- CR_j = Industry j's Concentration

Industry j's concentration is constructed by the INE using EI, and is defined as the value of production for the five biggest establishments in sector j.

Source: INE

- IMP_j = Industry j's Import Penetration

Industry j's import penetration is defined as imports over domestic consumption,

$$IMP_j = \frac{Imports_j}{Value\ of\ Production_j + Imports_j - Exports_j}$$

Source: Imports and Exports, DGAIE
Value of Production, EI

2. Data Selection[11]

The initial data set is an incomplete panel of 2,123 firms that had answered for five consecutive years the questionnaire sent by the "Central de Balances del Banco de España" over the period 1982-90. These firms are private firms, with more than 50% of production in non-energy manufacturing sectors. Some tests were performed on these firms, in order to obtain a subset of operating firms (for example, firms with value of production equal to zero for any year were eliminated), with time consistent data (for example, firms for which capital stock varies more than three times net capital stock were eliminated). These tests eliminated 317 firms. The 1,806 remaining firms were classified by sector; first, a 73 sector classification based on that used by EI was tried[12], but for a subset of firms, different sectors were reported in different years even if no appreciable changes on value of production or capital stock were observed that would have indicated a change of activity. Therefore, based on a one by one inspection, some sectors were aggregated, and 1,396 single-activity firms are finally used in the paper, belonging to 54 sectors.

[11] A more detailed description of data selection can be found in Mazón (1993).

[12] EI offers a 90 sector classification; 81 correspond to non-energy manufacturing sectors, but eight of them require a four digit "Clasificación Nacional de Bienes y Servicios" (CNBS) disaggregation when only three digits are reported by CBBE.

Table 1

Descriptive statistics 1985-1989.

Means and growth rates of selected variables and percentage of production accounted for by firms in the data over total of industry

	PCM	ΔPCM	CR	ΔCR	IMP/CI	ΔIMP/CI	K/VP	ΔK/VP	s	Δs	%
Consumer Chemicals	0.115	-6.8%	37.6	-7.8%	0.354	2.0%	0.28	6.2%	0.92	-8.8%	28.3%
Industrial Chemicals	0.167	8.4%	41.1	-16.4%	0.354	2.0%	0.40	23.2%	0.34	-3.0%	25.4%
Industrial Machinery	0.099	14.2%	5.2	-5.6%	0.683	25.0%	0.22	5.4%	0.27	4.7%	22.3%
Graphic Arts	0.148	3.7%	10.3	-35.2%	0.105	100%	0.34	-5.1%	0.29	-30.9%	17.9%
Meat Products	0.061	19.0%	11.3	0.0%	0.175	24.2%	0.16	11.4%	0.44	-0.7%	16.6%
Vegetable Products	0.101	-15.3%	12.9	-5.5%	0.135	85.7%	0.50	43.0%	0.68	-12.3%	20.5%
Leather	0.107	-12.0%	20.4	1.4%	0.310	-2.9%	0.17	18.8%	0.95	-21.4%	22.8%
Footwear	0.061	-6.4%	8.2	-1.2%	0.310	-2.9%	0.10	45.5%	0.18	-9.0%	4.3%
Metallic Products	0.120	2.3%	9.4	-21.9%	0.158	48.1%	0.37	2.0%	0.12	-7.1%	14.5%
Electronic Materials	0.123	-19.5%	30.3	32.2%	0.458	59.4%	0.27	13.7%	1.0	31.7%	20.4%
Paper	0.118	-2.8%	19.4	-4.1%	0.372	0.8%	0.44	7.5%	0.55	-10.1%	27.0%
Plastic and Rubbers	0.126	4.0%	22.1	-14.0%	0.248	5.4%	0.33	17.8%	0.51	2.6%	38.2%
Pharmaceutical	0.106	71.8%	14.2	9.8%	0.354	2.0%	0.33	3.4%	0.51	5.2%	31.8%
Textiles	0.120	-13.3%	12.4	-2.0%	0.195	52.9%	0.40	23.0%	0.19	5.8%	23.6%
Electric Machinery	0.112	19.2%	13.4	-6.6%	0.458	59.4%	0.28	-9.9%	0.60	5.9%	30.7%
Clothing	0.084	20.1%	10.4	3.6%	0.195	52.9%	0.17	7.4%	0.34	4.2%	15.6%
Motor Vehicles	0.113	5.6%	10.7	-27.6%	0.497	35.0%	0.36	11.8%	1.00	-3.2%	54.0%
Ceramics	0.147	8.2%	12.8	-5.5%	0.115	110.3%	0.52	3.2%	0.61	0% 5.	24.6%
Cement and Derivates	0.150	12.3%	6.0	-1.5%	0.161	6.1%	0.40	-13.0%	0.25	58.1%	5.1%
Wine	0.157	-2.4%	9.3	0.0%	0.062	89.5%	0.81	-13.0%	0.46	38.2%	11.4%
Non-Alcoholic Drinks	0.141	47.0%	25.1	14.9%	0.062	89.5%	0.62	-12.6%	1.54	-9.5%	32.0%
Wood Industries	0.122	0.5%	8.0	-23.3%	0.148	61.5%	0.44	23.0%	0.33	-13.5%	9.9%

Table 2
Estimated models of firm profitability. Dependent variable, PCM_{it}

Industry	Consumer Chemicals	Industrial Chemicals	Industrial Machinery	Graphic Arts	Meat Products	Vegetable Products	Leather	Footwear
Max.No.Firms	29	71	84	58	39	29	23	24
No.Obs.	126	318	378	237	151	128	98	96
K/VP	-0.14(-1.6)	0.03(0.6)	-0.33(-5.7)	-0.15(-3.3)	0.07(4.8)	-0.05(-2.4)	1.36(2.2)	-0.06(-0.6)
s	20.03(4.8)		68.32(7.5)				20.42(2.2)	64.32(2.7)
s85		-1.51(-0.8)		24.04(3.4)	15.30(4.3)	18.14(1.6)		
s86		18.63(3.5)		5.41(-2.1)	1.85(-3.0)	-8.35(-2.3)		
s87		17.35(5.5)		2.23(-2.0)	21.49(0.6)	21.22(0.3)		
s88		27.19(8.6)		66.66(5.2)	0.69(-3.3)	13.42(0.5)		
s89		27.53(5.6)		-3.59(-2.6)	-10.75(-3.2)	92.48(1.7)		
s^2	-399.27(-5.3)		-1333.93(-7.9)	-276.45(-5.2)		-280.24(-2.3)	-159.39(-2.0)	-5818.69(-2.1)
s^2 85					-277.94(-4.8)			
s^2 85					-13.52(3.8)			
s^2 87					-302.63(-0.2)			
s^2 88					157.77(2.4)			
s^2 89					400.92(2.5)			
Wald sdt		116.3(4)		429.6(4)		34.3(4)		
Wald dt	97.3(5)	177.0(5)	34.0(5)	29.8(5)	39.8(4)	41.6(5)	100.1(5)	29.1(5)
Sargan	11.5(15)	17.7(18)	22.2(21)	20.0(17)	11.53(13)	9.6(11)	2.9(7)	12.3(15)
m1	-2.010	-2.813	-2.592	-2.703	-2.433	-2.120	-3.916	-3.055
m2	-0.154	-0.862	-0.199	-0.869	-1.550	-0.433	-1.559	0.159

Notes:
1) All models estimated in first-differences by General Method of Moments (t-ratios in parentheses).
2) The instruments used are observations lagged t-2 (and earlier) of VP and s, with a maximum of 3 moment restrictions to be used in each cross section (except consumer chemicals, vegetable products and footwear, that uses 2, and electrical material and leather, that uses 1 due to the small data set), and time dummies.
3) Wald sdt is a χ^2 test of the joint significance of s multiplied by time dummies (degrees of freedom in parentheses).
4) Wald dt is a χ^2 test of the joint significance of time dummies (degrees of freedom in parentheses).
5) Sargan is a χ^2 test of the overidentifying restrictions (degrees of freedom in parentheses).
6) m1 (m2) is a N(0, 1) test for first (second) order correlation.
7) All equations estimated over 1985-89.

Table 2 (bis)

Estimated models of firm profitability. Dependent variable, PCM_{it}

Industry	Metallic Products	Electronic Materials	Paper	Plastic and Rubbers
Max.No.Firms	127	21	48	77
No.Obs.	547	95	211	339
K/VP	0.01(0)	-1.15(-5.6)	-0.03(-0)	-0.08(-1.4)
s				
s85	-22.37(-0.9)	-15.64(-6.8)	9.09(1.3)	17.90(4.8)
s86	-42.76(-1.0)	-14.95(0.1)	-11.25(-2.2)	25.37(0.7)
s87	-26.26(-0.2)	-12.32(0.8)	-3.66(-1.5)	-8.39(-5.0)
s88	13.45(2.2)	-9.27(1.9)	-55.76(-6.1)	-7.97(-3.8)
s89	-34.30(-0.5)	-10.24(0.8)	-13.07(-4.2)	0.59(-2.1)
s^2	540.6(2.03)	43.03(1.9)	166.49(4.2)	
s^2 85				-127.50(-3.6)
s^2 86				-55.94(1.1)
s^2 87				39.00(4.5)
s^2 88				38.66(3.9)
s^2 89				23.71(3.6)
Wald Δsdt	79.6(4)	19.3(4)	42.7(4)	
Wald dt	13.4(5)	55.8(5)	52.3(5)	27.8(4)
Sargan	24.3(17)	2.6(3)	17.9(17)	14.17(13)
m1	-3.311	-2.074	-2.250	-2.531
m2	0.227	1.086	-0.579	-0.006

Table 3

Industries for which no acceptable model is estimated

	Max. No. of firms
Pharmaceutical	63
Textiles	127
Electric Machinery	53
Clothing	46
Motor Vehicles	52
Ceramics	42
Cement and Derivates	22
Wine	26
Non Alcoholic Drinks	21
Wood Industries	29

Table 4

Estimated values of $(1 + \lambda_t^m) / \epsilon t$, and joint profit maximization and Cournot Values

	Estimated $\left(\frac{1 + \lambda_t^m}{\epsilon_t}\right)$	$\epsilon_t = 1$ Joint π max $(1/s_t^m) / \epsilon_t$	Cournot $1/\epsilon_t$	$\frac{1 + \lambda_t^m}{\epsilon_t}$ when Joint π max = 100 and Cournot = 1
Consumer Chemicals	16.4	290.3	1	5.6
Industrial Chemicals	22.7	209.4	1	20.7
Industrial Machinery	64.7	364.9	1	17.7
Graphic Arts	23.8	337.5	1	7.1
Vegetable Products	34.5	150.2	1	23.0
Leather	18.9	106.2	1	17.0
Footwear	53.8	562.5	1	9.6

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