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ABSTRACT

This paper offers empirical evidence for the Spanish case on the hypothesis that public ownership may be a determinant of a firm's performance. Two alternative definitions of efficiency are proposed: relative productivity and profitability. The role of ownership is tested, conditioning for the degree of competition, the financial position of the firm and labour quality. The data used is a sample of Spanish manufacturing firms for the period 1983-1996. The results show that ownership is not a determinant of efficiency and that other factors, in particular, the degree of competition, seem to have a positive and significant effect on a firm's performance. Although a negative relationship is found between public ownership and efficiency, it is not statistically different from zero. However, the constancy of ownership over time might explain this lack of significance, given that the model is estimated in first differences.

1. INTRODUCTION

The privatisation of state-owned firms has been one of the most widespread public policies carried out in economies all over the world in recent years. Spain has also followed this trend and, in fact, privatisation proceeds have amounted, on average, to close to 0.4 percentage points of GDP in the period 1989-1998.

The aims of privatisation have been very varied. Yarrow (1986) points at the following objectives in the British case: improving firms' efficiency; lessening public borrowing requirements; weakening trade union power; reducing the role of government in the corporate world; broadening the shareholder base; providing greater access to capital markets for the general public and, in particular, for workers to their own firms' shares; and income redistribution. In broad terms, three main aims may be identified for privatisation: improving efficiency, increasing general government revenue and redistributing income (Albi, Contreras, González-Páramo and Zubiri, 1994).

This paper focuses on the first of the above arguments, namely privatisation as a means to improve efficiency, which entails analysing the relationship between public/private ownership and the associated efficiency. Nonetheless, comparing efficiency between public and private firms is a complex issue. On the one hand, the comparison must be made under homogenous conditions, i.e. taking into account, for instance, the different sectors in which the firms operate and the degree of competition they face, which means isolating the role of ownership from other potential determinants of efficiency. On the another, a public enterprise may have objectives other than mere profit maximisation, whereby the comparison with its private-sector counterparts on the basis of this criterion may prove inappropriate. It is generally accepted that the only goal a public enterprise cannot elude is that of productive efficiency, i.e. the maximisation of the level of output given a specific level of inputs: therefore the comparison between public and private firms should be made in terms of this goal (Perelman and Pestieau, 1994).

This paper intends to offer empirical evidence for the Spanish case on the hypothesis that public ownership of firms may be a determinant of their efficiency. Two alternative definitions of efficiency are used: relative productivity and profitability. The former tries to approximate the concept of technical or productive efficiency, while the latter is more connected with allocative or price efficiency, involving minimising costs of producing a level of output, given the prices of inputs and their marginal productivities. Furthermore, the paper aims at isolating the role of ownership by controlling for other potential determinants of efficiency, in particular the degree of competition, the financial position of the firm and labour quality. The test is carried out on a sample of Spanish manufacturing firms, drawn from the Banco de España Central Balance Sheet Office, for the period 1983-1996. In Argimón, Artola and González-Páramo (1999), a sample of firms of 1994 from the same

source was used to test the same hypothesis. The construction of the panel has some advantages over the cross-section approach. On the one hand, it provides instruments to be used to avoid possible simultaneity biases. On the other, it allows a more streamlined construction of certain variables, in particular the firms' capital stock. However, it requires that estimation take into account the presence of individual effects: the bias arising from the possible correlation of the individual effects with the regressors has to be avoided.

The paper is structured as follows. The second section reviews the theoretical arguments and the available empirical evidence on the relationship between public ownership and business efficiency. The indicators of efficiency used in this paper are then discussed and the empirical model employed is formulated. The fourth section offers a brief analysis of possible determinants of business efficiency other than ownership, whose relevance will also be tested. The fifth section describes the main characteristics of public and private firms in the sample. The results of the tests are presented in the sixth section. Finally, the seventh section draws the main conclusions.

2. PUBLIC OWNERSHIP AND EFFICIENCY OF THE FIRM. A REVIEW OF THE LITERATURE.

The fundamental theoretical framework that analyses the relationship between public ownership and firm performance is provided by the so-called agency theory. Under this theory, public in comparison to private ownership introduces at least two main differences into the principal-agent (shareholder-manager) relationship: a) the goals of the principal are not the same under both types of firm: political or welfare goals in the case of public enterprise compared to profit-driven goals in the private firm; b) managers of state-owned enterprises have to face two principals, voters and the government, while there is only one principal, namely shareholders in the case of private firms, with the exception of regulated private enterprises, where the industry regulator has also to be considered. The issue at skate is whether these principal-agent differences also lead to differences in efficiency. The theoretical response, however, requires that the environment in which business activity unfolds (competitive sectors compared to sectors subject to market failure) should be defined, since this may affect the comparison.

A) COMPETITIVE INDUSTRIES

This first section attempts to compare the efficiency of public and private firms in a competitive environment, that is with neither market failure nor regulated private firms.

According to microeconomic theory, under perfect competition, the search for profit maximisation of private firms ensures efficiency (both technical and allocative). Public enterprises could, in principle, attain the same level of efficiency as private firms.

Nonetheless, the literature highlights certain problems affecting public enterprises which hamper the achievement of this goal.

1. The existence of different principals, to which we have already referred above, and the possible competition between such principals may lead to a more complex and diffuse definition of agents' goals. Thus, public firms do not have a single goal and, more important, the objectives are not fixed over time. In relation to the multiplicity of objectives it can be said that the Parliament's aims (voters' representatives) are different from those of the government, and moreover, different ministers may pursue different objectives (increase in employment, reduction of the deficit, improvement in efficiency, etc. [Aharoni, 1981]). The problem of public enterprises would not, however, be the plethora of goals in itself, but the fact that such goals are either contradictory, or are not clearly defined or clash with efficiency.

Secondly, the objectives of public firms change over time. A change in government, for instance, may radically alter the guiding principles and targets initially laid down, and they may even contradict those set by the previous Cabinet. This fact, which is undoubtedly known to the managers of public enterprises, prevents them from taking decisions with a medium- and long-term perspective, with the subsequent costs in terms of efficiency.

2. The very existence of a vague definition of ownership of state-owned enterprises lessens shareholders' (i.e. voters or members of the government) incentive to exert control over the firms' managers. Any action of control taken by a shareholder and the ensuing gains in efficiency arising therefrom would be shared among the rest, favouring the "free riders".

It can be argued that the problem of deficient control of agents also happens in private firms, especially those with wide-ranging and dispersed shareholder structures. However, in the case of public enterprises, the diffusion of ownership is always greater (insofar as the ultimate shareholders are the general public [Alchian and Demsetz, 1972]) and, if this is not the case, it is due to the presence of lobbying that influences management, pursuing their own interest and not that of the community (trade unions, consumers, suppliers). These groups are more aggressive in the pursuit of their own interest than the principals of the firm and may attain benefits for themselves at the expense of losses for the community (Zeckhauser and Horn, 1989).

In fact, the large number of intermediaries between voters and managers (voters, Parliament, government, ministers, managers). hampers control even more.

3. Public firms are not subject to the external control of capital markets, that reduces many of the inefficiencies facing private firms, and acts as a disciplining mechanism of

management conduct. This lack of control via the capital markets leads to at least two potential adverse effects on the efficiency of public firms:

a) The firm's share prices on the capital market contain information about the future of the firm and, therefore, they may be used as a means of evaluating the long-term effects of management decisions. In the case of public firms, since these prices are not available, principals lose an instrument of control, thereby reducing the incentive of management to act appropriately.

It can be argued that financial markets are not efficient or cannot be regarded as the best instrument for obtaining external information on the financial state of the firm. Further, this argument would not be valid for the so-called mixed firms, i.e. those in which the State has a share and the rest is privately owned. Holmström and Tirole (1991) argue, however, that even in this latter case, the control provided by the market is lost owing to the illiquidity that state participation gives rise to in connection with the rest of the shares.

b) The impossibility of bids by another group of shareholders to take a public firm means managers cannot lose their job in the face of changes in ownership. The argument runs as follows: given inefficient management, share prices fall and, consequently, the possibility of a private firm being bought by other shareholders increases, with the resulting replacement of the management responsible for such inefficiency. Once more, in the case of public firms, the disciplinary role of the market is lacking.

This argument has also received several criticisms. First, it could be argued that managers of public enterprises are also fired and that there are political takeover bids, although these are often motivated more by changes in government than by inefficient management. Moreover, Grossman and Hart (1980) point out that, in the face of a takeover bid, the current shareholders, anticipating the gain in efficiency brought about by the change in the firm management, do not sell their shares at prices that make the bid attractive, thereby reducing the possibility of these operations successfully being carried out. Other authors stress the different types of pre-emptive defensive action managers can take in order to lessen and, indeed, eliminate the attractiveness of these purchase operations; managers could, for instance, pursue size rather than profit maximisation, making firms a difficult purchase target (Scherer, 1980). Lastly, certain authors (Franks and Mayer, 1990) indicate that the possibility of takeover bids could have adverse effects on efficiency since it reduces investment in specific human capital, lowering the value of a long-term managerial investment.

In any event, what is evident is the fact that the effectiveness of the control exerted by the capital markets largely depends on the characteristics of the country analysed. In this sense, factors such as the legal shareholder safeguards, the restrictions imposed by

competition law or the tax system are decisive. This would partly account for the scant number of operations of this type in certain countries (Japan and Germany, for example).

4. The impossibility of public firms going bankrupt eliminates a further instrument for controlling the firm's management. This argument is also known as the soft budgetary constraint: any possible lag between revenue and expenditure is balanced by the government. In this way, the price mechanism ceases to be a determining factor of management behaviour. Managers can generate income overpaying suppliers, with the latter competing for this income and offering managers compensation in exchange for securing specific contracts. Other pressure groups, such as trade unions, use the existence of this soft budgetary constraint to their own advantage (Kornai, 1980).

It should not be forgotten, however, that the State has often come to rescue ailing private firms, with bankruptcy being, in many cases, the reason for nationalisation.

5. Management incentive schemes based on productivity are rarely found in state-owned enterprises. This is largely because of the multiple and diffuse goals referred to earlier. On the one hand, the achievement of some of the goals entrusted to public enterprises is difficult to evaluate because of the difficulty of finding indicators to measure performance. On the other, the multiplicity of objectives require that weights be established for each of them in case there should be some incompatibility among them. These weights are, however, difficult to set since the potential trade-off between the different goals is not accurately known (Tirole, 1994). The impossibility of establishing management incentive mechanisms related to productivity tends to lead managers to pursue their own interests.

Moreover, pay structures in public firms are set taking government and civil service pay as a reference, which acts as a ceiling (González-Páramo, 1995).

6. Laffonte and Tirole (1993) argue that managers of public firms do not invest enough because once investment is finalised, the government can always earmark it for purposes other than that for which it was made. This is what is known as the possibility of investment expropriation.

This argument cannot, however, distinguish between public and private enterprises as there is nothing to prevent the shareholders of a private firm from expropriating the investment made by the managers, although there will be fewer incentives in this latter case.

7. The political nature of the principals of public firms which, as we have seen, influences goal-setting, is also a determinant of management-selection conditions. Accordingly, appointments are not based so much on managerial capacity or effectiveness as on affiliation to the political party in power, confidence, etc. (González-Páramo, 1995).

8. Public enterprises are, in many cases, subject to the same administrative and financial controls as the rest of the State Administration. The essential aim of these controls is to preserve the legality of public-sector managers' conduct, without taking into account their level of efficiency, which is conducive to the emergence of routine and bureaucratic procedures that stifle appropriate and much-needed corporate dynamism.

This strong public control causes an excessive centralisation of decision-making, leading to a loss of independence on the part of middle management (Cuervo, 1997) and a concentration of decision-making at the highest executive level (Fernández, 1985).

9. Some authors (Grassini, 1981; Cuervo, 1997) highlight the role played by trade unions in public enterprises in causing inefficiency, as they use their strength as a source of income generation.

It could, therefore, be argued that, compared to private firms in competitive markets, state-owned enterprises are less likely to achieve efficiency. Moreover, the empirical evidence available supports this view (Borcherding, Pommerehne and Schneider, 1982; Millward and Parker, 1983; Boardman and Vining, 1989), with only scant exceptions (Milward, 1990 and Tulkens, 1993).

One particular case in the comparison we are reviewing is that of mixed ownership. From a theoretical standpoint, Boardman, Eckel and Vining (1986) find that mixed enterprises may be more efficient than public ones insofar as the latter can reconcile profit maximisation with social goals, provide internal information cheaply to the government and reduce their bureaucratic controls. The empirical evidence (Boardman and Vinig, 1989) shows, however, that mixed enterprises, in terms of profitability, obtain the same or worse results than public enterprises, while in terms of efficiency they are the same or just better. This result might be warranted by the existence of conflict between the two owner-principals (private and public sector) of the mixed enterprise.

Lastly, the literature emphasises the significance of competitive conditions as a pivotal factor in enhancing the efficiency of public and private enterprises (Yeaple and Moskowitz, 1995). Some authors (Kay and Thompson, 1986; Vickers and Yarrow, 1989) indicate that the development of competitive markets may be more important than the question of ownership.

B) NON-COMPETITIVE INDUSTRIES

The foregoing analysis becomes more complicated when seeking to compare the efficiency of the public as opposed to the private enterprise in non-competitive markets or those subject to market failure. In these cases, private enterprises ensure neither technical

efficiency (we may recall, for instance, the cases of X-inefficiency[1] in monopolistic markets; Leibenstein, 1978) nor allocative efficiency. A new factor, regulation, thus appears in the analysis. Regulation may allow both types of efficiency to be achieved, but new agency problems arise that hamper overall assessment of the results.

If we attempt to compare the efficiency of a public firm and a non-regulated private enterprise engaged in an industry subject to market failure, the result of the comparison is not clear. First, the non-regulated private enterprise ceases to be technically efficient since, as we have indicated, X-inefficiency problems emerge associated with the lack of competition. In this case the market failing is not resolved either and, therefore, allocative efficiency is not attained. Public firms, on the other hand, remain subject to the same inefficiencies referred to earlier. The choice now is between two imperfect alternatives. If we assume that the inefficiency of the private enterprise is positively related to the scale of the market failing and that the inefficiency of public firms depends positively on the significance of political motivation in the design of goals, we obtain the result that privatisation will be all the more desirable the lesser the significance of the market failure and the greater the weight of political goals in the function of the principal of the public enterprise. Otherwise, private ownership may cause greater inefficiencies than those generated by public one.

Vickers and Yarrow (1989) present a model summarising the trade-off between technical efficiency and allocative efficiency when a monopolistic public enterprise is compared to a non-regulated private monopoly. Insofar as privatisation involves a change in the firm's ultimate goal, namely profit maximisation at the private enterprise as opposed to the maximisation of social welfare at the public firm, prices will tend to increase towards their monopolistic equilibrium levels. This undoubtedly entails losses in terms of allocative efficiency. Conversely, the private monopoly has greater incentives to reduce costs and, therefore, privatisation prompts an improvement in terms of technical efficiency (Bös, 1991).

However, the most suitable analytical framework given the presence of market failure is that resulting from the comparison of public and regulated private firms. Regulation enables the firm to retain its profit maximisation goal (though not in all cases). However, it also alters agency relationships by setting management against two types of principals: shareholders and the regulatory agency. In this way, the factors indicated earlier as the causes of the relative inefficiency of public firms in a competitive setting appear here to a greater or lesser extent. We resume below the main problems facing the regulated private firm.

1. Regulated firms also have ambiguous and changing goals. The complexity of governmental goals and the continuous changes therein affect this type of firm. Indeed, in

[1] X-inefficiency refers to those inefficiencies arising from the behaviour of individuals in organisations not subject to market discipline, as a result of the lack of appropriate control mechanisms and incentives.

the case of regulated firms where two principals - shareholders and regulators - have different, varying interests, the definition of goals is even more diffuse and changing than at public firms, due to the conflict of interests between the two. As Laffont and Tirole (1993) indicate, the negative effects of this conflict tend to be fewer the more stable and defined the regulatory framework is.

2. Different lobbies press governments to regulate specific industries or to regulate them according to their interests. Consequently, this issue does not allow us to distinguish between public and private regulated enterprises.

3. The aim of regulation is not exclusively profit maximisation; rather, in many cases, distributive or other goals similar to those set for public enterprises are assigned. As a result, the problems generated by such a plethora of goals also appear in regulated private enterprises.

4. These enterprises face soft budgetary constraints. Frequently, governments come to the help of ailing regulated firms, perhaps not through explicit subsidies but certainly accepting, for instance, price increases.

5. The managers of regulated firms are at an advantage in relation to the regulator as they have all information on the firm's essential variables (Shapiro and Willig, 1990). This information is, moreover, of primary importance for decision-making by the regulatory agency. Management control of information can be used to its own benefit, with such conduct inherently generating inefficiency. In fact, in most models comparing the efficiency public as opposed to regulated private firms (Laffont and Tirole, 1993; Shapiro and Willig, 1990), privatisation leads to a reduction in the effort made by managers. However, Shapiro and Willig (1990) point out that privatisation also reduces the possibility of government members pursuing their own goals. While government members have all available information on the firm's relevant variables, the regulator only obtains information indirectly. Privatisation would, therefore, be a means of reducing the inefficiency brought about by government members or bureaucrats pursuing their own goals in a context in which they have all the information on the firm. Privatisation creates an information barrier between bureaucrats and the managers of the regulated firm which prevents the former from pursuing their objectives with the same ease as in the case of public ownership of the firm.

In light of all these arguments, comparison of the efficiency of public as opposed to regulated private firms does not lead to conclusive results. Nor does the empirical evidence available generally find greater efficiency at regulated private enterprises than at public firms. State-owned enterprises obtain the same or better results in the case of natural monopolies or highly regulated duopolies (electric and water utilities, for example) while the relative efficiency of private firms is greater in services susceptible to being operated on a

concerted or concessionary basis (health and educational services, non-rail transport or postal services, among others) (González-Páramo, 1995). In this respect, defining the most appropriate regulatory framework in each non-competitive situation is the key element for ensuring efficiency is achieved in these sectors.

Table 1 draws together the evidence available for the case of Spain. The table summarises the main characteristics of each paper: data sources, methodology and main results. Two conclusions may apparently be drawn from these results: a) using overall productivity or labour productivity indices, private enterprises show greater levels of efficiency than public ones; b) competitive conditions positively affect efficiency.

TABLE 1: EMPIRICAL EVIDENCE IN SPAIN ON THE RELATIVE EFFICIENCY OF PUBLIC ENTERPRISES

	Myro (1985)	Fedea (1987)	Prior, Verges, Vilardell (1993)	Sanchis (1996)	Argimón, Artola and González-Páramo (1999)
Statistical information	– AGGREGATE – Sources: "Las Grandes Empresas Industriales en España 1980-1981" and "Resumen de Actividades de las Empresas del INI en 1980" – Period: 1980.	– INDIVIDUAL data from firms in the manufacturing sector (excluding energy and mining industry) – Source: CBBE – Period: 1985	– AGGREGATE sectoral information – Source: CBBE for private enterprises and CICEP (Centro de Información Contable de la Empresa pública) – Period: 1981-84	– Sample of public enterprises (INI-INH) that have been privatised and/or undergone restructuring. – Source: INI and INH Annual Reports – Informe sobre la Industria Española - Period: 1978-1990	– INDIVIDUAL data – Source: CBBE – Period: 1994 – All sectors.
Methodology	– Measure of total factor productivity as ratio of value added to inputs used in its production (K y L)	– Total factor productivity index	– FARREL's methodology to determine the absolute efficient frontier and rates of change of total factor productivity – Non-parametric estimation of the coefficients relative to successive sectoral production functions	- Calculation of measured labour productivity (firm and sectoral average) - Econometric analysis of the effects of restructuring, privatisation and broder competition on productivity.	– Measured labour productivity index (Baldwin, 1992)
Conclusions	– Lower measured labour and capital productivity in INI enterprises as a whole	– Predominance of relatively inefficient public enterprises compared to private-sector counterparts, accounting for 64% of the sample.	– Overall, greater productive efficiency among private enterprises, although with strong differences across sectors.	– The effects of privatisation and restructuring have generally been positive for productivity – Increases in competition significantly raise productivity	– Average efficiency of public firms is lower than that of the other firms – Competitive conditions defining the market contribute significantly to explaining relative efficiency.

3. MEASURES OF PRODUCTIVITY, EMPIRICAL MODEL AND ESTIMATION METHOD

To compare the performance between state-owned and private enterprises we first need to agree on the definition of efficiency that we are going to use. A firm is technically efficient if it is at the limit of its production possibilities, i.e. if it cannot produce more of a good without increasing the amount of inputs used. And it is in a position of allocative efficiency if it is minimising production costs or maximising profit, which means not only that it is technically efficient but that it is using the most adequate input mix, given input prices and marginal productivities.

Since the objectives of public enterprises may differ from mere profit maximisation (mainly as a result of the redistributive function of the State) and given that the criterion of productive efficiency alone seems to be compatible with other objectives, comparison will be carried out in terms of productive efficiency. Nonetheless, and in order to analyse the sensitivity of the results to other definitions of efficiency, the comparison will also be made on the basis of the profit criterion.

3.1. PERFORMANCE MEASURES: RELATIVE PRODUCTIVITY AND PROFITABILITY

First, following Baldwin (1992), relative productivity is adopted as a reference for measuring performance. The efficiency indicator proposed compares the output per employee of each firm with the average output per employee of the set of most productive firms in a sector. Specifically, the efficiency indicator of a firm is defined as the ratio of actual output to potential output, which is calculated for each firm as the product of the level of employment and the efficient level of output per person in the sector **j** to which the firm belongs. In turn, the efficient level of output per person in a sector is defined as the ratio of aggregate output to aggregate employment in the group B_j made up of the most productive firms in the sector.

Analysing the technical efficiency of the firm with an indicator based on a measure of output per employee instead of total factor productivity implies implicitly that the goal of the firm is to maximise this variable and that those firms achieving the highest output per employee should be imitated. Under this approach it is assumed that labour is an homogenous input and that each sector is defined by a specific technology. Therefore, the index proposed is not an exact measure of technical efficiency but rather an approximation to the real indicator. In any event, Baldwin's index appears to be highly correlated with other more perfect measures [(see Baldwin, 1992)].

The firms in the reference set, B_j, are the most productive firms, **K**, in the sector. These firms have to account for at least, 10% of the value added of the sector (in relation to the firms included in the sample)[2].

The efficiency indicator of a firm i belonging to sector **j**, which shall be called $\mathbf{k10_{ij}}$, when output per person is defined as gross value added per employee[3], is therefore:

$$k10_{ij} = \frac{GVA_{ij}}{GVA^{P}_{ij}}$$

where:

$$GVA^{P}_{ij} = l_{ij} \bullet \frac{\sum_{k \in B_j} GVA_{kj}}{\sum_{k \in B_j} l_{kj}} \qquad [1]$$

GVA_{ij} = Value added of firm i in sector j.

GVA_{ij}^{P} = Potential value added of firm i in sector j. [2]

l_{ij} = number of employees in firm i in sector j.

The second factor of expression [2] is the efficient level of output per person in sector j to which firm i belongs.

$k10_{ij}$ can be calculated for each year (t) of the sample.

In addition, we will use the return on net assets (RAN) [4] as a second definition of efficiency. This indicator is adopted as a reference for measuring efficiency in the allocation of resources[5].

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[2] Alternative definitions of the efficiency index have also been tested, based on the reference set of firms (B_j) contributing at least 20% or 30% to the value added of the industry, without the results being significantly affected.

[3] Alternatively, labour productivity can be defined as production per employee. This second definition has also been tested and the results are basically the same.

[4] Other definitions of profitability (return on equity, financial profitability, economic profitability) have been tested and the results are basically the same.

[5] This indicator can only be considered a proxy of the economic profit of the firm since it is obtained from accounting information that might not provide a good approximation to the relevant economic concept (for example, this is the case of the depreciation of assets and the corresponding amortisation charges).

3.2. EMPIRICAL MODEL

The relative performance of public and private enterprises in relation to efficiency will be tested using the two proposed definitions. First, from a Cobb-Douglas production function ($Y_{it} = A\ K_{it}^{\beta}\ L_{it}^{\alpha}$), reordered and specified in logarithmic form (small case letters), we derive an equation whose dependent variable is the previously defined index [6], We, then, include an additional regressor which measures relative public ownership (KPUDIT) , so that the equation to be estimated becomes:

$$\log k10_{it} = \gamma_0 + \gamma_1 KPUDIT_{it} + \beta(k_{it} - l_{it}) + (\alpha + \beta - 1)l_{it} + \sum_{m=1}^{n} \phi_m X_{m_{it}} + \varepsilon_{it} \qquad [3]$$

where $\varepsilon_{it} = \eta_i + u_{it}$ and $E(\eta_i X_{it}) \neq 0$

We allow the coefficients of the capital-labour ratio and of the labour variable to differ for each sector so as to reflect the technological differences across sectors in terms of capital intensity and returns to scale. As a result, the equation becomes:

$$\log k10_{it} = \gamma_0 + \gamma_1 KPUDIT_{it} + \sum_{j=1}^{13} \beta_j (k_{it} - l_{it}) + \sum_{j=1}^{13} (\alpha_j + \beta_j - 1) l_{it} + \sum_{m=1}^{n} \phi_m X_{mit} + \varepsilon_{it} \qquad [4]$$

Under this formulation, the variable to be explained - the previously defined efficiency index - depends on the capital-labour ratio ($k_{it} - l_{it}$), the labour variable (l_{it}), a variable that measures the proportion of public to total capital in the firm (KPUDIT), and a set of variables that aim to approximate other relevant factors for productivity[7] (X_{it}).

The estimated coefficients will capture the effect of the level of the regressors on the level of relative efficiency (level effect). However, some authors (Nickell et al., 1992; Hernando and Vallés, 1994) point out that these effects might be more persistent over time, so they propose to model these persistent effects by including an additional vector of regressors (Z_{it}) in equation 4, where $Z_{it} = \sum_{h=1}^{t} X_{ih}$. These additional regressors have been included in some of the estimates in section 6. We shall see (section 3.3) that the model is estimated in first differences to avoid the bias derived from the correlation of the individual

[6] The most common expression of a production function has as dependent variable the output per employee. In our case, this variable has been replaced by the previously defined index, in logarithmic form (log k10). This is equivalent to assuming that the original production function has as an additional explanatory variable a sectoral average (as a proxy of the potential output) with a coefficient equal to one. However, the same regressions have been carried out taking as a dependent variable the output per employee instead of the productivity index and the results have not been substantially modified.

[7] This set of variables and their theoretical relationship to productivity are detailed in section 4.

effects with the regressors. The coefficients of these variables Z_{it}, which in first differences are equal to the level of the variables included in the vector X[8], will capture the growth effect[9].

And second, we will have as dependent variable a profitability measure of the firm. In particular, the return on net assets (RAN) will be regressed under the same specification than in equation 3. In this case, it cannot be interpreted as an estimation of a production function. We allow the capital-labour ratio and labour variable to vary for each sector, as in equation 4.

$$RAN_{it} = \gamma''_0 + \gamma''_1 KPUDIT_{it} + \sum_{j=1}^{13} \beta''_j (K/L)_{it} + \sum_{j=1}^{13} \alpha''_j L_{it} + \sum_{m=1}^{n} \phi''_m X_{mit} + \Theta_{it} \qquad [5]$$

3.3. ESTIMATION METHOD

where $\Theta_{it} = \eta''_i + u''_{it}$ and $E(\eta''_i X_{it}) \neq 0$

To avoid the bias derived from the potential correlation between the individual effects and the regressors, the model is estimated in first differences. Moreover, given the possible simultaneity of the determining variables of productivity and the dependent variable, estimation is carried out by the generalised method of moments (GMM)[10] [Arellano and Bond (1991)], using lagged regressors as instruments. To control for sectoral and aggregate-related disturbances, sectoral and temporary dummy variables are included in the estimation.

Under the assumption that the error is white noise in the model in levels, when estimation is carried out in first differences, an MA(1) structure is imposed in the residual term. Therefore, endogenous variables lagged by two or more periods are needed to be taken as instruments. For these instruments to be valid, the hypothesis that the error term is white noise must hold. If that is the case, the latter will not show second-order serial correlation in the equation in first differences. The m2 statistic, which is shown in the tables of results, is distributed asymptotically as a normal distribution and is used for testing this

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[8] $\Delta Z_{it} = \sum_{h=1}^{t} X_{ih} - \sum_{h=1}^{t-1} X_{ih}$

[9] The letter D before the name of a regressor X denotes first difference of the accumulated variable X (DCUOTA, DCONC, etc)

[10] At the start of section 6, the results of the OLS (Ordinary Least Squares) estimation for each year of the sample and for the whole period are also presented so they may be compared to the GMM results in first differences. Finally, in section 6.3, these results are compared to the GMM estimations in levels and the ones obtained using the *system estimator*.

hypothesis. Lastly, the Sargan test is presented and is used to test for the validity of the overidentification restrictions and is distributed asymptotically as a $\chi 2$.

4. OTHER DETERMINANTS OF PRODUCTIVITY

Along with the possible effect of public or private ownership on productivity, this paper will empirically test the influence of other factors which have traditionally been considered by the theoretical and empirical literature as determinants of efficiency. In particular, the influence of the degree of sectoral competition, the existence of financial constraints and the role of heterogeneous labour will be analysed.

The influence on individual productivity of the degree of competition in an sector, is first determined by the greater need that firms in competitive sectors have to increase efficiency in order to remain in the market (Schmidt, 1996; Aghion and Howitt, 1996). Moreover, in a competitive environment, the problems the shareholders face as far as controlling managers are reduced as the former have access to mechanisms for comparing results (Holmstrom, 1982). Lastly, under competition the price elasticity of demand is usually higher, whereby firms have a greater incentive to reduce costs as this brings about greater relative benefits. Nonetheless, given that in a monopoly situation the operations of the monopolist are usually of a greater volume, the absolute benefit of a reduction in cost is also greater (Willig, 1987).

The variables included in the empirical analysis to approximate the degree of competition in the sector are as follows:

- Sectoral import penetration (PENIMP), as a proxy of the level of foreign competition to which the different sectors are exposed. In this respect, the disappearance of tariff barriers following EC membership in 1986 produced a strong increase in competition in the industrial sector in Spain which might have affected the market structure and productivity of Spanish firms (Hernando and Vallés, 1994).

Nonetheless, some authors (Geroski, 1989) contend that the import penetration variable could gather an adverse effect on the efficiency of firms since, given total demand, an increase in import penetration may prompt a shift in domestic production without a parallel reduction in the stock of capital, thereby causing a decline in capital productivity. This negative sign could also be the result of reverse causation, in the sense that the sectors with the lowest productivity are those which attract a growing volume of imports (Martín Marcos, 1992).

- Exports as a percentage of sales (XSVTS), a variable which is justified by the argument that those firms most dependent on exports are also those with most incentives to improve their productivity, given the higher foreign competition. Nonetheless, variables such

as labour costs, the exchange rate or foreign prices may alter this relationship (Hernando and Vallés, 1994). Furthermore, there may be reverse causation: the most efficient firms being those with the highest export/sales ratio.

- Market share (CUOTA). In this case, if market share is regarded as a measure of the sector's degree of monopoly, the firms with the largest market share would also be those that would be dominant in the market, having less incentive to improve their productivity. However, the reverse relationship may also be explained if we believe that the most efficient firms are the ones that obtain the largest market share (Demsetz, 1974 and Hernando and Vallés, 1994). Finally, the positive sign could also be warranted by the existence of economies of "learning by doing" associated to accumulated production, that would be proxied by the market share.

- The degree of sectoral concentration (CONC), defined as the market share of the three firms with the largest market share in the sector[11]. In this case, there are two kinds of arguments explaining the relationship between market share and productivity. First, there is the view that it is in the least competitive environments (i.e. with most market concentration) where firms can benefit to a greater extent from the returns on R+D expenditure since the level of uncertainty is lower and cash flow higher. Second, there is the opposite view, that the least competitive sectors see the highest red tape costs discouraging technological investment (Martín Marcos, 1992) and innovative diffusion.

The theoretical foundations of the role of **financial constraints** on the efficiency of firms lie on the existence of imperfections in capital markets (non-perfect substitutability) which means that the financial position of the firm has consequences for its real variables as it affects its capacity to undertake projects or restructuring. The variables that have been included in the analysis in an attempt to approximate this role are the following ones:

- Indebtedness (REND): there is evidence that firms which have been acquired by a leveraged buyout have shown higher productivity growth rates since (Lichtenberg and Siegel, 1990). Also, Nickell et al. (1992) find a positive relationship between the proportion of debt per unit of asset and total productivity (in terms of both level and growth). This is justified by the disciplinary effect that an increase in indebtedness has on the use of available funds (Nickell et al., 1996; Jensen, 1986).

- Interest payments (GINTERES): Nickell (1996) justifies this variable with the argument that the higher the level of interest payments in relation to profit levels, the greater the likelihood of the firm declaring bankruptcy.

[11] Alternatively, the degree of sectoral concentration has been defined as the market share of the four and five firms with the largest market share in the sector, and the results have not significantly changed. .

- Cash-flow (CFK). The argument used for the inclusion of an interest payments variable can likewise be used, for the cash-flow variable, but to the opposite effect: the less cash-flow available to managers, the greater the likelihood of the firm declaring bankruptcy and the greater the pressure on management.

Nonetheless, the existence of asymmetrical information (for instance, because the return on investment projects cannot be fully observed by the lender) may be the source of credit rationing (Stiglitz and Weiss, 1981), in such a way that firms are mostly dependent on their ability to generate funds to undertake their investment projects. Even though there may be no rationing, if the cost of self-financing is lower than the cost of equity, the cash-flow variable will also be relevant. In this case, however, the relationship between the variable and productivity is in the opposite direction to the previous case: given a level of debt, more available resources allow more investment opportunities, increasing the firm's productivity.

- Presence of financial institutions in the firm's capital (INSFIN): as a measure of the firm's ability to gain access to sources of financing, and following the arguments above , the greater the access (proxied by the fact that financial institutions have a share), the lesser the pressure on management. However, if there is credit rationing, the greater the access to sources of financing, the greater the possibility of benefiting from all the investment opportunities that may arise for the firm.

Some authors point out that there could be a certain degree of substitutability between competition and financial pressure and that the positive effect of competition on productivity might be expected to be greater when interest payments are low (Nickell et al., 1996).

As regards to the **quality of labour**, the following variables have been defined

- The proportion of temporary to total employment in the firm (TEMP). Temporary employment has a considerable tradition in the literature as a relevant variable for labour productivity. In Spain, the emergence of temporary contracts as from 1984 may have prompted an important reduction in labour productivity (Jimeno and Toharia, 1991). Nonetheless, the expected effect of this variable on productivity may be twofold. First, the incentives for the firm to earmark resources to investment in human capital are greater in the case of a working relationship unlimited by time. On the other hand, temporary labour might provide a firm with substantial flexibility and better adaptability to changes in its environment. Furthermore, it could be argued that temporary workers have an incentive to make a greater effort with the aim of becoming permanent.

- Labour costs per employee (COSTEL), which may be an indicator of the quality of labour provided if there is a direct relationship between remuneration and the degree of

professional expertise. However, this variable may be influenced by the presence of greater/lesser trade union power, among other factors.

5. DESCRIPTIVE ANALYSIS

The data source is a sample of manufacturing firms that have co-operated with the Banco de España Central Balance Sheet Office (CBBE) for at least four consecutive years, in the period 1983-1996[12]. It should be borne in mind that reporting to CBBE is voluntary. In the case of the manufacturing sector, however, the coverage of the CBBE sample in terms of gross value added at factor cost is estimated to have reached 33% of all firms in the sector according to 1993 National Accounts information. Nonetheless, the sample shows certain biases: large, public firms with a high proportion of permanent staff predominate.

This section is devoted to highlighting the main productivity trends of the firms in the sample and to identifying the main differential characteristics between public and private firms.

Firstly, in Table 1, the median, mean and standard deviation of the previously defined efficiency index for the whole period under analysis (1983-1996) is presented. A comparison between public and private firms is included, where a firm is considered within the group of state-owned corporations if the public sector holds any proportion of the corporation's capital stock. The table shows that in the early years of the sample (1983-1986) the median of this efficiency index was higher in private corporations, although the difference with public firms is not statistically significant. From 1986 onwards public firms show, in median, a higher index than private corporations, and the difference is statistically significant. Note, however, that in these calculations other potential determinants of business efficiency are not taken into account. Nonetheless, as can be seen in Table 2, the sectoral and time differences in this index are high. In four of the thirteen sectors, the differences in the index between private and public firms are not statistically significant. In six sectors, the median of the index is higher and statistically significant in some periods in state-owned firms (in basic metals and manufactured metal products, the difference in the index is statistically significant in 12 over 14 years). Finally, private firms show higher indexes than public firms, the difference being statistically significant in some periods, in four sectors (in transport equipment, the difference in the index is statistically significant in 9 over 14 years).

Secondly, Table 3 shows some descriptive statistics of certain variables whose relevance in explaining productivity we discussed, distinguishing between public and private firms. The following conclusions may be drawn from this table.

[12] A detailed description of the characteristics of the sample used can be found in the Appendix.

As regards the use of productive inputs, public corporations have a greater number of employees (PERS) and a higher capital/labour ratio (K/L), in terms of medians, throughout the period considered. The volume of the stock of capital (SKR) is also higher in public corporations, whereupon their size may be said to be greater. Further, they have a lower percentage of temporary employees (TEMP) and higher labour costs (COSTEL).

The growth rates of activity (RVTAS, RVAB, REXP, RIMP) are generally higher in private corporations. In particular, public corporations grow less in upturns and yet still lag behind in recessionary phases, which seem to last longer than in the case of private corporations. Moreover, the financial ratios highlight one of the traditional problems of public corporations, namely overstaffing, whereby for virtually the entire period these ratios show negative rates of change in the number of employees (RPERS), indicating a possible ongoing adjustment thereof.

Public corporations have a bigger market share (CUOTA), in median terms, than their private counterparts throughout the period considered. At the same time, they assign a higher proportion of their sales to exports (XSVTS).

Public corporations have a higher debt ratio (REND) than private firms, while self-financing (AUTOFIN) is higher in the latter.

In terms of profitability, public firms have a lower gross economic return (REB) (i.e. after deducting personnel costs from value added) than that of private corporations owing to the fact that personnel costs (GP) account for a higher proportion of value added in public corporations. Moreover, the funds generated (RG) are also greater in private firms, as is the return on net assets (RAN) and the return on equity (RRP).

Generally, therefore, public enterprises may be said to show better results when value added is observed; however, once personnel costs, financial charges and depreciation are taken into account, their profitability ratios are far lower than those of private corporations, as a result of a higher number of employees and higher labour costs, greater indebtedness and a larger capital stock.

Lastly, Table 4 shows the medians of the sectoral variables of import penetration and of concentration, so as to characterise the degree of competition of the various sectors. This table also presents the number of public and private corporations included in each of the years and sectors of the sample. Generally, strong growth in import penetration is seen in all sectors, which would be an indication of the increase in the degree of competition: this variable stood at below 10% in seven of the sectors analysed in 1983, whereas in 1996 only two sectors (the food, beverages and tobacco industry and the non-metallic mineral products sector) were below 20%. Import penetration has been particularly high throughout

the period in construction and mechanical equipment, in electrical, electronic and optical materials and equipment, and in the chemical sector. As to the degree of concentration, this variable has generally declined during the period except in the chemical and textile and clothing industries. The other non-metallic mineral products and transport equipment industries have been among the most concentrated sectors both at the beginning and end of the period, while the paper and other manufacturing industries display low concentration ratios. In general, there is no clear relationship between the degree of concentration and import penetration except in the case of the other non-metallic mineral products sector which, as already stated, shows high concentration and a low weight in terms of import penetration.

6. RESULTS

This section details the results of the estimation of the equations presented in section 3, with the method set out in section 3.3. First of all, however, Tables 5 and 6 show the results of the Ordinary Least Squares (OLS) estimations of the equations of the relative productivity index and profitability, respectively, for each of the years of the sample and for the whole period[13]. Whatever the definition of efficiency adopted, the results show a negative and significant coefficient of the public ownership variable (KPUDIT), which would denote that public ownership has a negative effect on efficiency. These results coincide with those obtained by Argimón, Artola and González-Páramo (1999) in the case of the productivity index for all sectors of the Banco de España Central Balance Sheet Office in 1994.

As regards the financial variables, the coefficient is statistically significant in all annual regressions, the sign being positive in the case of cash flow per capital stock and negative in the case of indebtedness. Both signs are against the argument of the disciplining effect discussed in section 4, but, in the case of cash flow, it is coherent with the theory that, if there is asymmetrical information, firms are more dependent on their ability to generate funds to undertake their investment projects. Thus, more available resources allow investment opportunities to rise increasing the firm's productivity.

None of the variables proposed to approximate the competitive framework and the market structure are statistically significant in all and each year. The results for the period as a whole in Table 5 (column 15) show that exports, import penetration, market share and concentration positively and significantly affect productivity, which leads us to contradictory interpretations: the positive sign of the coefficients of the first two variables would be in accordance with the argument that a greater degree of competition leads to corporate efficiency, while a positive sign for the coefficients of the last two variables (market share and concentration) would denote the opposite. In the case of Table 6, which presents the

[13] All the panel estimations have been obtained using the DPD98 program by Arellano and Bond (1998).

results of the regressions in which profitability is the variable to be explained, only the concentration variable shows a significant coefficient. Its negative sign denotes that competition adversely affects business profitability.

Finally, the results show that, when the dependent variable is the relative efficiency index (Table 5), the temporary employment ratio and personnel costs per employee have a positive impact, while the percentage of subsidies[14] received has a negative non-statistically significant impact. When the dependent variable is profitability (Table 6), the previous results hold, except in the case of the personnel costs variable, which shows a negative coefficient. Nonetheless, these results do not hold for all the annual regressions.

The results presented in Tables 5 and 6 are obtained by OLS, so that they have not considered the possible simultaneity of the determining variables of productivity and the dependent variable, nor have they (except in the last two columns) addressed the possible correlation between the individual effects and the regressors[15]. In fact, the values of the first and second order serial correlation test statistics (M1 and M2 values in column 15 of Tables 5 and 6) may reflect the presence of firm specific effects. If these firm specific effects were correlated with the regressors, we would expect that OLS estimates in first-differences or orthogonal deviations would not be biased (Arellano and Bover, 1995), while OLS estimates in levels would. Columns 16 and 17 in Tables 5 and 6 show the results of the OLS estimations in first-differences and orthogonal deviations. The values of the first and second order serial correlation test statistics cannot reject the presence of first-order serial correlation in the transitory errors of the original model in levels. Moreover, the fact that the values of the coefficients in the estimations in first-differences and levels differ could be explained by the bias in the OLS levels estimate resulting from the correlation between the individual effects and the regressors. However, the values of the coefficients in the estimations in first-differences and orthogonal deviations also differ, so that the correlation between the individual effects and the regressors cannot be the only explanation of the difference with the level estimation. OLS estimates in first differences and orthogonal deviations can also be biased, for example, due to the presence of endogenous variables. For this reason, the Generalised Method of Moments (GMM) estimation is used.

6.1. OWNERSHIP AND RELATIVE LABOUR PRODUCTIVITY

Table 7 presents the results of the regression analysis where the dependent variable is the relative productivity index, defined in section 3.1 (logk10), and where the regressors are relative public ownership, the capital/labour ratio by sector and employment by sector, and another set of potential determining factors of productivity (see equation 4).

[14] The ratio subsidies over ouput has been included as an additional regressor to control for their distortionnary effects on prices.

[15] All the arguments included in this paragraph are based on Bover and Watson (2000)

Relative public ownership is defined in four different ways. First, the variable KPUDIT is defined as the percentage of the capital stock which is publicly owned. Second, the variable KPU is a dummy variable which takes the value one if the public sector has a share in the firm's capital stock and 0 otherwise. Third, KPUBCB is also a dummy variable which takes the value one if the public sector has more than 50% of the firm's capital stock and/or if, whatever the share, it has control of the firm[16]. Finally, KPU1.00 is a dummy variable that takes the value one if the public sector holds 100% of the firm's capital stock[17]and 0 otherwise.

The results in Table 7 are based on a different assumption as regards the endogeneity of the relative public ownership variable. In the estimations whose results are shown in columns 1 to 8, this variable is considered as exogenous while in the case of columns 9 to 12 it is considered endogenous[18]. In principle, the relative public ownership variable could be regarded as exogenous in relation to the productivity measure. However, given that, in the Spanish case, the corporate public-sector has often been the recipient of unprofitable or ailing firms (so that it is regarded as a "hospital for firms") (Cuervo, 1997) and, therefore, that the decision to nationalise a corporation has not been independent of its productivity or profitability, it seems relevant to also consider it an endogenous variable.

The first four columns show the results of the estimations of equation 4 for each of the definitions of the relative public ownership variable, including sectoral and time dummies and a different coefficient per sector for the capital/labour ratio, and for labour. The other potential determinants of productivity are included in the estimations whose results are given in columns 5 to 12, where only the coefficients of those that are statistically significant are presented. All estimations are in first-differences.

The results show that public/private ownership is not a determinant of relative apparent labour productivity since its coefficient is never significant, irrespective of the definition of relative public ownership chosen. Moreover, the sign of this variable is negative

[16] This variable has been taken directly from the information provided by the Banco de España Central Balance Sheet Office.

[17] Tests have been carried out, both for the relative efficiency index and the profitability index, in which the variables KPU and KPUDIT have been jointly included, and where also a square term ($KPUDIT^2$) has been added, with similar results to the ones presented in the tables. Alternatively, dummy variables indicative of whether the public share in the capital is at most 50%, if the share exceeds 50% but is lower than 80% and if the share is greater than or equal to 80% have been introduced in order to characterise the behaviour of the mixed corporation, and their coefficients have not been found to be statistically significant.

[18] Given that the relative public ownership variables presents little time variation, their lags cannot be considered good instruments. Therefore, we instrument this variable with the lags of some other regressors that, according to section 5, are highly correlated with the relative public ownership variable, for example, the capital/labour ratio, employment or indebtedness.

when it is treated as an exogenous variable, which would denote that public ownership adversely affects efficiency[19].

As regards the variables that attempt to proxy the degree of competition, the import penetration coefficient (PENIMP) is positive and significant, indicating that foreign competition has a favourable effect on the level of productivity. On the other hand, the coefficient of the variable representing the proportion of exports (XSVTS) is not found to be significant. Moreover, a positive and significant sign is obtained for the growth effect of the market share (DCUOTA) in consonance with our hypothesis that this variable may be an indicator of the accumulated output and there are economies of "learning by doing". In respect to concentration, a negative and significant coefficient of the growth effect is found (DCONC). As indicated in section 4, this could be explained by the fact that it is in the least competitive (most concentrated) sectors where there are fewest incentives for technological investment or where there is a lesser diffusion thereof.

As for the variables that proxy the degree of financial constraint, the coefficient of the cash-flow per unit of capital variable (CFK) has a positive and significant sign. This is compatible with the argument based on the existence of asymmetrical information, which points out that, in a credit rationing situation, corporations are more dependent on their ability to generate funds so as to be in a position to benefit from investment opportunities and, therefore, to increase productivity. The debt and interest payments ratios, however, are not significant.

Among the labour market variables, the labour costs per employee (COSTEL) shows a negative and significant coefficient. If this is taken as an indicator of the quality of work, it is contrary to the starting hypothesis that greater quality is associated with greater productivity. However, this variable may be influenced by the presence, for example, of trade union power. On the other hand, no evidence is found that the proportion of temporary employment is a determinant of efficiency.

Finally, as regards returns to scale, which is tested using the coefficient of the number of employees (whose results are not shown in the tables), the hypothesis of constant returns to scale cannot be rejected in nine sectors (food, beverages and tobacco; other non-metallic mineral products; construction of machinery and mechanical equipment; electrical, electronic and optical materials and equipment; transport equipment; textiles; timber and cork; paper; and other manufacturing). Diminishing returns are found in two sectors (chemicals and basic metals). And, finally, increasing returns are obtained in two sectors (leather and rubber processing).

[19] Given that the argument that the corporate public-sector has been recipient for unprofitable or ailing companies is not applicable to the whole period considered in this paper, the sample has also been divided into two sub-periods, 1990 being the break point year, and the above estimations were repeated. Results do not vary significantly.

6.2. OWNERSHIP AND PROFITABILITY

Lastly, Table 8 shows the results of the estimation of equation 5 (see section 3.2), i.e. when the dependent variable is business profitability. As in the previous case, the results of columns 1 to 8 are obtained under the hypothesis that the public/private ownership variables are exogenous, while in the case of columns 9 to 12 they are considered to be endogenous. At the same time, the first four columns of each table give the results of the estimation of equation 5 for each of the definitions of the relative public ownership variable, including sectoral and time dummies and with a different coefficient per sector for capital and for labour. The other potential determinants of productivity, are also included in columns 5-12, although their coefficient is recorded only if it is statistically significant.

The results show that the coefficients of the relative public ownership variables are not significant for this definition of productivity either, although the sign is still negative[20]. In this case, the coefficients of the variables of cash-flow per unit of capital and of indebtedness are statistically significant (the first with a positive and the second with a negative sign), highlighting once again the importance of financial position in determining profitability. Nonetheless, it should be pointed out that the relationships between the two former variables and profitability may be highly influenced by a purely accounting dependence: the cash-flow variable is an important part of the firm's final profits and, likewise, greater debt entails higher interest payments which reduce profits. A positive and significant relationship is also found between the market share (level and growth effect) and profitability, indicating that firms with a larger market share obtain larger profits. There is a negative and significant relationship between the labour costs per employee and profit variables, leading to the same interpretation as in section 6.1.

6.3. DIFFERENT METHODS OF ESTIMATION

The results presented so far are affected by the lack of variation in some of the variables, as the estimation is carried out in first differences. It becomes difficult to assess whether the lack of statistical significance in these variables arises because of their temporal constancy or because of a "genuine" lack of relevance. The relative public ownership is one of these variables as it presents time variation only in 311 observations in the case of KPU, in 552 in the case of KPUDIT, in 199 in the case of KPUBCB and, lastly, in 155 in the case of KPU100. However, it should be taken into account that the loss of statistical significance in the estimation in first differences might also be explained the potential biases due to the correlation of the individual effects with the regressors and the

[20] As in the case of the relative productivity, the sample has been divided into two sub-periods as well, 1990 being the break point year, and the above estimations were repeated. Results do not vary significantly for each sub-period.

simultaneity between the explanatory variables and the dependent variable in the estimation in levels.

This problem of the scarcity of time variation can be addressed if it is assumed that some of the regressors have a constant correlation with the fixed effects, which only requires stationarity in mean of the regressors, given the effects[21]. Arellano and Bover (1995) show that, in this case, the first differences of the variables are appropriate instruments for the equations in levels. Accordingly, in addition to the instruments in levels for the equations in first differences, they propose using the instruments in first differences for the equations in levels. This model of first differences and levels, which they call *system estimator*, is half-way between the fixed effects model, in which all the explanatory variables are potentially correlated with the effects, and the random effects model, in which no variable is. In this paper we have also applied this procedure and the generalised method of moments (GMM) with variables in levels. In this latter case, bias derived from the potential simultaneity between the regressors and the dependent variable is avoided but not the one derived from the correlation between the fixed effects and the regressors.

Tables 9 and 10 show the results of these estimations when the dependent variables are the productivity index and business profitability, respectively. In both cases, GMM estimates in levels and by the system estimator are biased since the validity of the overidentification restrictions is rejected and it is found first order and second order correlation. Nevertheless, in the first case (table 9), the coefficients of the public/private ownership variables are always negative but never significant, except for the variable KPU100 in the GMM estimation in levels. This might indicate that the loss of significance of the coefficients of these variables is not due to the scarcity of time variation but to the bias introduced by the simultaneity of some of the regressors with the dependent variable in the OLS estimates in levels. As regards the estimates when the dependent variable is business profitability (Table 10), again, the sign of the coefficients of the relative public ownership variables is always negative, but now they are also significant in the GMM estimations in levels and, in the case of the variable KPU, also under the system estimator. In this case, it is not possible to know whether the loss of significance of the ownership variables is due to the scarcity of time variation of these variables or to the bias derived from the correlation of the fixed effects with the regressors in the estimations in levels.

7. CONCLUSIONS

Efficiency enhancement is one of the most commonly used arguments to justify privatisation. Public firms' performance is assumed to be poorer than private firms' and

[21] Alternatively, the problem of the scarcity of time variation in the public/private ownership variable in the estimations in first-differences has been treated by introducing among the regressors new variables generated by multiplying some regressor with the public/private ownership variable. However, the coefficients of these variables were not statistically significant.

therefore, the privatisation of the former is expected to increase global efficiency. From a theoretical standpoint, however, the relationship between public ownership and efficiency requires identification of the competitive framework in which the firm operates. Private enterprises are generally acknowledged to be more efficient than their public counterparts in competitive markets, while the results of the comparison are not conclusive in the case of non-competitive or regulated sectors.

This paper has empirically tested, for the Spanish case, the hypothesis that public ownership is a determinant of a firm's performance. The comparison between public and private enterprises in terms of efficiency may be inappropriate as public firms may have objectives not related to profit maximisation. Accordingly, in this paper performance has been measured in two alternative ways: relative productivity and profitability. The first definition aims at proxying the concept of technical or productive efficiency, which is generally taken to be the sole objective that public enterprises cannot elude, while the second one proxies allocative efficiency. Moreover, the role of ownership as regards a firm's performance is isolated, by conditioning on other possible determinants of efficiency, in particular, the degree of competition, the firm's financial situation or the heterogeneity of labour.

The evidence gathered here show that public ownership has a negative effect on efficiency, proxied by a labour productivity index, but it is not statistically significant. This lack of statistical significance contrasts with the results obtained in Argimon, Artola and Gonzalez-Paramo (1999) with data for 1994. In fact, annual estimations for the whole period presented here also find a negative statistically significant coefficient for the public ownership variable. Two factors may account for these seemingly conflicting results: on the one hand, annual estimations may be biased by the possible simultaneity of the variables, and on the other, the lack of time variation of the variable that captures ownership might explain this lack of significance in the estimation in first-differences. The tests carried out here, although not conclusive, seem to favour the first of these explanations.

On the other hand, a significant relationship is found between some of the variables attempting to approximate the degree of competition (in particular, import penetration and the degree of concentration) and relative productivity, showing that competition positively affects efficiency. In addition, a positive and significant relationship is found for the growth effect of market share, that if this variable is considered an indicator of the accumulated output, it would favour the hypothesis that there are economies of "learning by doing". As for the variables that proxy the degree of financial constraint, the coefficient of the cash-flow per unit of capital has a positive and significant sign. This is consistent with the argument based on the existence of asymmetric information, which indicates that, given a situation of credit rationing, enterprises are more dependent on their ability to generate funds with the aim of taking advantage of investment opportunities and, therefore, increasing corporate

productivity. Finally, the input variables show that higher capital resources increase the productivity of a given quantity of labour. On the other hand, higher labour costs per employee are associated with lower productivity, so that either this variable is not a good proxy for labour quality or, if it is, higher quality does not lead to greater productivity.

The estimated relationship between public ownership and profitability is always negative. The estimated coefficient is moreover statistically significant in many of the estimates, so that public ownership has a negative effect on the profitability of a firm.

Table1.EFFICIENCY INDEX (k10) AND OWNERSHIP IN THE MANUFACTURING SECTOR

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
TOTAL														
Median	40.3	36.4	38.1	36.5	33	29.2	30.8	35.6	38.6	38.9	36.4	34.2	30.5	35.7
Average	48.5	42.8	44.1	41.9	39.3	36.3	37.7	41.8	43.8	45.1	42.4	40.8	37.4	42.1
Standard Deviation	36.7	27.3	26.8	25.8	28.2	29.2	28.1	32.8	27.2	39.3	31.6	26.9	25.9	25.3
Obs	1268	1685	2059	2508	2787	2811	2812	2707	2560	2484	2433	2225	2054	1642
PUBLIC (*)														
Median	35	31.2	37.4	32.9	33.8	**29.9**	33	**34**	40.1	**39.5**	**40.3**	**35.5**	29.4	36.5
Average	44.2	39.6	43.1	36.6	42.2	47	38	48.5	47.1	65.6	55.5	46.4	40.2	42.2
Standard Deviation	25.9	25.1	23.1	19.9	47.5	77.2	24.8	60.3	43.2	180.6	126.1	51	36.8	22.1
Obs	70	87	80	92	89	89	81	65	60	58	59	56	49	42
PRIVATE														
Median	40.8	36.8	38.1	**36.7**	32.9	29.2	30.8	35.6	38.4	38.9	36.4	34.2	30.6	35.7
Average	48.7	43	44.1	42.2	39.2	36	37.7	41.7	43.7	44.6	42.1	40.6	37.3	42.1
Standard Deviation	37.2	27.4	26.9	26	27.4	26.2	28.2	31.9	26.7	28.4	25.1	26	25.6	25.4
Obs	1198	1598	1979	2416	2698	2722	2731	2642	2500	2426	2374	2169	2005	1600

Values in black indicate that it is significant the coefficient of a dummy variable that takes the value of 1 if any proportion of the corporation's capital stock is public, in a regression where this variables is the only regressor and the dependent variables in the productivity index.

(*) A company is considered public if any proportion of the corporation's capital stock is state-owned.

Table 2.PRODUCITIVITY INDEX (K10) AND OWNERSHIP BY SECTORS (MEDIANS)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1. FOOD, BEVERAGES AND TOBACCO PRODUCTS														
PUBLIC	32.3	37.7	36.5	33.1	34.1	**44.1**	45.3	**57.6**	45.4	36.3	40.3	32.4	29.4	35.3
PRIVATE	35.7	38.8	37.9	37.3	31.2	29.1	30.7	32.5	33.7	31.2	34.4	31.6	30	33.6
2. QUEMICALS														
PUBLIC	31.3	24.8	27	28.9	**2.3**	**23.7**	**27.3**	33.5	42.9	37.8	43.3	**48**	**46.2**	52.7
PRIVATE	36.4	24.8	25.4	27.6	23.4	19.6	23.5	35.2	46.6	41.8	40.7	32.9	23.3	32.3
3. OTHER NON-METALLIC MINERAL PRODUCTS														
PUBLIC	35.2	44	37.8	29	26.8	18.9	9.8	29.3						
PRIVATE	32.3	35.5	30.2	26.7	25.8	21.4	20.8	21	22.4	26.1	28.9	22	20.9	23.1
4. BASIC METALS AND FABRICATED METAL PRODUCTS														
PUBLIC	**25.5**	**25.3**	40.5	41.5	**35.6**	**25.1**	**27.5**	**30.3**	**40.1**	**45.9**	**40.1**	**37.9**	**29**	**41.3**
PRIVATE	17.7	18.5	32	34.1	27.6	17.5	19.3	28	37.9	49.8	34.6	27.4	16.5	31.5
5. MACHINERY AND EQUIPMENT														
PUBLIC	64.4	62.7	34.5	50.5	**49.8**	**45.7**	46.7	45.7	49.1	35.8	45.8	43	45.4	18.3
PRIVATE	65.4	57.9	49.2	55	49.2	46.1	54.7	52.9	56.2	51.4	43.1	55.3	**57.5**	**54.3**
6. ELECTRICAL, ELECTRONIC AND OPTIMAL EQUIPMENT AND INSTRUMENTS														
PUBLIC	30.6	28.5	23.4	23.8	30.3	28.6	**36.9**	32.8	29.4	31.3	33.8	46.8		
PRIVATE	31.7	25.2	20.3	24.7	25.5	25.2	25.5	28.6	28.4	31.6	28.3	31.3	36.2	32.5
7. TRANSPORT EQUIPMENT														
PUBLIC	59.3	48.8	64.2	40.5	40.9	46.3	43.9	44.1	45.6	53.2	43	26.5	30.4	39.2
PRIVATE	74.9	**62**	**62.7**	**50.9**	50	47.1	**50.1**	**51.6**	**57.7**	66.1	53.4	**45.3**	**48.3**	**52.5**
8. TEXTILES AND CLOTHING														
PUBLIC	33.5	21.5	40.7	35	46.9	42.3	41.5	62.7	42.5		69.2	78.9	78.8	69.8
PRIVATE	**53.9**	**48.6**	51.8	40.6	43.2	43.7	41	49.1	44.1	48.7	44.6	46.5	49.1	47
9. LEATHER AND FOOTWEAR INDUSTRY														
PUBLIC	22.6	17.8	20.5	24.5	14.3	11.1	7.4							
PRIVATE	35.4	32.8	33.2	41.4	34.4	35.2	**32.3**	43.8	46.1	46.4	49.3	53.8	52.2	49
10. WOOD AND CORK INDUSTRY														
PUBLIC		25.7	24.6	18.8	19.7	23.4	24.9	30.1	24.3	13.7	24.4	17.6	19.8	27.8
PRIVATE	33.2	34	32	25.2	25.4	30.5	27.2	33.4	34.6	25.7	27.5	28.9	24.8	35.6
11. PULP, PAPER, ETC														
PUBLIC	39.9	33.4	50.6	42.7	35.1	**33.7**	**32.7**	32	22.5	24.7	25	**53.7**	**35.2**	25.9
PRIVATE	38.1	27.3	43	36.1	32.4	27.6	24.8	24.5	24.9	22.9	26.4	25.2	15.7	23.4
12. RUBBER AND PLASTIC PRODUCTS														
PUBLIC	88.9	87.9	70.5	61.7	59.4	63.4	76.4	70.2	83.7	62.5	39.9	48.2		
PRIVATE	86.6	70.8	68.5	55.8	55.6	46.8	47.9	48.3	47.7	54	40.9	45.8	49	48.8
13. OTHER MANUFACTURING INDUSTRIES														
PUBLIC		26.6												
PRIVATE	48.6	43	44.3	31.9	28.6	30	39.1	40.4	41.6	36	38.6	34.1	30.6	38.1

Values in black indicate that it is significant the coefficient of a dummy variable that takes the value of 1 if any proportion of the corporation's capital stock is public, in a regression where this variable is the only regressor and the dependent variable is the productivity index.

Table 3. DETERMINANTS OF EFFICIENCY AND OWNERSHIP
MANUFACTURING SECTOR
Medians

		1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1. ACTIVITY															
DVTAS	Private		13.8	13.8	9.4	10.7	10.7	11.6	4.7	3.9	0.5	-1.6	13.9	10.7	4.4
	Public		11.9	10.6	0.1	3.1	14.3	5.6	2.9	-4.8	-2.7	1.6	17.5	17.6	-2.8
DVAB	Private		10.4	12.4	13.7	11.0	9.1	10.8	8.2	6.7	2.9	-0.9	9.7	7.3	4.3
	Public		10.7	6.5	8.3	8.5	14.5	5.7	4.3	-9.8	-3.4	-1.4	6.4	13.1	-5.1
DEXP	Private		21.6	11.7	3.2	7	11.3	8.7	2.4	-2.3	7	15.9	29.1	17.5	8.7
	Public		34.8	3.7	-19	-6.6	16.0	12.3	-4.8	-8.3	-4.3	7.6	15.3	22.0	6.8
DIMP	Private				19	17.6	13.1	15.1	6.8	-3.7	5.4	1.9	19.6	13.9	4.7
	Public				-4	6.9	16	7.3	6.7	-10.5	-5.5	-4.4	-1.8	10.9	16.6
DPERS	Private		-0.3	0	0	0.4	1.1	0	0	0	-0.8	-2.9	0	0	0
	Public		-1.8	-0.7	0	-1.2	0	0.5	-0.5	-4.2	-3.0	-4.2	-3.7	-1.6	-2.4
2. INPUTS															
SKR	Private	253	195	178	146	134	130	128	133	142	145	143	152	170	184
	Public	934	829	1113	1089	947	1099	1432	2337	1726	1998	1994	1820	2117	2137
KL	Private	2.1	2.1	2.2	2.1	2.1	2.2	2.3	2.4	2.7	2.9	3.1	3.3	3.5	3.7
	Public	3.3	4.0	3.9	3.6	4.0	4.4	4.9	5.3	5.8	6.4	7	6.1	8.0	7.4
PERS	Private	118	4.5	85	68	61	68	57	57	64	50	46	46	46	47
	Public	440	280	350	299	275	319	336	413	386	321	298	344	397	364
COSTEL	Private	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.7	2.9	3.2	3.3	3.5	3.6	3.7
	Public	1.8	2.0	2.1	2.3	2.6	2.9	3.4	3.7	3.9	4.3	4.7	4.8	5.2	5.3
TEMP	Private	0	0	0	0.8	2.1	3.8	6.4	7.1	8.8	11.1	10.3	11.4	13.0	12.5
	Public	0.1	1.5	1.4	1.0	2.8	3.9	4.2	4.8	4.6	4.1	2.1	2.3	2.0	1.4
3. COMPETITION															
XSVTS	Private	5.1	4.0	3.8	3.2	1.9	1.8	1.5	1.4	0	1.5	2.5	4.0	5.5	6.2
	Public	6.4	8.1	6.0	5.3	5.9	7.6	10.1	9.4	9.9	12.0	16.8	12.2	13.9	22.9
CUDTA	Private	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Public	0.14	0.12	0.13	0.10	0.13	0.12	0.10	0.14	0.13	0.12	0.08	0.10	0.10	0.13
4. FINANCIAL POSITION AND PROFITABILITY															
REND	Private	21.8	27.6	27.4	25.9	23.6	21.5	21.2	21.7	21.9	23.9	24.2	22.1	20.6	19.3
	Public	43.2	4 .9	42.2	36.7	37.4	32.2	28.7	34.6	37.7	34.3	31.6	28.4	23.2	15.0
AUTDFIN	Private	15	15.0	17.2	18.6	18.5	17.8	17.1	15.7	16.3	14.5	14.2	18.6	19.5	20
	Public	8.0	10.5	10.7	13.9	13.3	18.0	14.6	8.2	-1.8	-11.4	-1.9	6.0	15.3	11.9
REB	Private	10.5	10.2	10.5	11.04	10.6	10.3	10.1	9.7	10	9.2	8.7	9.5	9.7	9.8
	Public	10.1	10.0	8.6	8.7	9.7	9.8	8.0	7.2	4.5	3.6	2.8	5.2	8.4	5.3
GP	Private	68.7	68.4	66.2	64.7	65.1	65.6	66.7	68.3	67.9	70.7	71.4	68.2	68.7	67.2
	Public	71.1	68.2	68.1	72.5	68.0	67.6	77.7	79.3	81.6	89.5	89.9	84.7	71.4	78.2
CFK	Private	25.7	25.2	28.5	30.8	30.6	28.3	26.7	22.6	21.4	16.7	14	18.8	19.1	18.7
	Public	4.4	10.0	12.1	10.4	11.9	16.2	13.7	6.8	0.5	-4	-0.5	5.3	12.1	8.7
RG	Private	5.8	5.5	6.1	6.6	6.7	6.4	6	5.5	5.7	5.2	4.7	6.1	6.5	6.8
	Public	1.9	3.5	4.0	4.1	5.5	8.6	6.8	3.0	-0.2	-2.4	-0.8	2.7	4.6	4.7
RAN	Private	11.5	11.6	11.7	13.7	15.3	15.5	15.6	14.6	13.7	11.1	9.3	11.5	12.1	11.3
	Public	4.8	7.6	5.8	6.3	7.9	8.7	9.3	7.4	4.7	-1.6	0.5	2.1	8.0	3.6
RRP	Private	6.8	8.5	9.8	14.3	16.7	17.2	16.2	13.2	11.8	8.1	5.6	10.7	12.0	11.1
	Public	0.5	5.7	4.8	7.8	9.8	8.9	11.7	6.3	1.1	-5.6	0.0	0.8	13.6	5.5

Values in black indicate that it is significant the coefficient of a dummy variable that takes the value of 1 if any proportion of the corporation's capital stock is public, in a regression where this variable is the only regressor and the dependent variable is the productivity index.
The variables are defined in the Appendix

Table 4.DEGREE OF SECTORAL COMPETITION

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1. MANUFACTURE OF FOOD, BEVERAGES AND TOBACCO PRODUCTS														
PENIMP	4.7	5.2	5.3	6.8	8.6	10.9	12.4	12.2	12.4	13.3	13.0	14.9	16.8	18.9
CONC	8.2	8.0	7.3	7.1	6.0	6.2	6.1	6.2	6.4	6.1	5.6	5.4	5.6	6.7
Observationes	207	272	364	451	516	534	520	491	469	460	453	417	384	296
Private	195	257	351	437	503	521	509	482	460	450	442	406	375	289
Public	12	15	13	14	13	13	11	9	9	10	11	11	9	7
2. MANUFACTURE OF CHEMICALS AND CHEMICAL PRODUCTS														
PENIMP	23.3	24.3	23.3	30.9	33.5	33.4	36.4	38.9	42.3	45.2	47.4	53.6	59.7	61.7
CONC	6.8	6.4	6.3	6.1	9.1	11.7	11.0	7.3	9.2	4.9	6.0	6.5	7.0	8.4
Observationes	185	234	276	313	332	329	315	305	297	291	276	247	230	177
Private	179	226	268	305	323	319	304	295	290	283	272	243	226	173
Public	6	8	8	8	9	10	11	10	7	8	4	44	4	4
3. MANUFACTURE OF OTHER NON-METALLIC MINERAL PRODUCTS														
PENIMP	5.0	5.5	6.2	7.0	7.6	8.1	8.6	9.0	9.3	9.1	8.8	9.2	12.4	13.6
CONC	18.8	17.1	16.6	15.5	16.0	14.9	12.5	12.5	12.0	10.6	10.9	11.4	12.8	13.0
Observationes	99	129	152	179	197	196	192	188	185	184	176	169	163	125
Private	96	125	148	174	192	191	189	187	185	184	176	169	163	125
Public	3	4	4	5	5	5	3	1	0	0	0	0	0	0
4. MANUFACTURE OF BASIC METALS AND FABRICATED METAL PRODUCTS														
PENIMP	9.1	9.6	11.1	15.0	15.5	16.0	17.4	20.6	22.1	23.7	23.5	28.7	32.1	32.4
CONC	11.4	11.8	11.1	11.8	10.6	11.4	11.0	10.4	9.3	8.6	9.1	8.6	7.3	8.9
Observationes	119	170	205	257	291	288	296	287	264	244	252	230	215	183
Private	105	155	189	239	275	271	277	269	245	225	228	209	197	168
Public	14	15	16	18	16	17	19	18	19	19	24	21	18	15
5. MANUFACTURE OF MACHINERY AND EQUIPMENT														
PENIMP	35.2	33.9	38.8	48.4	61.6	74.8	79.0	80.7	83.2	85.4	69.2	71.7	79.7	83.8
CONC	9.9	8.9	9.1	5.3	5.1	6.0	5.4	5.7	5.9	5.9	6.4	6.2	7.9	9.6
Observationes	119	169	193	213	245	236	237	226	203	193	183	157	142	126
Private	114	163	188	209	240	230	232	222	199	189	179	154	139	123
Public	5	6	5	4	5	6	5	4	4	4	4	3	3	3
6. MANUFACTURE OF ELECTRICAL, ELECTRONIC AND OPTICAL EQUIPMENT AND INSTRUMENTS														
PENIMP	35.2	33.9	38.8	48.4	61.6	74.8	79.0	80.7	83.2	85.4	69.2	71.7	79.7	83.8
CONC	14.7	16.6	16.4	14.7	12.9	15.4	15.2	14.4	12.3	11.2	12.6	11.2	9.2	12.0
Observationes	70	95	112	149	172	176	184	187	184	173	152	139	125	100
Private	64	86	104	135	159	163	175	182	179	169	150	137	125	100
Public	6	9	8	14	13	13	9	5	5	4	2	2	0	0
7. MANUFACTURE OF TRANSPORT EQUIPMENT														
PENIMP	10.3	12.6	18.2	19.4	27.3	36.1	41.4	40.5	42.5	44.6	48.8	51.6	48.2	61.2
CONC	18.8	20.5	20.3	20.7	18.3	18.3	20.1	19.3	20.4	16.9	17.7	16.9	16.1	16.0
Observationes	71	90	113	131	145	143	141	136	118	116	113	106	102	75
Private	59	77	102	118	134	133	132	128	111	109	106	98	93	67
Public	12	13	11	13	11	10	9	8	7	7	7	8	9	8

8. MANUFACTURE OF TEXTILES AND CLOTHING														
PENIMP	4.5	4.9	5.5	7.7	10.3	11.7	14.9	18.8	25.1	30.9	28.5	33.3	35.5	39.4
CONC	12.7	12.6	11.7	10.5	13.6	14.3	15.9	15.0	12.4	11.2	12.9	15.1	15.0	16.3
Observationes	147	185	218	268	294	297	282	267	249	235	236	211	186	149
Private	145	182	215	265	290	293	279	266	248	235	235	210	185	148
Public	2	3	3	3	4	4	3	1	1	0	1	1	1	1
9. LEATHER AND FOOTWEAR INDUSTRY														
PENIMP	4.5	4.9	5.5	7.7	10.3	11.7	14.9	18.8	25.1	30.9	28.5	33.3	35.5	39.4
CONC	9.2	8.9	8.0	7.7	7.4	7.0	6.6	6.0	5.7	6.0	6.6	5.8	4.8	5.1
Observationes	38	51	63	80	84	83	83	76	70	64	63	60	57	39
Private	37	50	62	79	83	82	82	76	70	64	63	60	57	39
Public	1	1	1	1	1	1	1	0	0	0	0	0	0	0
10. WOOD AND CORK INDUSTRY														
PENIMP	12.1	11.7	12.5	10.8	12.6	14.5	16.0	17.4	20.5	24.3	20.2	21.2	23.0	24.8
CONC	11.4	10.4	9.9	9.1	9.2	8.8	9.1	8.3	7.5	8.2	8.1	8.0	7.3	10.2
Observationes	29	38	51	72	78	81	88	85	83	83	79	66	60	49
Private	29	37	50	69	75	79	85	82	80	82	78	65	59	48
Public	0	1	1	3	3	2	3	3	3	1	1	1	1	1
11. PULP, PAPER, PUBLISHING AND REPRODUCTION OR RECORDED MEDIA														
PENIMP	6.3	7.1	8.0	10.3	11.0	12.0	13.2	15.3	16.7	19.3	18.7	20.9	21.7	21.1
CONC	6.4	6.2	5.2	5.3	5.3	5.3	4.7	3.5	3.8	4.4	4.1	4.0	4.8	5.3
Observationes	87	117	139	176	193	189	195	181	180	181	192	180	168	136
Private	80	108	133	170	187	184	191	177	176	177	188	176	164	133
Public	7	9	6	6	6	5	4	4	4	4	4	4	4	3
12. MANUFACTURE OF RUBBER AND PLASTIC PRODUCTS														
PENIMP	8.0	10.1	12.0	14.7	17.6	15.1	17.0	19.7	22.9	26.5	27.5	33.2	39.1	44.0
CONC	18.6	17.7	16.0	17.8	13.8	13.4	12.1	11.4	12.1	12.0	12.4	11.7	13.5	6.6
Observationes	45	71	90	111	121	126	138	136	128	121	119	113	104	87
Private	43	69	86	108	118	123	135	134	127	120	118	112	104	87
Public	2	2	4	3	6	3	3	2	1	1	1	1	0	0
13. OTHER MANUFACTURING INDUSTRIES														
PENIMP	12.1	11.7	12.5	10.8	12.6	14.5	16.0	17.4	20.5	24.3	20.2	21.2	23.0	24.8
CONC	6.6	7.2	6.3	5.1	5.1	5.7	4.9	4.2	3.9	3.5	3.7	4.2	4.3	4.5
Observationes	52	64	83	108	119	133	141	142	130	139	139	130	118	100
Private	52	63	83	108	119	133	141	142	130	139	139	130	118	100
Public	0	1	0	0	0	0	0	0	0	0	0	0	0	0

The variables are defined in the Appendix

Table 5 ESTIMATION OF THE INCIDENCE OF THE MAIN DETERMINANTS OF EFFICIENCY
DEPENDENT VARIABLE: LOG K10
ANNUAL REGRESSIONS AND POOL
ORDINARY LEAST SQUARES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	LEVELS (1) 1983-1996	FIRST DIF (1) 1983-1996	ORTH. DEV. (1) 1983-1996
1. OWNERSHIP																	
KFUDT	-0 001	-0 003	-0 0018	-0 003	-0003	-0 002	-0 005	-0 002	-0 004	-0 003	-0 004	-0 002	-0 002	-0 004	-0 003	-0 0006	-0 0003
	(2 65)	(5 43)	(3 47)	(5 76)	(8 66)	(3 5)	(9 37)	(3 19)	(6 24)	(5 2)	(6 18)	(3 32)	(2 87)	(8 07)	(4 54)	(0 93)	(0 3)
KSAN2	0 0006	0 003	0 0005	-0 001	-0 001	-0 001	0 0003	-0 001	0 004	-0 001	0 0006	0 0005	0 001	-0 001	-0 0001	0 0006	0 001
	(0 74)	(1 99)	(0 47)	(1 6)	(0 99)	(-1 56)	(0 3)	(1 12)	(3 36)	(1 05)	(0 5)	(0 42)	(0 57)	(9 52)	(0 3)	(1 04)	(1 96)
2. FINANCIAL VARIABLES																	
REND	-0 126	-0 083	-0 15	-0 24	-0 14	-0 102	-0 18	-0 11	-0 1	-0 14	-0 17	-0 092	-0 04	-056	-0 18	-0 18	-0 15
	(2 62)	(2 19)	(3 71)	(7 42)	(4 92)	(3 74)	(0 32)	(3 48)	(3 03)	(4 16)	(5 003)	(2 71)	(1 18)	(1 47)	(17 11)	(6 88)	(4 21)
CFK	0 08	0 037	0 07	0 07	0 178	0 19	0 058	0 16	0 16	0 16	0 13	0 2	0 35	0 38	0 129	0 083	0 075
	(12 001)	(7 3)	(12 18)	(15 64)	(25 52)	(26 37)	(14 59)	(22 1)	(33 1)	(17 99)	(15 93)	(22 5)	(25 95)	(24 07)	(3 59)	(2 94)	(3 13)
3. DEGREE OF COMPETITION AND MARKET STRUCTURE																	
KSVTS	0 002	0 002	0 001	0 0002	0 0001	0 0001	0 0001	-0 001	-0 0003	0 0003	0 002	0 002	0 001	0 001	0 0004	0 001	0 0005
	(6 06)	(8 36)	(3 384)	(0 505)	(0 33)	(0 15)	(0 19)	(2 88)	(1 08)	(1 03)	(4 78)	(4 62)	(4 34)	(3 02)	(2 06)	(2 83)	(1 35)
CUOTA	0 05	0 08	0 04	0 043	0 039	0 032	0 048	0 02	0 009	-0 001	-0 02	002	0 04	0 012	0 03	0 32	0 26
	(3 41)	(4 52)	(3 02)	(3 34)	(3 53)	(3 07)	(3 92)	(1 51)	(0 62)	(0 07)	(1 18)	(1 36)	(2 81)	(0 78)	(2 9)	(4 38)	(4 09)
PENIMP	0 004	0 018	0 0093	0 012	0 0067	-0 005	-0 001	-0 003	0 0006	0 004	0 003	001	0 01	0 018	0 0055	-0 001	0 0005
	(0 504)	(2 38)	(0 057)	(3 03)	(2 38)	(2 1)	(0 38)	(1 59)	(0 29)	(1 83)	(1 06)	(4 01)	(3 52)	(0 49)	(0 24)	(1 25)	(0 81)
CONC	-0 036	0 083	0 08	0 034	0 037	-0 008	0 012	-0 003	0 008	0 01	0 01	-0 008	0 017	-009	0 01	-0 01	0 007
	(1 59)	(4 88)	(3 08)	(3 74)	(3 96)	(0 45)	(1 47)	(0 009)	(1 02)	(099)	(1 09)	(0 66)	(1 98)	(4 929	(3 92)	(4 16)	(2 61)
4. OTHER FACTORS																	
TEMP	-0 004	0 0003	0001	0 0005	0 0004	0 0004	0 0004	0 0002	0 002	0 001	0 002	0 001	0 001	0 001	0 001	0 0003	0 0005
	(5 53)	(0 52)	(1 44)	(1 33)	(1 05)	(1 24)	(1 21)	(0 77)	(4 8)	(3 42)	(4 82)	(2 48)	(3 5)	(2 28)	(4 5)	(0 51)	(1 54)
BUBE	-0 015	-0 018	-0001	-0 007	0 003	-0 004	0 002	0 003	0 005	0 004	-0 001	-0 01	0 0004	-0 005	-0 002	0 008	0 002
	(1 84)	(1 83)	(0 161)	(1 53)	(0 94)	(1 81)	(0 81)	(1 12)	(2 18)	(1 57)	(0 68)	(4 14)	(0 192)	(1 6)	(1 17)	(2 21)	(0 99)
COSTEL	0 18	0 49	0 42	0 38	0 37	0 33	0 33	0 27	0 29	0 24	0 23	017	0 2	0 18	0 24	0 18	0 125
	(18 305)	(27 31)	(27 27)	(34 25)	(39 7)	(41 46)	(42 52)	(36 76)	(34 99)	(33 49)	(31 78)	(25 5)	(33 99)	(29 19)	(29 69)	(7 22)	(12 63)
5. GROWTH EFFECT																	
DCONC																0 003	-0 015
																(1 83)	(8 48)
DCUOTA																0013	0 045
																(038)	(1 52)
DPENIMP																0 006	0 006
																(0 1)	(0 03)
R2	0.7	0 73	0 68	0 68	0 74	0,78	0 73	069	0 66	0 64	0 57	0 65	0 62	0 74			
M1															0	0	0
M2															0	0	0

Sectoral dummy variables and 4 coefficients for the capital-output ratio and the labour variable for each industry have been included in all the regressions. The values of these coefficients are not reported.
The t-statistics are indicated in brackets.
Temporary dummy variables have been excluded in the last three columns.
M1 and m2 are the p-values relating to the first- and second-order correlation tests.
(1) Heteroskedasticity-robust.

Table 6. ESTIMATION OF THE INCIDENCE OF THE MAIN DETERMINANTS OF EFFICIENCY
DEPENDENT VARIABLE: RAN
ANNUAL REGRESSIONS AND POOL
ORDINARY LEAST SQUARES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	LEVELS (1) 1983-1996	FIRST DIF (1) 1983-1996	ORTH. DEV. (1) 1983-1996
1. OWNERSHIP																	
KPUDIT	-0.001	-0.001	-0.001	-0.001	-0.001	-0.0007	-0.001	-0.001	-0.001	-0.001	-0.001	-0001	-0.001	-0.001	-0.0004	-0.0002	-0.0006
	(4.83)	(6.03)	(5.13)	(5.79)	(6.99)	(5.56)	(6.82)	(4.56)	(3.58)	(4.11)	(3.22)	(5.48)	(7.9)	(5.47)	(6.68)	(6.82)	(2.76)
INSFINC	0.00002	0.00002	-0.00008	-0.0004	0.001	-0.0002	-0.0002	-0.001	-0.001	-0.0004	0.0001	-0.00002	0.0001	-0.0005	-0.0004	-0.0002	-0.0001
	(0.12)	(0.15)	(0.3)	(1.6)	(3.44)	(0.972)	(0.48)	(2.14)	(2.7)	(0.89)	(0.34)	(0.04)	(0.23)	(1.06)	(3.3)	(1.41)	(0.45)
2. FINANCIAL VARIABLES																	
REND	-0.16	-0.18	-0.18	-0.21	-0.19	-0.19	-0.2	-0.21	-0.21	-0.21	-0.21	-0.17	-0.16	-0.15	-0.267	-0.267	-0.197
	(13.73)	(18.013)	(18.82)	(24.75)	(23.08)	(24.78)	(23.68)	(24.42)	(20.95)	(20.24)	(21.83)	(16.31)	(18.4)	(3.29)	(21.26)	(7.87)	(12.6)
CFK	0.018	0.012	0.02	0.015	0.05	0.05	0.01	0.049	0.05	0.06	0.07	0.05	0.094	-0.11	0.04	0.024	0.03
	(11.9)	(10.49)	(15.37)	(13.62)	(25.13)	(22.96)	(8.42)	(23.95)	(20.41)	(21.59)	(28.82)	(18.04)	(22.84)	(23.31)	(3.3)	(2.42)	(2.66)
3. DEGREE OF COMPETITION AND MARKET STRUCTURE																	
XSVTS	0.001	0.0003	0.0003	-0.00005	-0.0002	-0.0001	-0.0002	-0.0004	-0.0003	0.0001	0.001	0.0003	0.0004	0.0002	0.0001	0.0002	0.0002
	(8.3)	(5.84)	(3.79)	(0.62)	(1.94)	(1.38)	(3.22)	(4.33)	(1.82)	(0.78)	(5.4)	(3.29)	(0.63)	(1.95)	(1.08)	(2.41)	(2.23)
CUOTA	0.005	0.009	0.003	0.001	0.0001	0.003	0.006	0.0013	-0.005	0.002	-0.003	-0.003	-0.0007	-0.003	0.001	0.07	0.055
	(1.52)	(2.86)	(1.03)	(0.43)	(0.843)	(0.81)	(1.68)	(0.35)	(1.48)	(0.4)	(0.62)	(3.29)	(0.15)	(0.7)	(0.34)	(4.38)	(4.02)
PENIMP	0.0014	0.002	-0.002	0.001	-0.00001	-0.001	0.002	-0.0001	-0.0003	0.001	0.001	0.00003	0.0006	0.001	-0.0001	0.0004	0.0001
	(0.83)	(1.75)	(1.1)	(1.08)	(0.016)	(1.33)	(0.29)	(0.17)	(0.5)	(1.33)	(1.07)	(0.025)	(0.83)	(2.02)	(0.7)	(1.45)	(0.63)
CONC	0.001	0.006	-0.007	0.002	0.001	-0.005	0.002	-0.002	-0.002	-0.001	0.003	-0.002	0.0005	0.001	0.002	0.001	0.001
	(025)	(1.63)	(2.11)	(0.9)	(0.336)	(1.56)	(0.74)	(0.61)	(0.95)	(0.4)	(0.97)	(0.5)	(0.15)	(0.16)	(2.5)	(1.49)	(1.5)
4. OTHER FACTORS																	
TEMP	0.0002	0.0003	0.0003	0.0003	0.003	0.0004	0.005	0.0006	0.001	0.008	0.001	0005	0.0004	00005	0.0008	0.0002	0.0004
	(0.97)	(2.16)	(1.35)	(298)	(3.87)	(4.32)	(514)	(4.83)	(5.48)	(5.34)	(5.98)	(4.15)	(3.96)	(449)	(9.36)	(2.72)	(4.23)
SUBE	-0.004	-0.004	0.0001	-0.002	-0.002	-0.005	-0.001	-0.001	-0.0004	-0.00005	0.0004	-0.0004	-0.0004	-0.001	-0.001	0.0003	-0.00005
	(2.19)	(1.42)	(0.04)	(1.78)	(2.42)	(7.15)	(0.94)	(1.52)	(0.6)	(0.08)	(0.71)	(0.48)	(0.55)	(1.48)	(1.7)	(0.24)	(0.06)
COSTEL	0.003	0.01	0.005	0.002	-0.0001	0.0019	0.009	-0.005	-0.004	-0.007	-0.006	-0.005	-0.003	0.002	-0.002	-0.01	-0.009
	(1.24)	(2.3)	(1.43)	(071)	(0.044)	(0.87)	(4.22)	(2.13)	(1.9)	(2.84)	(4.35)	(2.2)	(1.78)	(1.04)	(0.92)	(2.34)	(3.34)
5. GROWTH EFFECT																	
DCONC																-0.0006	0.0001
																(082)	(0.24)
DCUOTA																0002	0.02
																(038)	(3.32)
DPENIMP																0.0003	0.001
																(132)	(3.26)
R2	0.2	0.31	0.3	0.32	0.4	0.4	0.25	0.39	0.32	0.33	0.43	0.27	0.41	0.41			
M1																	
M2															0	0	0
															0	0	0

Sectoral dummy variables and a coefficient for the [illegible] ratio and the lagged variable for each industry have been included in all the regressions. The values of these coefficients are not reported.
The t-statistics are indicated in brackets.
Temporary dummy variables have been included in the last three columns.
M1 and m2 are the p-values relating to the first- and second-order [illegible] tests.
(1) [illegible]

Table 7.

DETERMINANTS OF RELATIVE LABOUR PRODUCTIVITY. DEPENDENT VARIABLE: logk10 [22]

	1	2	3	4	5	6	7	8	9	10	11	12
KPUDIT	-0,002 (1,07)				-0,001 (0,98)				-0,006 (0,7)			
KPU		-0,042 (0,53)				-0,011 (0,14)				-0,201 (0,35)		
KPUBCB			-0,0003 (0,084)				-0,0002 (0,16)				-0,02 (1,5)	
KPU100				-0,0006 (0,92)				-0,0004 (0,7)				-0,003 (0,52)
DCONC					-0,012 (2,22)	-0,012 (2,23)	-0,012 (2,24)	-0,012 (2,23)	-0,012 (2,20)	-0,012 (2,22)	-0,013 (2,31)	-0,012 (2,25)
PENIMP					0,006 (2,34)	0,005 (2,35)	0,006 (2,35)	0,006 (2,35)	0,006 (2,31)	0,006 (2,35)	0,005 (2,08)	0,006 (2,36)
DCUOTA					0,22 (3,5)	0,22 (3,45)	0,22 (3,53)	0,22 (3,5)	0,213 (3,49)	0,212 (3,51)	0,195 (3,02)	0,218 (3,5)
CFK					0,24 (1,91)	0,24 (1,92)	0,237 (1,92)	0,24 (1,92)	0,237 (1,91)	0,239 (1,92)	0,234 (1,89)	0,24 (1,92)
COSTEL					-0,21 (2,7)	-0,21 (2,7)	-0,19 (2,4)	-0,21 (2,7)	-0,21 2,74	-0,21 (2,68)	-0,21 (2,68)	-0,21 (2,69)
TS	0,384	0,393	0,389	0,393	0,161	0,158	0,161	0,159	0,158	0,144	0,415	0,151
M1	0,031	0,031	0,029	0,031	0,026	0,026	0,025	0,026	0,026	0,027	0,028	0,026
M2	0,715	0,736	0,717	0,730	0,341	0,340	0,336	0,340	0,337	0,341	0,305	0,350

The variables are defined in the appendix.

Number of observations: 27023. Number of firms: 3889.

First differences estimates. Estimation method: generalised method of moments. Included as instruments are the regressors considered endogenous and present in each estimate lagged by two and three periods (CONC and PENIMP are considered exogenous variables). First-step estimates, heteroskedasticity-robust.

Temporary and sectoral dummy variables have been included in all the regressions as regressors and instruments.

The t-statistics are indicated in brackets.

TS includes the p-values relating to the Sargan test, and m1 and m2 the p-values relating to the first- and second-order correlation tests.

Table 8

DETERMINANTS OF PROFITABILITY. DEPENDENT VARIABLE: RAN

	1	2	3	4	5	6	7	8	9	10	11	12
KPUDIT		-0,0003 (0,39)			-0,0001 (0,17)				-0,001 (0,4)			
KPU			-0,025 (0,87)			-0,009 (0,54)				-0,01 (0,21)		
KPUBCB	-0,001 (0,76)						-0,0003 (0,62)				-0,001 (0,45)	
KPU100				-0,003 (0,66)				-0,0004 (0,99)				-0,0005 (0,42)
CFK					0,109 (7,94)	0,109 (7,93)	0,109 (7,96)	0,108 (7,87)	0,11 (8,77)	0,11 (8,63)	0,112 (9,3)	0,104 (8,11)
DCUOTA					0,018 (1,83)	0,018 (1,86)	0,018 (1,83)	0,018 (1,89)	0,018 (1,97)	0,019 (1,96)	0,019 (2,1)	0,02 (2,23)
CUOTA					0,036 (2,39)	0,036 (2,37)	0,036 (2,38)	0,036 (2,37)	0,034 (2,66)	0,038 (2,95)	0,039 (3,3)	0,028 (2,16)
COSTEL					-0,058 (3,75)	-0,058 (3,74)	-0,057 (3,69)	-0,058 (3,73)	-0,066 (4,68)	-0,067 (4,73)	-0,057 (4,3)	-0,065 (4,79)
REND1					-0,21 (5,18)	-0,21 (5,17)	-0,214 (5,13)	-0,213 (5,16)	-0,20 (5,24)	-0,19 (5,13)	-0,20 (6,00)	-0,205 (5,71)
TS	0,451	0,470	0,478	0,484	0,182	0,182	0,180	0,170	0,092	0,086	0,079	0,080
M1	0,268	0,249	0,267	0,267	0,003	0,003	0,002	0,003	0,021	0,017	0,043	0,024
M2	0,993	0,968	0,981	0,973	0,480	0,520	0,511	0,423	0,435	0,360	0,592	0,549

The variables are defined in the appendix.

Number of observations: 20358. Number of firms: 3889.

First differences estimates. Estimation method: generalised method of moments. Included as instruments are the regressors considered endogenous and present in each estimate lagged by two and three periods (CONC and PENIMP are considered exogenous variables). First-step estimates, heteroskedasticity-robust.

Temporary and sectoral dummy variables have been included in all the regressions as regressors and instruments.

The t-statistics are indicated in brackets.

TS includes the p-values relating to the Sargan test, and m1 and m2 the p-values relating to the first- and second-order correlation tests.

Table 9

Determintants of relative labour productivity. Dependent Variable: logk10. Results with different estimation methods.			
	First differences/GMM[24]	Levels/GMM[25]	System estimator[26]
KPUDITt	-0,006 (0,7)	-0,002 (1,22)	-0,002 (0,53)
KPU	-0,201 (0,35)	-0,26 (1,24)	-0,2 (0,11)
KPUBCB	-0,02 (1,5)	-0,003 (1,15)	-0,004 (1,34)
KPU100	-0,003 (0,52)	-0,005 (1,74)	-0,001 (0,16)

Results of columns 9, 10, 11 y 12, table 7.

Included as instruments are the regressors present in each estimate lagged by one or two periods. First-step estimates, heteroskedasticity-robust. Temporary and sectoral dummy variables have been included in all the regressions as regressors and instruments. The t-statistics are indicated in brackets. The p-values relating to the Sargan test are equal to zero for the four estimates, and also the p-values relating to the first- and second-order correlation tests are equal to zero.

System of equations in fiils-differences and levels. Included as instruments are the regressors present lagged by one or two periods for the equations in first-differences, and the lagged first-differences of the regressors for the level equations. First-step estimates, heteroskedasticity-robust. Temporary and sectoral dummy variables have been included in all the regressions as regressors and instruments. The t-statistics are indicated in brackets. The p-values relating to the Sargan test are equal to zero for the four estimates, and also the p-values relating to the first- and second-order correlation tests are equal to zero.

Table 10

Determinants of profitability. Dependent Variable: ran. Results with different estimation methods.			
	First differences/GMM[27]	Levels/GMM[28]	System estimator[29]
KPUDIT	-0,001 (0,4)	-0,003 (3,39)	-0,001 (1,22)
KPU	-0,01 (0,62)	-0,27 (3,37)	-0,17 (1,9)
KPUBCB	-0,001 (0,45)	-0,003 (3,15)	-0,001 (1,1)
KPU100	0,001 (0,42)	-0,004 (3,46)	-0,001 (1,17)

Results of columns 9, 10, 11 y 12, table 8.

Included as instruments are the regressors present in each estimate lagged by one or two periods. First-step estimates, heteroskedasticity-robust. Temporary and sectoral dummy variables have been included in all the regressions as regressors and instruments. The t-statistics are indicated in brackets. The p-values relating to the Sargan test are equal to zero for the four estimates, and also the p-values relating to the first- and second-order correlation tests are equal to zero.

System of equations in first-differences and levels. Included as instruments are the regressors present lagged by one or two periods for the equations in first-differences, and the lagged first-differences of the regressors for the level equations. First-step estimates, heteroskedasticity-robust. Temporary and sectoral dummy variables have been included in all the regressions as regressors and instruments. The t-statistics are indicated in brackets. The p-values relating to the Sargan test are equal to zero for the four estimates, and also the p-values relating to the first- and second-order correlation tests are equal to zero.

APPENDIX. SAMPLE SELECTION AND DEFINITION OF VARIABLES

A.1. SAMPLE SELECTION.

The statistical source underpinning this paper has been the individual information of the non-financial corporations reporting to the Banco de España Central Balance Sheet Office (CBBE) during the period 1983-1996. As the study has focused on manufactures, firms whose main activity is in energy, agriculture, construction and services were dropped from the sample. Moreover, firms which did not reply to the CBBE survey for at least four consecutive periods were also dropped.

Lastly, the observations of those firms exhibiting any of the characteristics detailed below were dropped:

a) Zero employment and capital stock greater than zero.

b) Net property, plant and equipment equal to zero.

c) Negative or zero gross value added.

d) Zero personnel costs.

e) Negative or zero capital stock.

f) Net amount of turnover negative or zero.

g) Negative capital stock in one or more years, all observations dropped.

h) Negative interest on borrowed funds.

i) Negative borrowed funds.

The final sample resulting from this filtering process is an incomplete panel made up of 3,889 firms and a total of 32,035 observations. The distribution of the firms on the basis of the number of consecutive observations is detailed in Table A1.

Firms are classified by sector according to the group of activities called "Major CBBE industries" (CB-26). Table A2 lists the sectors used, along with the associated CNAE 93 (National Classification of Economic Activities) references and the number of observations relating to each sector.

Table A1

Incomplete panel of firms 1983-1996

No. of periods	No. of firms	No. of observations
4	607	2,428
5	517	2,585
6	440	2,640
7	316	2,212
8	334	2,672
9	276	2,484
10	284	2,840
11	276	3,036
12	195	2,340
13	218	2,834
14	416	5,824
Total	3,889	32,035

Table A2

Industrial classification

Sectors	Reference CNAE 93	No. of observations
1. Manufacture of food, beverages and tobacco products	15-16	5,834
2. Manufacture of chemicals and chemical products	24	3,807
3. Manufacture of other non-metallic mineral products	26	2,334
4. Manufacture of basic metals and fabricated metal products	27-28	3,301
5. Manufacture of machinery and equipment	29	2,642
6. Manufacture of electrical, electronic and optical equipment and instruments	30-33	2,018
7. Manufacture of transport equipment	34-35	1,600
8. Manufacture of textiles and clothing	17-18	3,224
9. Leather and footwear industry	19	911
10. Wood and cork industry	20	942
11. Pulp, paper, publishing, printing and reproduction of recorded media	21-22	2,314
12. Manufacture of rubber and plastic products	25	1,510
13. Other manufacturing industries	36-37	1,598
MANUFACTURING INDUSTRIES TOTAL		32,035

A.2. DEFINITION OF VARIABLES[30]

a) Individual variables

AUTOFIN: undistributed profits as a proportion of total profits

CFK: cash-flow per unit of capital, calculated as retained profits plus provisions for depreciation deflated by the GDP deflator and divided by the stock of real capital.

COSTEL: average personnel costs per employee.

CUOTA: firm's sales as a percentage of total sales in the sector, adjusted for the sector's annual representativeness in terms of GVA, as deduced from CBBE publications.

GINTERES: interest payments on borrowings as a percentage of output.

GP: personnel costs as a proportion of gross value added.

INSFIN: financial institutions' share as a percentage of the corporation's total capital stock.

KL: capital/labour ratio, defined as capital stock/number of employees.

KPU: dummy variable that takes the value of 1 if any proportion of the firm's capital stock is public.

KPUDIT: public capital as a percentage of total capital.

KPUBCB: dummy variable that takes the value of 1 if the public sector holds more than 50% of the firm's capital stock or, irrespective of the percentage share, has control over the firm.

KPU100: dummy variable that takes the value of 1 if the public sector holds 100% of the firm's capital stock.

PERS: total employment defined as the sum of permanent plus temporary employment, which is obtained weighting the number of temporary employees with the average number of weeks worked in the firm.

RAN: return on net assets, defined as the pre-tax profits/net assets ratio.

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[30] Small case letters indicate that variables are in logarithms.

REB: gross economic return defined as (gross value added less personnel costs)/sales. RVTAS: growth rate of sales.

REND: proportion of debt per unit of assets.

REXP: growth rate of exports.

RG: resources generated, defined as (gross economic return - net financial charges + other revenues - tax on profits)/sales.

RIMP: growth rate of imports.

RPERS: growth rate of the number of employees.

RRP: return on equity, defined as pre-tax profits/equity.

RVAB: growth rate of gross value added.

SK: capital stock, calculated as the value at replacement cost of net property, plant and equipment. The value at replacement cost is obtained through the perpetual inventory procedure (Salinger and Summers, 1983, include a detailed description of this method in their appendix), taking the book value of the net property, plant and equipment as the value for the initial year.

SKR: real capital stock, using the gross fixed capital formation deflator.

SUBE: operating subsidies as a percentage of output.

TEMP: temporary employment, calculated as temporary employment divided by total employment.

XSVTS: export sales of the corporation as a percentage of its total sales.

b) Aggregate variables

CONC: share of the three largest firms' value added in relation to total value added for the sector, the latter being adjusted for the representativeness of the sector in the CBBE.

LOGKML: logarithm of the capital/labour ratio.

LOGPERS: logarithm of the number of employees.

LKLSECx: LOGKML * NGSECx

LPSECx: LOGPERS * NGSECx

NGSECx: dummy variable that takes the value 1 if the firm belongs to the sector x, and 0 otherwise.

PENIM: import penetration, calculated as real imports in the sector divided by the sector's output at real market prices.

VASVAT: value added in the sector according to National Accounts divided by total value added of manufactures.

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