MARKET POWER, TOTAL FACTOR PRODUCTIVITY GROWTH, AND STRUCTURAL CHANGE. AN ILLUSTRATION FOR SPAIN, 1983-1996

Georges Siotis

Banco de España - Servicio de Estudios
Documento de Trabajo nº 0001

MARKET POWER, TOTAL FACTOR PRODUCTIVITY GROWTH, AND STRUCTURAL CHANGE. AN ILLUSTRATION FOR SPAIN, 1983-1996 (*)

Georges Siotis (**)

(*) This paper was begun while I was a Research Fellow of the Bank of Spain's Research Department. I would like to thank the staff of the Bank of Spain for their help with the data, and seminar participants at Universidad Complutense, CEMFI, and the Bank of Spain for useful comments and suggestions. I am particulary indebted to César Alonso, Olympia Bover, Ignacio Hernando, Pedro L. Martín, Ricardo Mora, and Alessandro Sembenelli, for insightful suggestions and numerous discussions during the preparation of this paper. Enrique Cañizares provided excellent research assistance. My full gratitude goes especially to Nadine Watson who helped me with this large firm level data set. I also want to thank Central de Balances for providing me the data set.

(**) Departamento de Economía, Universidad Carlos III de Madrid, Calle Madrid, 126, 28903 Getafe (Madrid), Spain, e-mail: siotis@eco.uc3m.es.

Banco de España - Servicio de Estudios
Documento de Trabajo nº 2001

In publishing this series the Banco de España seeks to disseminate studies of interest that will help acquaint readers better with the Spanish economy.

The analyses, opinions and findings of these papers represent the views of their authors; they are not necessarily those of the Banco de España.

The Banco de España disseminates its principal reports and economic indicators via INTERNET and INFOVÍA.PLUS at: http://www.bde.es

ISSN: 0213-2710
ISBN: 84-7793-696-X
Depósito legal: M. 10566-2000
Imprenta del Banco de España

ABSTRACT

This paper analyses the evolution of total factor productivity growth and market power in Spain during the period 1983-1996. The data consists of a large firm level data set that encompasses all sectors of economic activity apart from financial institutions. The results show that traditional growth accounting yield poor results when applied to firm level data. It is argued that the presence of market power is the main culprit for these findings. Using different specifications and estimation techniques, the paper then goes on to identify the amount of market power found in the Spanish economy.

1. Introduction

Total factor productivity (TFP) growth has received growing attention over recent years. Most of the literature examines TFP growth at the level of the entire economy, and only few papers have ventured to examine the evolution at the sectoral level. Data limitation have seriously hindered work at the level of individual firms. This paper argues that sectoral, and even more so, aggregate measures of TFP growth give a misguided picture of the underlying market structure. The basic argument is that the way data are collected and aggregated in national accounts will mechanically generate a well behaved aggregate Cobb-Douglas function with constant returns to scale for the economy, a finding consistent with perfect competition (J. Felipe and J.S.L. McCombie (1998)). The latter is a widespread finding in the empirical literature, and has sometimes been interpreted as a validation of the Cobb-Douglas *cum* perfect competition view of the world.

Hall's (1986) pioneering work on the cyclical behaviour of TFP has shed new light on this issue. He demonstrated that the behaviour of the Solow residual was incompatible with the hypothesis of perfect competition and constant returns to scale. Hall's (1986) first findings implied an important degree of market power. He then showed that the most probable causes for high price to marginal cost ratios were increasing returns. Indeed, the level of pure profits implied by his estimates were too high in the context of the US economy, and he showed that these could be attributed to the existence of fixed costs.

A number of subsequent papers proposed alternative explanations for the behaviour of the Solow residual over the US cycle. Caballero and Lyons (1992) provide evidence that is compatible with the presence of increasing returns at the level of the industry and/or the whole economy. A possible explanation for this finding may be related to presence of thick market externalities. This hypothesis implies that the productivity of existing factors increases with the number of transactions. It may be an industry or firm specific phenomenon. In addition, the original hypotheses proposed by Hall (market power and increasing returns) have been pursued. Roeger (1995) shows that imperfect competition can explain the behaviour of TFP, while Domowitz, Hubbard and Petersen (1988) have confirmed the existence of market power. Basu and Fernald (1997) highlight the importance of firm heterogeneity to interpret the finding of important increasing returns at the aggregate level. Basu (1996) shows that once capacity utilisation is properly controlled for, increasing returns are of secondary importance. Burnside (1996) argues that increasing returns become negligible once heterogeneity and capacity utilisation are properly accounted for. Burnside, Eichenbaum, and Rebelo, (1995) also highlight the importance of capacity utilisation. Jun (1998), in an attempt to reach a verdict on these alternative explanations, has confronted the same data and spelled-out competing empirical hypotheses. His verdict is that market power and increasing returns are the main influences on the -cyclical- behaviour of the Solow residual. Industry and/or economy wide increasing returns, thick market externalities, and labour hoarding appear as having second order effects.

The majority of these papers have to impose some restrictions on the data in order to carry-out their empirical testing. For instance, unraveling the degree of market power usually implies assuming that the latter is constant over time. By the same token, increasing returns have often been identified by assuming that they are equal across industries. Last, the existing empirical literature has almost entirely focused on the *cyclical* behaviour of the Solow residual. To a large extent, these assumptions are valid in the context of the US: a large, highly competitive economy most probably operating at the frontier. This may not necessarily be the case for an economy experiencing a regime change.

This paper presents results obtained with a methodology that, as a first step, somewhat departs from standard techniques. The basic idea is that the Spanish economy -contrary to the US- has been subjected to profound structural change. Perhaps the closest paper, both in terms of methodology and focus, is that of Jaumandreu and Martín (1999), which analyses TFP dynamics in Spain during the period 1979-1990.

To illustrate this point, I first estimate TFP growth using standard techniques based on the assumption of perfect competition. The estimates yield results that are simply not credible. Not only does TFP growth display strong cyclical behaviour, but the estimate of the trend rate of growth does not make sense. This finding is robust to the functional form used, estimation technique, and identifying assumptions. I conjecture that one of the culprits for these awkward results is the existence of market power. A cursory glance at accounting margins lends support to that hypothesis.

The second set of results replicates some of the exercises carried out for the US economy. The original findings pointing to market power are confirmed using three different methodologies that have been used in the empirical literature. The latter are well in line with priors on the evolution of the Spanish economy during that time period. Notwithstanding, the point estimates ought to be taken with a grain of salt, as they are based on the assumption of constant margins (a fact not always corroborated by primary data).

This paper makes use of an extensive survey of firms carried by the Bank of Spain since 1983, gathered in the database *Central de Balances*. The data collected is comprehensive, each annual sample exceeds four thousand observations, and it covers all sectors of economic activity, except for financial institutions. Data quality and sample size permit an extensive study of market power and TFP dynamics.

The paper is organised as follows. Section 2 is a reminder on growth accounting, while section 3 describes the data set. Section 4 presents estimates of TFP growth using standard techniques. Section 5 presents the estimates of market power at the industry level using a variety of techniques. Section 6 concludes and draws some policy implications.

2. A reminder on growth accounting

Solow (1957) pioneered the empirical study of TFP growth. He identified the component of output growth that could not be accounted by variation in input quantities. Suppose that the sectoral production function is of the form:

$$\Theta_{i,t} F(.)_{i,t} = Y_{i,t} \qquad (1)$$

where t stands for time and i indexes the unit of observation. The arguments of $F(.)$ are the inputs used in production. After choosing the appropriate functional form and identifying the set of relevant inputs, TFP growth can be approximated using (1).

As an illustration, suppose that (1) is represented by a Cobb-Douglas production function, with three inputs: labour, materials and capital. Further, assume that TFP can be modelled in a Hick's neutral way and takes the form $\Theta_{i,t} = Ae^{\vartheta_t + u_{i,t} + z_i}$. ϑ_t denotes the rate of productivity growth common to all firms, z_i is a time invariant firm specific parameter, and $u_{i,t}$ is assumed to be white noise. Expressed in logs and normalised by the capital stock, this yields:

$$\ln(Y/K)_{i,t} = \ln(A) + \vartheta_t + \alpha_{i,t}\ln(L/K)_{i,t} + \gamma_{i,t}\ln(M/K)_{i,t} + \eta_i \ln(K) + z_i + u_{i,t} \quad (2)$$

where η_i represents the local elasticity of scale minus 1 (assumed to be constant over time). Its point estimate indicates the presence (absence) of local returns to scale. Clearly, if firm level fixed effects are important, (2) must be estimated in difference in order to eliminate $z_{i\cdot}$. Factor shares have been indexed by time; an alternative is to consider that they are constant.

Under perfect competition in product and factor markets, factor shares (α, γ and β) are equal to the respective output elasticities (which in turn is equal their marginal products). If constant returns to scale (CRS) are assumed ($\eta = 1$), then capital's share can be obtained as a residual. This implies that if data is available on input quantities and factor shares, TFP growth rates can be *computed* directly. If a different functional form is chosen, some parameters may have to be estimated, or retrieved from alternative sources. Nonetheless, the basic message remains the same: except when faced with serious data shortages, it is not necessary to have recourse to estimation. In principle, if the underlying assumptions of the model are correct, the two approaches (direct computation and estimation) should yield identical results, save for some measurement error (or random noise).

The way (2) has been spelt out assumes that TFP grows at a constant rate over time. An alternative avenue is the inclusion of annual dummies (the latter is less restrictive, but more costly in terms of degrees of freedom). Last, expression (2) has been normalised by capital, in line what is usually done in the literature. However, it should be noted that the choice of normalisation (an arbitrary choice) is not innocuous to the empirical results.[1]

When sectoral data is available, TFP growth can be estimated/computed at a disaggregated level. It is indeed quite unlikely that all sectors display the same behaviour of TFP growth over time. Formula (2) would have to be indexed by industry.

3. The data

The data comes directly from the raw files of *Central de Balances*, a survey carried by the Bank of Spain. This annual survey is made up of two questionnaires, one for large firms (number of employees greater than 100), and a shorter version for smaller firms.[2] The data used in this paper is to be found in both questionnaires, so that the entire sample of responding firms is available.

[1] This may be due to differences in the accuracy with which the variables are measured, multicolinearity between the regressors, or more disturbingly, that (3) is not the true model. There is no "cure" for these problems, thus the choice of (4). Alternative normalisations (with materials or labour) in fact yielded slightly better results.

[2] In addition to the number of employee, there another two financial criteria (on turnover and assets). These cut-offs are periodically revised and do not affect sample construction.

The original data file contains more than ninety one thousand observations (with one observation corresponding to data pertaining to one firm in a given year). The data is annual, for the time period 1983-1996. Given sample size, it is possible to impose strict filters, aimed at eliminating dubious observations (replies), or questionnaires for which some of the essential data is missing. The filters that are applied are described in the appendix. The latter are those typically used by researchers familiar with *Central de Balances* (see, for instance, J. Valles and I. Hernando (1994)). Some further edition of the data was necessary for the exercise carried in this paper.

The final sample is about half the original size, and consists of 39944 observations. This panel is unbalanced in the time dimension, given that some firms do not report in all years. Each firm is assigned an anonymous identification number specific to the data base. Last, each firm is classified according to its sectoral activity. This affiliation ranges from broad sectors (26 for the whole economy), intermediate (82 sectors), to very fine (more than 400 sectors). Subject to the number of observations available, it is thus possible to work at very different levels of aggregation.

Both questionnaires provide data on the number of employees. Given the large number of short term (or temporary) contracts in Spain, the questionnaires report separately the number of employees on long term and short term contracts. Firms also report the average number of weeks that employees on short term contracts have provided during the year. Thus, it is possible to construct the labour input in full time equivalents.

Output is measured as gross output (i.e., including intermediate consumption).[3] Consumption of intermediate inputs is directly reported in *Central de Balances*. In order to get a precise measure of intermediates' contribution to output growth, the relevant variable is net consumption of intermediates. Gross purchases would typically overstate the importance of that input, as many firms trade or stock parts of their purchases. Net consumption has thus been chosen, except for sectors belonging to distribution, where gross consumption of intermediates has been chosen instead.[4]

---

[3] As shown by Hall (1988 p.927) and Domowitz, Hubbard, and Petersen (1988, p.56) this is a better measure when data on intermediate consumption are available.

[4] Given the nature of their activity, the distribution sectors (wholesale and retail) do not report any net purchases, but only gross consumption. These sectors do not carry a direct physical production *per se*, so that the measurement problem mentioned in the text does not apply in their case. Resale of their purchases is their main activity, so that intermediate consumption is an appropriate measure of that input's contribution to output growth.

Values for factor shares are computed in the following manner. The labour share is obtained as the ratio of total labour costs to gross output, both measured in value. Total labour costs are made up of wage costs as well as social security contributions, both reported in the survey. Intermediate's elasticity is obtained as the value of net intermediate purchases on output. If constant returns to scale are assumed, capital's share is then obtained as a residual. Alternatively, output elasticities can be econometrically estimated, using (2). In that case, it is possible to allow for locally increasing returns to scale.

As is often the case, construction of the capital stock proved the trickiest issue. In the survey, firms report their level of fixed assets, gross investment, and depreciation allowance, for each year. In addition, the Bank of Spain computes annual fixed capital formation (net of depreciation) for each firm, using the raw data. The capital stock was constructed as follows: the level of fixed assets reported by the firm in the first year available was taken to be the true value of capital stock in that year (see J. Valles and I. Hernando (1994) for a discussion). That initial capital stock was then expanded using the series constructed by the Bank of Spain.

It is well known that firms may have distorted incentives (e.g. tax) to report the true value of their capital stock, so that the initial estimate may be a biased one. In addition, the initial value of the stock is reported using historical costs. This is problematic, as it introduces a positive bias in the computation of the *growth rate* of the capital stock. *Ceteris paribus*, this generates a downward bias in TFP estimates.

Bearing this caveat in mind, the estimates obtained make sense. First, the survey carried out by the Bank of Spain is extremely detailed (so that cross-referencing is possible), thus minimising the risk of blunt mis-reporting. Second, these surveys are confidential, and not made available to tax authorities. Third, it is possible to compute an implicit depreciation rate (and thus expected lifetime of an investment). The resulting estimates are quite sensible not only at the aggregate level (all sectors, or broad sectors), but also at the disaggregated level. On average, depreciation is estimated to be between 5% and 10% per year, well in line with what is found in the literature. Moreover, when a closer look is taken at the sectoral data, that initial impression is confirmed.[5] Nonetheless, the positive

[5]That is, sectoral depreciation rates are in line with priors. For instance, depreciation is estimated at 20,2% for business machines (computers), 18,13% for aerospace equipment, and 11,4% for computer services. By contrast, depreciation for railway services stands at 2,6%, that of ancillary port and airport services at 2,9%, and that of electricity production and distribution

bias pertaining to the growth rate of the capital remains. Unfortunately, there is no way to correct for this bias, save for ad-hoc adjustments.

All variables have been deflated using aggregate (economy-wide) deflators, taken from the *Boletín Estadístico* published by the Bank of Spain. The value-added deflator has been applied to output, and capital has been deflated using the deflator for machinery and equipment. Net purchases of intermediate goods has been adjusted using the deflator for intermediate consumption. Finally, the capital input has been adjusted by an aggregate indicator of capacity utilisation.[6]

4. Base case results: negative TFP growth?

This section briefly presents the results derived from applying standard techniques for computing TFP growth. The results pertain to an 82 sector disaggregation of the economy, but carry over to finer or more aggregate measures.[7] Results are reported for fewer sectors, as for some the number of observations is too small.[8]

I begin by estimating (2) in levels, separately for each sector. To this end, I assume that within sectors, elasticities, returns to scale, and TFP growth are equal across firms for the entire time period. Clearly, results are biased in the presence of firm level fixed effects (whenever $z_i \neq 0$). Nonetheless, comparing the estimates of (2) in levels and in differences gives an idea of the magnitude of these

at 4,8%. In between, depreciation for electro-domestic apparatus stands at 7,7%.

[6] Data on electricity consumption by establishment would provide a much more accurate indicator of capacity utilisation. Unfortunately, no such data is available.

[7] The Bank of Spain aggregates the data for 26 broad sectors (CB 26), and also provides the same data for more than 400 sectors, classified according to Spanish national nomenclature (*Clasificación Nacionál de Actividades Económicas* -CNAE/93). The 82 sector breakdown has the twin advantage that disaggregation is quite fine, and that for most sectors, the number of yearly observations is sufficiently large.

[8] All sectors for which there were less than 35 observations for the entire time period were dropped. For the remainder, the number of observations is typically above 200, and ranges in the thousands for a few of them. The sectors that have been eliminated are: oil extraction, uranium extraction, extraction of mineral ores, treatment of nuclear fuels, metallurgy, arms and munitions, production and distribution of steam, rental of demolition equipment, pipeline distribution, postal services, and R&D. These sectors fall in three categories. The first group is made of totally marginal activities in Spain (e.g., oil and uranium extraction, armaments and munitions, independent R&D labs). The second is made-up of natural and/or regulated monopolies (e.g. pipeline distribution, steam distribution, postal services). Metallurgy stands on its own; it is not a state and/or a regulated monopoly, and it is an important sector in Spain. For an unknown reason, the raw files of *Central de Balances* only contain data for 1996; this sector had to be dropped for this reason.

differences across firms within a sector. Moreover, the presence of firm level fixed effects blurs inference on the competitive regime (fixed effects may or may not be compatible with the presence of market power).

Under the hypothesis of perfect competition and homogeneous firms, the right-hand side variables are exogenous and (2) can be estimated directly. However, as I relax this assumption in the next section, I use an instrumental variable approach to correct for possible endogeneity (and thus have comparable results). The instruments used are two period lagged values of the right-hand side variables.[9] Standard errors are corrected for heteroskedasticity using White's (1980) proposed covariance matrix. Estimating the growth of TFP (modelled as a time trend) does not require an assumption regarding returns to scale; the latter's importance is left to be determined by the data.[10]

The results are not reported as they are clearly counter-intuitive. In a nutshell, TFP growth during the period 1983-1996 is found to be negative, or zero, for a large number of sectors. Less than 15% of observations belong to sectors which experience positive and significant TFP growth, while for the rest it is negative -and mostly significant- growth that is the rule.

When constant returns are assumed, the data permits to retrieve a direct measure of TFP levels without having recourse to estimation. These results -not reported either- are even less satisfactory than the previous ones. Grouping these TFP levels by sector, and regressing them on a time trend indicates that, apparently, less than 5% of observations belong to sectors that experience positive TFP growth. These results are simply not credible.

To try to make sense of the results, alternative specifications were chosen, such as one with only capital and labour as inputs (and using value added instead of sales). Different functional forms were also tried, such as a constant elasticity of substitution (CES) or translog (in both cases, the estimation was carried out with and without allowing increasing returns).[11] The essence of the results remained the same. Last, instead of using a time trend (which imposes a specific structure on TFP growth), the various specifications mentioned above were tried with annual dummies. The same results obtain, that is TFP growth appears to follow a

[9] The estimates obtained without instruments are very similar. The precision of the estimation is somewhat higher, as the sample contains all observations. Different lags for the instruments were tried, and none of the results changed.

[10] A specification with local returns to scale set equal to zero (i.e. $\eta = 1$) yielded similar results.

[11] It should also be noted that using a translog or CES can pose serious econometric problems, as some of the quadratic terms are highly colinear with the non-quadratic regressors.

negative trend in far too many cases. When annual dummies are introduced, the ones that are significant appear with a negative sign in most cases.

With the same motivation in mind, I tried to estimate the level of technical inefficiency within Spanish industry. Using a stochastic production frontier approach, I estimated production functions at different levels of aggregation (from broad to very fine sectors), using the three functional forms mentioned above. The results were systematically unsatisfactory in the sense that the residuals of the estimation were not skewed, or worse, positively skewed in almost all cases.[12]

As mentioned above, the presence of firm level fixed effects will bias the estimates obtained from a specification in levels. Thus, I estimated (2) in first difference to eliminate fixed effects. Table 1.a summarises the results. The first cell of table 1.a provides a headcount of the number of sectors (and the corresponding number of observations) for which TFP growth is found to be negative and significant.[13] Column 2 provides the number of sectors for which TFP growth is negative and not significant, while column 3 gives the same number for positive, but imprecisely estimated, coefficients. The last column numbers the sectors for which a positive and significant time trend is found. As can be readily seen, the picture is still quite unsatisfactory.

In only 46.2% of sectors does TFP growth appear to follow a positive trend; for the remainder, the sign of the trend is imprecisely estimated, or negative. Apart from the estimate of the time trend, the coefficients for these sectoral production functions are reasonable, and the adjusted R^2 satisfactory.[14] The lower part of Table 1.a provides summary information on the estimated coefficients. It reports the weighted (by the number of observations) and unweighted average for the estimated elasticities, as well as the average R^2 (weighted and unweighted). These

[12] Inefficiency is identified from the estimation of the production function (see Caves *et al.*, 1992 for a presentation). Under the assumption that some inefficiency exist, the residuals will be formed of a normally distributed white noise, and a negatively skewed distribution that reflects the fact that some firms operate below what is technically optimal. By making an assumption on the form of the skewed part of the empirical distribution (e.g. half normal or exponential), it is possible to obtain an estimate of technical inefficiency from the residuals' third moments. A positive skew indicates that there is a small group of very efficient firms, but that the bulk are technically inefficient. This finding is hard to reconcile with the assumption of perfect competition. Unraveling the true level of inefficiency in Spanish industry is the topic of another paper.

[13] I also looked at the proportion of output or employment that each of these cells represent (e.g. share of total employment belonging to sectors which experience negative TFP growth). The picture is very similar to the one described in the text.

[14] The full set of results is available from me upon request.

results pertain to significant estimates; the percentage indicates what proportion of the total sample these observations represent.

As can be seen, the point estimate of η is often quite large and significantly negative (indicating strong decreasing returns to scale at the sectoral level). Suspicious of this result, I re-estimated (2) -in differences- setting $\eta = 0$. The results, summarised in Table 1.b, confirm the initial finding: TFP growth is found to be negative in far too many cases. While the estimates of the elasticities are more in line with priors than those reported in Table 1.a, the proportion of sectors which experience significant and positive TFP growth falls to a paltry 9.2%.

These results are at best puzzling. First, negative or zero TFP growth is highly unlikely in any economy during a time period of fourteen years.[15] Second, the time period under consideration is considered to be one of fast technological progress in the Spanish economy, not one of stagnation or decline. Moreover, these awkward results are corroborated by an analysis of technical inefficiency. Last, the important differences between estimates in levels and those in differences are indicative of the presence of significant fixed effects. As mentioned earlier, fixed effects may result from the existence of market power. The next paragraphs discuss possible causes that could account for these peculiar results.

With firm level data mixing nominal and real variables, biases due to the absence of hedonic adjustment will be present. In other words, the nominal value of output may underestimate its true economic value, as many quality improvements will not be reflected in prices.[16] Unfortunately, given the data available, it is not possible to adjust the variables for quality changes. The remainder of the analysis proceeds without controlling for hedonic adjustment; this is due to data limitation, not to a belief that this has not been an important phenomenon during the period under consideration.

Thus far, the standard Cobb-Douglas *cum* perfect competition description of the economy has been assumed. Clearly, if the firms in the sample do not operate under perfect competition, the TFP estimations presented above are unreliable. For one, factor shares may not approximate true output elasticities. The remainder of the paper focuses on identifying the degree to which firms are able to price above marginal cost.

[15] That is, an economy functioning under "normal" conditions, i.e. not subjected to a drastic negative shock, such as a war or a change in the socio-political system.

[16] To my knowledge, the only statistical office that intents to adjust for quality changes in a transparent and consistent manner is the US Bureau of Labour Statistics. See Moulton and Roses (1997) for a discussion. Regarding durable goods, the classic reference is Gordon (1990).

5. Accounting for the degree of market power

5.1. Existing evidence

Industrial organisation theorists have developed a wide variety of models in which firms interact strategically in an oligopolistic context. Even with homogeneous products, these models imply firms will price above marginal cost, except in the polar case of a one-shot Bertrand game with unlimited capacity in the short-run. Moreover, simple models of product differentiation involve a departure from the assumptions of perfect competition, as firms can exercise market power on their market segment. Most empirical studies of specific industries (or group thereof) has found evidence of substantial market power.[17] The increasing levels of industry concentration in developed economies do suggest that market power is a pervasive phenomenon (Clarke 1985). Casual observation of the workload faced by the US Federal Trade Commission, European national competition authorities, and Directorate General IV of the European Commission indicate that the exercise of market power is widespread.

From our perspective, the most relevant work are the pioneering contributions of Robert Hall (1986, 1988) and Domowitz, Hubbard, and Petersen (1988) -DHP thereafter. Hall (1986, 1988) convincingly showed that industries do not operate under perfect competition as they establish prices above marginal (or average variable) cost. Thus, estimates of TFP growth that do not adjust for market power will be biased. Using a more extensive and detailed dataset, DHP (1988) provide robust and significant evidence pertaining the existence of market power. A number of papers have confirmed these initial findings (see Hall (1990) and Botasso and Sembenelli (1999)). More generally, there is an important empirical literature that studies the evolution and determinants of price-cost margins (see for instance DHP (1986), Petersen and Katic 1994, Jacquemin and Sapir (1991)).

Hall's and DHP's work pertain to the US, which is considered as the most competitive economy in the world. *A priori*, economies that are less competitive than the US are more likely to be subjected to the exercise of market power. From that perspective, Spain is an ideal subject of study (see section 5.8 below). At the beginning of the period under consideration, 1983, it was an economy just emerging from decades of corporatist/statist economic management. By the end of the time period, 1996, Spain was fully integrated in the EU, and eventually made it into the first group of participants to Economic and Monetary Union (EMU).

[17] See Bresnahan (1989) for a survey.

This preliminary evidence suggests that important changes in market structure occurred during that period. Spain presents the twin advantage of a presumption of substantial market power at the beginning of the period, and changes in it thereafter. Using a different data set, Jaumandreu and Martín (1999) provide convincing evidence pointing in that direction.

5.2. Assessing the degree of market power

Hall ((1986), (1988), (1990)) uses the invariance properties of the Solow residual to assess the degree of market power. The key insight is that, once there is a departure from perfect competition, firms charge prices above marginal cost. This implies that when output expands, total revenues increase faster than total costs. In the words of DHP (1988 p. 56), the consequence is that: "if price exceeds marginal cost, then the labor share in cost α_L^* is equal to $(p/c)\alpha_L$, where α_L is defined with respect to the value of output (PQ)". Given that firms minimise costs irrespective of the competitive regime, it is possible to retrieve an estimate of the price to marginal cost ratio. To do so, it is necessary to assume that factor markets are competitive.

Hall's ((1988) p. 926) estimation is based on the following expression:

$$\Delta q - \alpha\Delta n - \gamma\Delta m = (\mu - 1)(\alpha\Delta n + \gamma\Delta m) + \vartheta \qquad (3)$$

where q is the log of gross output to capital, n the log of the ratio of labour to capital, and m is the log of the materials to capital ratio. α and γ are, respectively, the factor shares of labour and materials in the value of gross output.[18] ϑ is the rate of Hicks neutral technological progress and μ is the ratio of price to marginal cost (p/c). The way (3) is written implies constant returns to scale.[19] Estimates of μ obtained using (3) are referred as "Hall" in the tables reporting the results.

Hall (1988) does not estimate (3) directly as his data does not contain materials. Rather, he regresses the Solow residual (computed with value-added) on a set of instruments uncorrelated with technological progress (ϑ), but correlated with inputs and output.[20] Only under the assumption of perfect competition ($\mu = 1$)

---

[18] When I turn to estimation, output, shares, and inputs are indexed by time and unit of observation, just as in (4) and (5) below. Equation (3) is spelled out the way it appears in Hall's (1986) original paper.

[19] The presence (absence) of returns to scale has key implications for the interpretation of the results. This issue is examined in section 5.7.

[20] The instruments used are military spending, the political party of the US president, and oil prices.

is this correlation equal to zero. Note that this is an indirect method of assessing the effect of market power. His results pertain to a two-digit level of aggregation.

DHP (1988) make use of a different data set that contains information on gross output and materials. Their estimates of price cost margins is thus corrected for materials.[21] In addition, the level of aggregation is much finer. Using Hall's framework, and assuming that material consumption varies in strict proportion to output, they estimate the following equation:

$$\Delta q_{i,t} - \alpha_{i,t}\Delta n_{i,t} - \gamma_{i,t}\Delta m_{i,t} = \vartheta_i(1-\delta) + \delta\Delta q_{i,t} + (1-\delta)\Delta a_{i,t} \quad (4)$$

where i indexes the industry, ϑ_i is the trend rate of TFP growth, $a_{i,t}$ is the log of a productivity shock, and δ is the Lerner index, that is $(p-c)/p$. Using (4) and correcting for endogeneity ($\Delta q_{i,t}$ appears on both sides), DHP (1988) are able to estimate price-cost margins directly. Estimates of the latter will be referred as "DHP".

These exercises share the following characteristics. First, both sets of authors assume constant returns to scale.[22] Second, price-cost margins are assumed to remain stable over time. Third, factor markets are assumed to be competitive, an assumption that I also maintain.

Last, Botasso and Sembenelli (1999) extend Hall's framework by including materials and allowing for variable returns to scale. The equation, they estimate is based on:

$$\Delta q_{i,t} = \Delta\vartheta_{i,t} + \mu_{i,t}(\alpha_{i,t}\Delta n_{i,t} + \gamma_{i,t}\Delta m_{i,t}) + \eta\Delta k_{i,t} + \Delta u_{i,t} \quad (5)$$

where $k_{i,t}$ is the log of the capital stock. Estimates of μ from (5) will be referred as "BS".

The formulations of (3), (4), and (5) exploit the fact that in the presence of market power, a factor's share in costs is equal to its share in gross output times the price to marginal cost ratio. As shown by Konings, Van Cayseele and Warzynski (1999), it is possible to give a structural interpretation to (3), (4), and (5). These equations are extensions of the structural framework developed by Levinsohn (1993), which introduces conjectural variations in a model of oligopoly.

[21] They show that if output varies in strict proportion to materials (a fact clearly corroborated by empirical evidence -see Basu (1996)), the true markup (δ) is equal to $\delta_{va}(1-\gamma)$, where δ_{va} is the estimate of the markup using value added, and γ the share of materials.

[22] Hall (1990) relaxes this assumption by obtaining a direct measure of the cost of capital. Given the data available for Spain, I could not follow that additional route.

The remainder of the paper focuses on these three equations. In addition, given the data available, I can directly compute price-cost margins without resorting to estimation. In that way, I am able to check for the consistency and robustness of the results by comparing my estimates with an accounting measure of price-cost margins.[23]

5.3. Computing price cost margins

To get an accounting estimate of price cost margins, I adopt the methodology proposed by Dommowitz, Hubbard and Petersen (1986). Price cost margins are defined as:[24]

$$\frac{p-c}{p} = \frac{\text{Value of sales} + \Delta \text{ inventories} - \text{payroll} - \text{cost of materials}}{\text{Value of sales} + \Delta \text{ inventories}} \tag{6.1}$$

Where Δ stands for "changes in". The inclusion of inventory changes ensures that adjustment for business cycle fluctuations are catered for in our measure of price cost margins.[25] According to the accounting definitions adopted in the *Central de Balances* survey, this is equivalent to:

$$\frac{p-c}{p} = \frac{\text{Value added} - \text{payroll}}{\text{Value added} + \text{net cost of materials}} \tag{6.2}$$

The latter are referred to as "PCM" in the tables. An alternative expression is the price to marginal cost ratio:

---

[23] As will become clear in the next section, the data contains sufficient information to estimate TFP growth after having adjusted the data to take market power into account. However, I was unable to find good instruments to correct for endogeneity; this resulted in imprecisely estimated coefficients.

[24] Expression 6.1 looks very similar to the share of capital in revenue. This should come as no surprise, as profits in excess of the normal rate of return will be reflected in the share of capital. It may also be the case that excess returns are appropriated by factors of production other than capital. This will occur whenever costs are endogenous, reflecting a bargaining process between the parties involved. Throughout, I maintain the assumption that factor markets are competitive, i.e. rents or quasi-rents accrue to capital only. The distribution of rents between factors of production is the topic of another paper.

[25] It is often the case that researchers assume that the value of sales is equal to the value of output. This is unlikely to be the case if business fluctuations lead to important changes in inventories.

$$\frac{p}{c} = 1/(1 - \frac{p-c}{p}) \tag{6.3}$$

This formula provides an annual accounting estimate of the price-marginal cost ratio for each firm.

Note there is no *a priori* reason to think that changes in the degree of market power have been homogeneous across sectors. In some cases, market power may have remained stable, or increased, over the time period. Before proceeding with the analysis, it is useful to briefly examine the behaviour of price-cost margins during the period under consideration. Table 2.a provides summary information on price cost margins for the sectors present in the sample.

It is interesting to note that for almost *all* sectors, the mean of price-cost margins is greater than the median, an indication that some firms enjoy a greater ability to price above marginal cost. This is confirmed by a cursory glance at skewness.

Regressing price-cost margins on a time trend and GDP growth reveals that price-cost margins have fallen in some sectors, but no clear tendency can be detected over the time period. This finding confirms my prior that the degree of structural change has been important during that period. What is more, this trend is far from homogeneous across sectors. A similar picture emerges from their cyclical behaviour. Overall, price-cost margins appear as pro-cyclical, but there are marked differences across sectors. Table 2.b summarises the information pertaining to the trend and cyclical evolution of price-cost margins at the sectoral level.[26]

5.4. Estimating the degree of market power

In this section, I directly estimate (3), (4) and (5). To do this, I have to assume that, within sectors, the price to marginal cost ratio is constant through time and identical across firms. The first two equations assume constant returns to scale, while (5) allows for variable returns and in this sense, it is a more general formulation. However, interpretation for the returns to scale parameter remains problematic in view of the capital stock data.

In order to estimate the price to marginal cost ratio, I pre-multiply input quantities by -time-varying- factor shares.[27] Note however that estimation of

[26]The tables just gives a headcount of sectors; the entire set of results is available from me.

[27]A Thönqvist (1936) approximation has been used for the change in factor shares. See

these three equations will yield precise and unbiased estimates only if margins are roughly constant over time. Table 2.b indicates that this may not always be the case.

When firms enjoy market power, output prices are no longer exogenous to the model. To address the issue of endogeneity, an instrumental variable (IV) approach has been adopted. I use the same instruments as DHP (1988), that is current and lagged GDP growth. These authors defend the use of these instruments by arguing that real-business-cycle technology shocks are absent from the economy.[28] If this condition holds and no sector is large enough to influence the economy-wide rate of growth (which is the case for my sample), then GDP growth ought to be correlated with input and output changes, but not with TFP growth. In order to maintain consistency across procedures, I used the same instruments in the estimation of (3), (4), and (5).

A superior procedure involves the use of the generalised method of moments (GMM) proposed by Arellano and Bond (1991). This approach fully exploits all orthogonality conditions (i.e., two-stage least squares -TSLS- are a special case of GMMs), and easily allows for a general mispecification. test. The drawback is that a large number of consecutive observations is necessary to obtain precise estimates, thus greatly reducing sample size. Therefore, to check the consistency of the results obtained using TSLS, I applied GMM at a higher level of aggregation (in order to have sufficient observations).[29] The instruments used are three to five period lags of the independent variables. This procedure also permits the introduction of annual dummies, which yield a better estimate of TFP growth. For strict comparability purposes, I also re-ran the same estimation using the instruments applied to the TSLS estimation, namely current and lagged measures aggregate GDP growth. The disadvantage is that I am no longer able to introduce annual dummies to retrieve TFP growth, as this instrument is the same for all observations for a given year.

Diewert (1976) or Barro and Sala-i-Martin (1995) for a discussion of this approximation. This is in line with the exercises reviewed in this paper. Imposing constancy of shares yields similar results to those reported below.

[28]One may disagree with this view; I stick to the same specification for strict comparison purposes. DHP (1988) provide evidence in support of the view that aggregate technology shocks are absent. Hall (1986) also adopts this stance.

[29]For sectors that contain enough observations, I applied GMMs at the same level of aggregation. The results are very similar.

5.5. TSLS estimates

Estimating each of these three equations allows me to check broad consistency of the results using different methodologies. Furthermore, I can directly compare the margins constructed using the raw data from *Central de Balances* (given by (6.2)) and those retrieved from the estimation of (4).[30] Given that the relationship between the price to marginal cost ratio and price-cost margins is not linear, transforming the former into the latter for comparison purposes can be problematic. For instance, this will be the case whenever the means of two series are different. In this case, comparisons can only be made using simple rank correlations. However, the raw correlation between estimates of μ in (3) and (5) on the one hand (untransformed), and δ in (4) and accounting margins on the other, should be positive.

Table 3 summarises the results; an empty cell means that the estimate was not significant at the 15% level.[31] As can be readily seen, I did not obtain significant estimates for a number of sectors. Apart from the small number of observations for some sectors, the imprecise estimates are probably due to the difficulty of finding good instruments and the fact that price-cost margins *are not* constant over this time period for a good few sectors.

The first column reports the estimates using Hall's original methodology, but inclusive of materials (i.e., eq. (3) indexed accordingly). The estimated price to marginal cost ratio is, on average, quite high (the latter is obtained by adding 1 to the point estimate of $\mu - 1$ obtained from (3)). High estimates obtained from (3) have been reported in the literature, and should come as no surprise.

I then estimated (5), which is equivalent to (3), save that it allows for variable returns to scale. From this equation, I obtain a direct estimate of the price to marginal cost ratio, μ. *Stricto sensu*, this variable ought to be significantly superior to one in the presence of market power. The latter condition is not fulfilled for some sectors. The results that are reported are for sectors for which the point estimate was found to be significantly different from zero, and greater or equal to one.[32] Apart from the presence of the scale parameter, this selection

[30] For accounting margins, I use the average over the entire period for each sector.

[31] The use of instruments means that standard errors easily become very large. Thus, I chose 15% as the cut-off significance levels. This marginally expands the set of estimates deemed to be significant.

[32] There is an intrinsic problem associated with the estimation of the price to marginal cost ratio, particularly when instruments have to be used. An economically acceptable value of the price to marginal cost ratio ought to be equal or greater than one, but not take excessively

rule explains why I get a larger number of estimates using (5) rather than (3). A simple average of these estimated price to marginal cost ratios across sectors gives a mean value of 1.47, and when each sector is weighted by the number of observations it contains, the value falls to 1.37. Both are reasonable values, particularly the second one. Overall, estimates of (4) ought to be taken with a grain of salt, as some of the point estimates are not significantly different from one.

Turning to eq. (5), most of the estimates of the Lerner index are significantly different from zero, which means that the hypothesis of perfect competition is rejected. Overall, DHP's (1998) method yields the largest number of significant estimates, and the fit of the equation (F statistic) is by far superior. In addition, the point estimates are, for most sectors, more reasonable in the sense that estimated margins are within acceptable values.

I also examined the correlation between the series, and computed simple as well as rank correlations between pairs of estimates. The results are presented in Table 4; the first entry in each cell reports the simple correlation, the second, the rank correlation, and the third, the number of sectors for which the different methodologies yielded significant results. The correlations are computed for the sectors which form the intersection of significant estimates between pairs of methodologies. As can be readily seen in Table 4, both the simple and rank correlations between each pair of estimates are quite high. This table also reports correlations between estimated and accounting margins (denoted PCM). The previous result of high correlations carries over to that exercise as well.[33]

5.6. GMM estimates

I then estimated margins by applying the GMM procedure.[34] The results pertain to a higher level of aggregation (26 sectors for the entire economy), as I need a larger number of observations for each sector. Table 5 reports four sets of results obtained from estimating (3) and (4). Results pertaining to estimates (5) are not reported for two reasons. First, the results are very similar to those pertaining to the estimate of (3). Second, results pointed to strong decreasing returns at the

high values, as this would imply very high pure profits. The difficulty lies in the fact in the absence of very good instruments, it is difficult to obtain very precise estimates. The end result is that equality to one cannot be rejected at standard significance levels for a two tailed test, eventhough the point estimate appears as reasonable.

[33]DHP (1988) carry out the same exercise; the results are qualitatively similar.

[34]For this exercise, I used DPD, a free software developed by Arellano and Bond.

sectoral level, which rendered the results of dubious value. In addition, estimates of (5) quite often failed the standard econometric tests associated with a GMM procedure.

For both (3) and (4), I applied GMMs using the same instruments as those pertaining to the simple TSLS procedure, that is current and lagged GDP growth.[35] Using current and lagged GDP growth does not permit the introduction of time dummies, and is reported simply for comparison purposes (the results are labelled "IV"). The second set of results (denoted "GMM") are obtained by using three, four, and five period lags of the regressor. This permits the introduction of time dummies to approximate TFP growth annually. This latter set of results, reported in Table 5, is superior from an econometric perspective, but can only be obtained after having aggregated the data.

These results confirm the earlier findings of pricing above marginal cost. However, in a number of respects, they represent a marked improvement over previous estimates. First, the coefficient measuring market power is estimated very precisely (most estimates of (4) are significant at the 0.01% levels). Second, the magnitudes are more reasonable in sectors for which the degree of market power was found to be very high using simple TSLS.[36] Third, almost all sectoral estimations safely pass the rather stringent statistical tests associated with GMMs (Wald, Sargan, and 1st and 2nd order autocorrelations).[37] Fourth, the time dummies (not reported in the Table) point to a significant slowdown in TFP growth during the second half of the time period. This result is in line with other findings regarding the reduction of catch-up opportunities in Spanish economy (de la Fuente 1995), and is corroborated by another study using micro data (Jaumandreu and Martín (1999)).

---

[35] Given the suspicious value taken by the point estimate of η in previous exercises, the results pertain to a specification with $\eta = 0$.

[36] For instance, the estimates found for coke and lignite extraction applying (4) and using simple TSLS yielded price cost margins of 1.077, which implies negative costs (though this estimate is not significantly different from 1). Given the amount of subsidies this sector receives, this may not be so implausible. Nevertheless, the GMM estimates yield a more reasonable estimate (which stands below one). As a general rule, all GMM estimates are more in line with priors on sectoral margins.

[37] It is interesting to note that the "worst" estimations from the perspective of statistical tests are also the ones that yield point estimates that are very high.

5.7. Returns to scale

The nature of returns to scale has important implications for the interpretation of the results. The following simple relationship holds in equilibrium (Basu 1996):

$$\frac{P}{C} = \frac{P}{MC} = \frac{P\ AC}{AC\ MC} = \frac{1}{1-\Pi}RTS \tag{7}$$

Where AC denotes average cost, Π the pure profit rate and RTS the degree of returns to scale. This formula implies that positive margins coupled with decreasing returns give rise to pure profits. In the estimation using differences, I found strong evidence of decreasing returns (see Table 1). Combined with the -significant- estimates on margins, this would imply huge pure profits, of the order of 40% or more for many sectors. As in the case of TFP estimates, these results are simply not credible. The culprit is most likely due to the estimation of the capital stock. Overestimation of the latter's growth rate results in a negative bias both in the estimation of TFP and of returns to scale.

While there is no obvious solution to this measurement problem, it is nonetheless possible to retrieve reasonable estimates of returns to scale. Indeed, estimation of (2) in levels somewhat alleviates the problem of mismeasurement;[38] the drawback is that firm-level fixed effects are not controlled for. Despite this caveat, the point estimates obtained using levels make sense. For most sectors, I find evidence of slight increasing returns to scale, though in most cases, it is not possible to reject the hypothesis of constant returns. The average for the entire sample is 2.7%; which is much more reasonable than the value of -0.32% obtained using differences. While estimates in levels are credible, the bias associated with the measurement of capital remains. Thus, these values ought to be interpreted as a lower bound for the true degree of returns to scale.

As pointed by Basu (1996), positive margins require increasing returns for pure profits to remain within acceptable ranges. Increasing returns are present if there are some sort of fixed costs associated with starting operations. This condition holds in most, if not all, sectors of economic activity. Thus, the picture that emerges from this data is one of increasing returns coupled with positive margins, which yield important pure profits in some sectors. Overall, the implied level of pure profits remain within credible magnitudes for most sectors.[39]

[38] Estimates in levels display more "inertia"; this makes easier to unravel the relationship between output and capital growth.

[39] In the case of the US, pure profits in the 4-6% are typically reported. It thus not surprising to find higher values for Spain.

The simple and rank correlations between pure profits obtained with the estimates of returns to scale from (2), price cost ratios from estimates of (3), (4), and (5), and using (7), is very high (the lowest value is 0.87). A similar picture emerges if the same exercise is carried out with accounting estimates of pure profits (using (2) and (6.3)). The *lowest* value of these simple correlations between pairs of pure profits is 0.31. Table 6 summarises these results.

5.8. Competition conditions in Spain and the impact of EU entry

This section provides a summary overview of Spain's economy. The basic argument is that there is pervasive evidence indicating that degree and nature of competition changed during that time period. In 1983, Spain was emerging form its political transition, and with it, the previous statist/corporatist economic system was being progressively dismantled. The exercise of labour's rights put many firms under strain.[40] By 1986, Spain had signed its accession agreement with the EC. Spanish entry coincided with the most important liberalisation exercise in Europe since the 1960's, namely the implementation of the single market programme. A foreign direct investment boom during the late 1980's increased domestic competition to a degree hitherto unknown. As a result of its accession, Spain adopted the *acquis communautaire*, which resulted in the opening of many sectors of economic activity.[41] A competition tribunal was set-up in 1989 to apply the legislation adopted to protect competitive conditions in the domestic market.[42] As an example of anecdotal evidence pertaining to competitive conditions, domestic distribution systems were overhauled following the wave of FDI. To sum-up, Spain was subjected to a sharp increase in the degree of competition.

In the absence of entry and exit, and all else equal, this ought to have resulted in a fall in average margins.[43] As shown in section 5.3, there is some evidence

[40] Until the late 1970's, many firms had survived because labour costs had been kept down by suppressing workers rights. Once the right to free trade unions were recognised, many firms went bust because they could not operate profitably with higher labour costs.

[41] As an example, Spain had to adapt its system of intellectual protection. Till then, Spanish pharmaceutical products could not be sold on the European market, as the country was not offering adequate intellectual property rights protection (IPR). As a result of adopting an adequate IPR framework, foreign investment boomed in the pharmaceutical sector. This resulted in a drastic increase in competition in that sector.

[42] Current competition in Spain is modelled on the relevant articles of the Treaty of Rome and the related secondary legislation. In short, Spanish competition law applies European rules to domestic competition cases.

[43] A fairly general formulation to identify firms ability to price above marginal cost is given

pointing in that direction (for some sectors, regressing margins on a time trend yields a significantly negative estimate).

Of course, unraveling the true relationship between margins' dynamics and competitive pressure require that consideration be given to entry and exit. An increase of competition is compatible with stable (or slightly falling margins), if the reductions in prices are matched by changes in the composition of firms within the industry. Under this scenario, inefficient firms exit while new entrants ought to be characterised by a higher level of efficiency. Exit may occur even margins remain positive, as they may be too low to cover fixed costs.

Unfortunately, *Central de Balances* does not allow for a proper treatment of entry and exit processes. At best, it is possible to have a first approximation of true entry and exit by constructing proxies for these two variables.[44] In order to gain an idea of how these proxies behaved with respect to accounting margins (obtained using 6.2), I looked at yearly margin averages for different groups of firms.[45] Focusing on yearly averages ensures that inference is not driven by aggregate cyclical fluctuations. Due to space limitations, I only report results for averages for the entire sample; sectoral averages yield very similar results.

Apart from 1989, a clear cut pattern emerges from the results. Systematically, margins are lower for firms that have been defined as "exiters". By contrast, "entrants" generally enjoy higher margins. Moreover, "entrants" that do not exit enjoy higher margins than those that will eventually "exit".[46] This pattern is the

---

by:

$$\frac{p-c}{p} = \frac{1}{h_i + \sum h_{i,j} \frac{\partial p_j}{\partial p_i} \frac{p_i}{p_j}}$$

where h denotes product i's elasticity of demand and $h_{i,j}$ the cross price elasticity. The market structure underpinning this equation is one of n firms each producing a single differentiated product, itself an imperfect substitute for the other goods produced in the industry. With unchanged consumer preferences, the effect of increased competition (both from domestic and foreign sources) would work its way through the denominators' second term. See Neven, Nuttal and Seabright (1993) for a comprehensive discussion.

[44] I have defined "entry" as the first year in which a firm appears in the database. A firm is deemed to have "exited" if it does not report in any of the last three years of the sample. Clearly, the sample is censored on both sides, and both measures of entry and exit contain biases. Nonetheless, these definitions, which definitely contain an ad-hoc element, are probably acceptable first approximations.

[45] See Jaumandreu and Martín (1999) for a fuller treatment of entry and exit in Spanish industry during the period 1979-1990.

[46] In order to rationalise "entry" followed by "exit", one has to appeal to concepts of trembling hand equilibria, or to a particularly negative realisation of nature for these firms. Of course, these

one expected in a situation where competitive pressure becomes sharper, while at the same time, average margins are stable or falling slightly. This is due to the fact that, as a result of greater competition, efficiency differences across firms increase as a result of entry and exit.

These results seem to corroborate a claim often made by scholars of economic integration, namely that the main effect of integration is to sharpen competitive conditions (CEPR 1992). Empirical studies which evaluated the effect of integration typically found that the latter is small (Smith and Venables (1987)). However, these comparative statics exercises (often consisting of calibration) cannot capture the pro-competitive impact related to integration. A few papers have analysed the issue in a dynamic setting, but the focus has been on aggregate investment and TFP growth (investment is positively affected, while no clear effect is detected on TFP). As argued by Felipe and McCombie (1998) aggregate series mimic a well behaved Cobb-Douglas with no market power, and it is therefore not possible to unravel to effect of integration on competition conditions. The findings reported in this paper suggest that economic integration does have a strong pro-competitive effect (see also Jaumandreu and Martín (1999) for similar evidence pertaining to the late 1980's).

6. Conclusion

This paper was begun with the modest objective of estimating sectoral TFP growth at a fine level of disaggregation for the Spanish economy. Standard techniques, based on the assumption of perfect competition, systematically yielded poor results. To try to make sense of the results, I identified the degree of market power at the sectoral level. The bottom line conclusion of these exercises is that there is evidence of pricing above marginal cost.

Nevertheless, data on accounting margins indicate that some Spanish firms have been subjected to an increase in competitive pressure, probably as a result of EU entry. Unfortunately, the lack of accurate data on entry and exit processes does not permit formal testing of that conjecture. However, using proxies for entry and exit does suggest that less efficient firms have been replaced by more productive entrants. This pattern is consistent with an increase in competition coupled with stable or slightly falling margins.

firms could be true entrants that do not exit, but simply fail to fill in the *Central* questionnaire at the end of the sample period.

Last, this paper has only addressed the "puzzle" generated by micro data TFP estimates based on the assumption of perfect competition. There remains the task of better understanding the firm-level determinants of TFP growth and its relationship with market power. For instance, the latter has probably been affected by the presence of foreign firms in the Spanish economy. By the same token, estimates of technical (in)efficiency could be retrieved once changes in market power are catered for. Also, changes in the degree of competition ought to generate important changes in market structure -in the presence of sunk costs, firms need a larger market share to survive. These issues are left for further research.

References

[1] Arellano, M, Bond, S, (1991), "Some Tests of Specification for Panel Data Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies*, Vol. (58), pp. 277-297.

[2] Bank of Spain, *Boletin Estadistico*, various issues.

[3] Barro, R, Sala-i-Martin, X, (1995), *Economic Growth*, McGraw-Hill.

[4] Basu, S, Fernald J G, (1997), "Returns to Scale in U.S. Production: Estimates and Implications", *Journal of Political Economy*, Vol. 105(2), pp.249-283.

[5] Basu, S, (1996), "Procyclical Productivity: Increasing Returns or Cyclical Utilization", *The Quarterly Journal of Economics*, Vol. CXI, pp. 719-751.

[6] Bottasso, A, Sembenelli, A, (1999) "Market Power, Productivity and the EU Single Market Program. An Ex-Post Assessment on Italian Firm Level Data", miméo, *CERIS-CNR*, forthcoming *European Economic Review*.

[7] Bresnahan, T, (1989), "Empirical Studies of Industries with Market Power", in R. Schmanlensee, R. Willig (eds.), *Handbook of Industrial Organisation*, Amsterdam, Nortn Holland.

[8] Burnside, C, (1996), "Production Function Regressions, Returns to Scale and Externalities", *Journal of Monetary Economics*, Vol. 37, pp. 177-201.

[9] Burnside, C, Eichenbaum, M, Rebelo, S, (1995), "Sectorial Solow Residuals", *NBER*, Working Paper 5286.

[10] Burnside, C, Eichenbaum, M, Rebelo, S, (1995), "Capital Utilization and Returns to Scale", *NBER*, Working Paper 5125.

[11] Caballero, R, Lyons, R, (1992), "External Effects in U.S. Procyclical Productivity", *Journal of Monetary Economics*, Vol. 29, pp. 209-225.

[12] Caves, R, (1998), "Industrial Organization and New Findings on the Turnover and Mobility of Firms", *Journal of Economic Literature*, Vol. XXXVI (4), pp. 1947-1982

[13] Caves, R, Barton, D, (1990) *Efficiency in US Manufacturing Industries*, MIT Press

[14] Caves, R, *et al.*, (1992) *Industrial Efficiency in Six Nations*, MIT Press.

[15] CEPR, (1992), *Is Bigger Better?*, Monotoring European Integration No 3, London.

[16] de la Fuente, A, (1995), "Catch-up, Growth and Convergence in the OECD", *CEPR* DP No. 1274.

[17] Clarke, R, (1985) *Industrial Economics*, Basil Blackwell

[18] Diewert, E, (1976), "Exact and Superlative Index Numbers", *Journal of Econometrics*, Vol 4 (2), pp. 115-146.

[19] Domowitz, I, Hubbard, R, Petersen, B, (1986) "Business cycles and the relationship between concentration and price-cost margins", *The Rand Journal of Economics,* Vol. 17 (1), pp. 1-17.

[20] Domowitz, I, Hubbard, R, Petersen, B, (1988) "Market Structure and Cyclical Fluctuations in U.S. Manufacturing", *The Review of Economics and Statistics,* pp. 55-66.

[21] Felipe, J, McCombie, J.S.L (1998) "Methodological Problems with Recent Analyses of the East Asian Miracle", unpublished manuscript.

[22] Gordon, R, (1990), *The Measurement of Durable Goods Prices*, University of Chicago Press

[23] Hall, R, (1986), "Market Structure and Macroeconomics Fluctuations", *Brookings Papers on Economic Activity,* Vol. 2, pp. 285- 338.

[24] Hall, R, (1988), "The Relation between Price and Marginal Cost in U.S. Industry", *Journal of Political Economy,* Vol. 96 (5), pp. 921-947.

[25] Hall, R, (1990), "Invariance Properties of Solow's Productivity Residual", in *Growth/Productivity/Unemployment: Essays to Celebrate Bob Solow's Birthday*, edited by Peter Diamond, Cambridge, Mass.: MIT Press.

[26] Hernando, I, Vallés, J, (1994), "Algunas Diferencias en la Productividad de las Empresas Manufactureras Españolas", *Investigaciones Económicas*, Vol. XVIII (1), pp. 117-141.

[27] Jacquemin, A, Sapir, A, (1991), "Competition and Imports in the European Market", *American Economic Review*, Vol. 81, pp. 166-170.

[28] Jun, S, (1998), "Procyclical Multifactor Productivity: Tests of the Current Theories", *Journal of Money, Credit and Banking*, Vol. 30(1), pp.51-63.

[29] Katics, M, Petersen, B, (1994), "The Effect of Rising Import Competition on Market Power: a Panel Data Study of US manufacturing", *The Journal of Industrial Economics,* Vol. XLII (3), pp. 277-286.

[30] Konings, J, Van Cayseele, P, Warzynski, F, (1999), "The dinamics of Industrial Markups in Two Small Open Economies: Does National Competition Policy Matter?", *Center for Economic Studies*, Discussion Paper 99.14, Katholieke Universiteit Leuven.

[31] Levinsohn, J, (1993), "Testing the Imports-as-Market-Discipline Hypothesis", *Journal of International Economics,* Vol. 35, pp. 1-22.

[32] Martín, A, Jaumandreu, J, (1999), "Entry, exit, and productivity growth in Spanish manufacturing during the eighties", *Fundación Empresa Pública,* miméo.

[33] Moulton, , B, Moses, K, (1997) "Addressing the Quality Change Issue in the Consumer Price Index", *Brookings Papers on Economic Activity*, Vol.1 pp. 305-349.

[34] Neven, D, Nuttal, R, Peabright, P (1993), *Merger in Daylight*, CEPR, London

[35] Roeger, W, (1995), "Can Imperfect Competition Explain the Difference between Primal and Dual Productivity Measures? Estimates for U.S. Manufacturing", *Journal of Political Economy*, Vol.103(2), pp. 316-330.

[36] Salinger, M, (1990), "The Concentration-Margins Relationship Reconsidered", *Brooking Papers: Microeconomics*, pp. 287-335.

[37] Smith, A, Venables, A, (1988), "Completing the internal market in the European Community: some industry simulations" *European Economic Review*, Vol. 37(2), pp. 1501-25.

[38] Solow, R, (1957), "Technical Change and the Aggregate Production Function", *Review of Economics and Statistics,* Vol. 39, pp. 312-320.

[39] Thörnqvist, L, (1936), "The Bank of Finland's Consumption Price Index", *Bank of Finland Monthly Bulletin*, No. 10, pp. 1-8

Appendix

The data was filtered in order to systematically eliminate observations of dubious value.

Labour input: firms reporting non positive values for this variable were dropped.

Value added and gross output: firms reporting non-positive values for either of these variables were eliminated.

Firms reporting total labour costs greater than value added, inclusive of subsidies, were dropped.

Firms which reported gross fixed capital formation data which implied an expected life time of the investment greater than sixty years, or less than three years, were dropped from the sample.

Firms whose payments to suppliers of inputs and total labour costs were greater than the value of gross output were dropped from the sample.

Firms for which some of the data necessary to construct at least one of the variables were dropped from the sample.

Table 1.a: Estimation of (2) in first differences. Upper part: distribution of sectors according to TFP estimates. Lower part: weighted and unweighted average across sectors of the significant point estimates of the coefficients (weighted by the number of observations the sector represents). The adjusted R^2 to the average across all sectors. Cut-off significance level chosen: 10%. Robust estimates obtained using White's (1980) covariance matrix. Sectors with less than 35 observations were dropped. 82 sectors breakdown of the economy.

	Negative & significant	Negative & not significant	Positive & not significant	Positive & significant
% of sectors (No. In parenthesis)	1.5% (1)	15.4% (10)	36.9% (24)	46.2% (30)
% of obs. (No. In parenthesis)	0.9% (292)	21.0% (6469)	29.7% (9148)	48.3% (14844)

	α	γ	η	θ	R^2
Simple average	0.394	0.240	-0.358	0.022	0.748
Weighted average	0.439	0.205	-0.317	0.016	0.786
%Sectors	92.3%	83.1%	93.8%	53.8%	100%
%Observations	98.6%	96.0%	98.5%	52.2%	100%

Table 1.b: As above, save for the setting of $\eta=0$.

	Negative & significant	Negative & not significant	Positive & not significant	Positive & significant
% of sectors (No. In parenthesis)	12.3% (8)	38.5% (25)	40.0% (26)	9.2% (6)
% of obs. (No. In parenthesis)	25.6% (7869)	38.5% (11851)	27.7% (8532)	8.1% (2501)

	α	γ	θ	R^2
Simple average	0.409	0.434	0.000	0.755
Weighted average	0.370	0.484	-0.006	0.702
%Sectors	98.5%	92.3%	24.6%	100%
%Observations	99.8%	98.3%	36.7%	100%

Total number of sectors: 65
Total number of observations: 30753

Table 2.a: Second and third row: quintile distribution of the mean of price cost margins –denoted M- for sectors (each quintile represents 14 sectors). Fourth and fifth rows: quintile distribution of skewness by sectors.

1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
0.039≤M≤0.132	0.136≤M≤0.149	0.150≤M≤0.179	0.184≤M≤0.249	0.250≤M≤0.499
Skewness (S)	Skewness (S)	Skewness (S)	Skewness (S)	Skewness (S)
-0.467≤S≤0.397	0.492≤S≤0.880	0.889≤S≤1.167	1.186≤S≤1.505	1.646≤S≤3.753

Total number of sectors: 70
Total number of observations: 39944

Table 2.b: Evolution over time of price-cost margins and their cyclical behaviour. The first two rows refer to the point estimate for the time trend, while the next two pertain to that of GDP growth. Cut-off significance level: 10%.

	Negative & significant	Negative & not significant	Positive & not significant	Positive & significant
% of sectors (No. in parenthesis)	21.7% (15)	33.3% (23)	24.6% (17)	20.3% (14)
% of obs. (No. in parenthesis)	44.6% (17794)	24.6% (9829)	16.1% (6424)	14.7% (5875)
	Negative & significant	Negative & not significant	Positive & not significant	Positive & significant
% of sectors (No. in parenthesis)	7.2% (5)	36.2% (25)	37.7% (26)	18.8% (13)
% of obs. (No. in parenthesis)	8.9% (3566)	23.3% (9301)	29.3% (11713)	38.4% (15342)

Total number of sectors: 69
Total number of observations: 39922

Table 3: Margin estimates using TSLS, 82 sectors breakdown of the economy

SECTOR	DESCRIPTION	BS	HALL	DHP	PCM
1	Coke and lignite extraction			1,077	0,275
5	Non energetic nor metallic ore extraction		3,353	0,714	0,334
7	Fish based products	1,113		0,171	0,095
9	Beverages	1,416	1,416	0,294	0,184
14	Basic chemicals	1,369	1,379	0,275	0,178
16	Other chemical industries	1,158	1,217	0,186	0,147
17	Glass products			0,679'	0,186
19	Other non metallic mineral products		4,042	0,762	0,219
21	Metal products (except mach and eqpt)	1,147	1,219	0,189	0,145
22	General use machinery		1,495	0,368	0,145
23	Industrial and agricultural machinery	1,069			0,142
25	Domestic equipment	1,221			0,132
27	Electrical machinery and equipment	1,302	1,270	0,215	0,137
28	Electronic equipment and material	1,291			0,149
29	Medical-surgical, optical and watchmaking equipment and instruments	1,471			0,148
30	Motor vehicles	1,446	1,404	0,289	0,095
31	Vehicle bodywork and equipment	1,561	1,541	0,354	0,142
32	Shipbuilding	1,319		0,307	0,151
33	Other transport equipment	1,665		0,405	0,127
34	Textile fibres	1,195			0,169
35	Textiles	1,462	1,327	0,271	0,148
36	Other textiles	1,470		0,333	0,143
37	Dress-making	1,078		0,210	0,125
39	Wood and cork industries	1,539	1,652	0,449	0,127
40	Paper industry	1,510		0,313	0,139
42	Rubber products	1,520	1,401	0,297	0,136
43	Plastic products	1,010			0,155
44	Other manufacturing industries	1,142			0,137
45	Electric power prod. and distr.		2,333	0,649	0,313
46	Gas prod. and distr. (except pipelines)	1,036		0,209	0,267
48	Water purification and distribution			0,720	0,249
49	Preparation of civil engineering works			0,463	0,227
50	Building and civil engineering works			0,766	0,139

SECTOR	DESCRIPTION	BS	HALL	DHP	PCM
53	Rental of building and demolition eqpt			1,018	0,235
57	Retail trade (except motor vehicles)	1,533		0,387	0,216
59	Other passenger transports		1,787	0,567	0,198
61	Other activities related to iand transport			0,730	0,499
63	Sea transport			1,310	0,253
65	Other activities rel. to sea and air transp.			1,058	0,461
66	Handling and storage	3,239	3,170	0,685	0,386
70	Agricultural and livestock farming	2,530		0,543	0,162
72	Fishing		4,467	0,780	0,222
74	Real estate activities			0,945	0,466
76	Computer related activities			1,017	0,169
79	Other business activities	2,341	2,368	0,578	0,176
81	Health and veterinary care services			0,472	0,179

"Hall" coefficients in the table are μ=p/c (I added 1 to the estimated coefficients, μ-1). The significance ievels refer to the original estimates, μ-1 (i.e. indicate if the estimated coefficient is significantly different from zero).

"BS" coefficients are a direct estimate of μ=p/c. The significance levels indicate whether the coefficient is different from zero.

DHP coefficients in the table are (p-c)/p. For the GMM estimates, all of them are different from zero at the 0.1% or less significance level.

Table 4: Correlations between margin estimates

	BS	HALL	DHP	PCM
BS	1,000 1,000 28	0,992 0,902 12	0,942 0,935 21	0,582 0,115 28
HALL		1,000 1,000 18	0,918 0,990 18	0,654 0,637 18
DHP			1,000 1,000 39	0,597 0,649 39

The first entry m each cell reports the simple correlation while the second entry pertains to the rank correlation.
The third entry indicates the number of sectors for which the different methodologies yielded significant results.

Table 5: Margin estimates applying TSLS and GMM to (3) and (4), using the 26 sectors breakdown of the economy. Constant returns to scale are assumed.

26 sectors breakdown		**DHP GMM**	**DHP IV**	**HALL GMM**	**HALL IV**
1 Extraction of energetic Minerals	**Coefficient**	**0.932**	**0.805**	**2.126**[2]	**2.319**[1]
	Wald j-sign	0.000	0.000	0.026	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**1.000**	**0.992**	**1.000**	**0.999**
	1st autocorr	0.050	0.554	0.406	0.499
	2nd autocorr	0.494	0.593	0.232	0.570
2 Extraction of other minerals, Except energy products	**Coefficient**	**0.678**	**0.712**	**1.739**[1]	**2.138**[1]
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.997**	**0.991**	**0.987**	**0.832**
	1st autocorr	0.164	0.463	0.108	0.214
	2nd autocorr	0.452	0.638	0.927	0.863
3 Food, beverages and tobacco	**Coefficient**	**0.270**	**0.290**	**1.047**[4]	**0.987**[4]
	Wald j-sign	0.000	0.000	0.235	0.653
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.193**	**0.022**	**0.595**	**0.090**
	1st autocorr	0.000	0.000	0.001	0.002
	2nd autocorr	0.847	0.756	0.227	0.094
4 Petroleum refinery and Nuclear fuel treatment	**Coefficient**		**0.095**	**-0.010**[4]	
	Wald j-sign		0.003	0.755	
	Wald j-s.dum				
	Sargan test		**0.186**	**1.000**	
	1st autocorr		0.001	0.109	
	2nd autocorr		0.884	0.740	
5 Chemical industry	**Coefficient**	**0.350**	**0.280**	**1.212**[1]	**1.199**[1]
	Wald j-sign	0.000	0.000	0.006	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.585**	**0.447**	**0.379**	**0.460**
	1st autocorr	0.000	0.000	0.000	0.000
	2nd autocorr	0.135	0.138	0.125	0.182
6 Other non metallic mineral Product industries	**Coefficient**	**0.542**	**0.573**	**1.352**[1]	**1.653**[1]
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.784**	**0.285**	**0.489**	**0.173**
	1st autocorr	0.249	0.285	0.067	0.059
	2nd autocorr	0.059	0.097	0.174	0.153

26 sectors breakdown		DHP GMM	DHP IV	HALL GMM	HALL IV
7 Metallurgy and metallic Products	**Coefficient**	**0.289**	**0.233**	**1.170[1]**	**1.090[1]**
	Wald j-sign	0.000	0.000	0.001	0.010
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.937**	**0.584**	**0.232**	**0.257**
	1st autocorr	0.000	0.000	0.000	0.000
	2nd autocorr	0.738	0.790	0.298	0.209
8 Mechanical equipment and machinery	**Coefficient**	**0.312**	**0.302**	**1.078[3]**	**1.123[1]**
	Wald j-sign	0.000	0.000	0.079	0.003
	Wald j-s.dum	0.373		0.001	
	Sargan test	**0.536**	**0.635**	**0.285**	**0.375**
	1st autocorr	0.000	0.000	0.000	0.000
	2nd autocorr	0.065	0.074	0.029	0.056
9 Electrical, electronic and Optical material and Equipment	**Coefficient**	**0.382**	**0.249**	**1.159[1]**	**1.186[1]**
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.111**	**0.134**	**0.179**	**0.112**
	1st autocorr	0.025	0.004	0.001	0.000
	2nd autocorr	0.875	0.716	0.894	0.848
10 Transport material	**Coefficient**	**0.284**	**0.326**	**1.123[1]**	**1.256[1]**
	Wald j-sign	0.000	0.000	0.010	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.817**	**0.522**	**0.372**	**0.383**
	1st autocorr	0.000	0.001	0.000	0.000
	2nd autocorr	0.580	0.478	0.819	0.572
11 Textile industries	**Coefficient**	**0.355**	**0.340**	**1.000[4]**	**1.013[4]**
	Wald j-sign	0.000	0.000	0.996	0.783
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.151**	**0.084**	**0.844**	**0.866**
	1st autocorr	0.001	0.001	0.051	0.039
	2nd autocorr	0.115	0.103	0.061	0.067
12 Leather and shoe industry	**Coefficient**	**0.128**	**0.170**	**-0.042[4]**	**-0.055[1]**
	Wald j-sign	0.000	0.000	0.171	0.004
	Wald j-s.dum	0.003		0.000	
	Sargan test	**0.455**	**0.764**	**0.625**	**0.843**
	1st autocorr	0.000	0.000	0.001	0.002
	2nd autocorr	0.963	0.983	0.393	0.458

26 sectors breakdown		DHP GMM	DHP IV	HALL GMM	HALL IV
13 Wood and cork industries	**Coefficient**	**0.278**	**0.299**	**1.158**[1]	**1.204**[1]
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.335**	**0.746**	**0.202**	**0.160**
	1st autocorr	0.000	0.000	0.000	0.000
	2nd autocorr	0.978	0.987	0.364	0.357
14 Paper industry	**Coefficient**	**0.499**	**0.423**	**1.245**[1]	**1.107**[2]
	Wald j-sign	0.000	0.000	0.000	0.024
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.592**	**0.059**	**0.058**	**0.032**
	1st autocorr	0.023	0.003	0.000	0.000
	2nd autocorr	0.081	0.125	0.685	0.725
15 Rubber and plastic Products	**Coefficient**	**0.244**	**0.239**	**1.121**[1]	**1.102**[1]
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.001		0.000	
	Sargan test	**0.707**	**0.437**	**0.122**	**0.085**
	1st autocorr	0.052	0.064	0.042	0.052
	2nd autocorr	0.496	0.531	0.442	0.470
16 Other manufacturing Industries	**Coefficient**	**0.282**	**0.269**	**0.190**[1]	**0.194**[1]
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.292**	**0.199**	**0.465**	**0.241**
	1st autocorr	0.000	0.000	0.000	0.000
	2nd autocorr	0.955	0.992	0.687	0.905
17 Electric power, gas and Water production and Distribution	**Coefficient**	**0.445**	**0.462**	**1.395**[1]	**1.543**[1]
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.376**	**0.368**	**0.553**	**0.281**
	1st autocorr	0.099	0.074	0.030	0.027
	2nd autocorr	0.595	0.573	0.423	0.455
18 Water purification and Distribution	**Coefficient**	**0.432**	**0.414**	**1.581**[1]	**1.745**[1]
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.953**	**0.473**	**0.973**	**0.435**
	1st autocorr	0.035	0.027	0.009	0.010
	2nd autocorr	0.146	0.154	0.063	0.186

26 sectors breakdown		DHP GMM	DHPIV	HALL GMM	HALL IV
19 Building industries	**Coefficient**	**0.458**	0.381	**0.990[4]**	**0.913[4]**
	Wald j-sign	0.000	0.000	0.898	0.192
	Wald j-s.dum	0.000		0.000	
	Sargan test	0.990	0.532	**0.644**	**0.344**
	1st autocorr	0.000	0.000	0.120	0.142
	2nd autocorr	0.023	0.024	0.045	0.195
20 Rental, repairs, Wholesale, and retail trade	**Coefficient**	**0.369**	**0.346**	**1.198[1]**	**1.137[3]**
	Wald j-sign	0.000	0.000	0.009	0.063
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.066**	0.000	**0.079**	**0.000**
	1st autocorr	0.000	0.000	0.000	0.000
	2nd autocorr	0.000	0.000	0.000	0.000
21 Transport, storage and Communications	**Coefficient**	**0.619**	**0.653**	**1.282[1]**	**1.299[1]**
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.205**	**0.123**	**0.376**	**0.372**
	1st autocorr	0.259	0.291	0.195	0.221
	2nd autocorr	0.890	0.989	0.305	0.251
22 Agriculture, livestock Farming, and hunting	**Coefficient**		**0.404**	**1.151[1]**	**1.215[1]**
	Wald j-sign		0.000	0.007	0.000
	Wald j-s.dum			0.000	
	Sargan test		0.503	**0.872**	**0.604**
	1st autocorr		0.031	0.049	0.103
	2nd autocorr		0.078	0.061	0.060

26 sectors breakdown		DHP GMM	DHPIV	HALL GMM	HALL IV
23 Fishing	**Coefficient**	**0.270**			
	Wald j-sign	0.000			
	Wald j-s.dum	0.000			
	Sargan test	**0.883**			
	1st autocorr	0.028			
	2nd autocorr	0.093			
24 Real estate and other Business services	**Coefficient**	**0.444**	**0.453**	**0.574[1]**	**0.558[1]**
	Wald j-sign	0.000	0.000	0.000	0.000
	Wald j-s.dum	0.000			0.000
	Sargan test	**0.579**	**0.551**	**0.568**	**0.373**
	1st autocorr	0.116	0.108	0.059	0.065
	2nd autocorr	0.282	0.403	0.394	0.496
26 Other services	**Coefficient**	**0.769**	**0.566**	**1.416[1]**	**1.415[1]**
	Wald j-sign	0.000	0.000	0.005	0.000
	Wald j-s.dum	0.000		0.000	
	Sargan test	**0.330**	**0.579**	**0.608**	**0.441**
	1st autocorr	0.023	0.335	0.410	0.198
	2nd autocorr	0.040	0.521	0.066	0.388

[1] Indicates significance at the 1% confidence level.
[3] Indicates significant at 10% confidence level.
[2] Indicates significance at the 5% confidence level.
[4] Indicates non significant.
When no superscript appears, the coefficient is significant at more than the 0.1% level.
"Hall" coefficients in the table are $\mu=p/c$ (we added 1 to the estimated coefficients, μ-1).
The significance levels refer to the original estimates, μ-1 (i.e. indicate if the estimated coefficient is significantly different from zero).
DHP coefficients in the table are (p-c)/p. For the GMM estimates, all of them are different from zero at the 0.1% or less significance level.

Table 6: Correlations between estimates of pure profit estimates

	BS	HALL	DHP	PCM
BS	1.000 1.000 28	0.973 0.874 12	0.949 0.927 21	0.444 0.311 28
HALL		1.000 1.000 18	0.987 0.996 18	0.484 0.337 18
DHP			1.000 1.000 39	0.498 0.348 39

The first entry in each cell reports the simple correlation while the second entry pertains to the rank correlation.
The third entry indicates the number of sectors for which the different methodologies yielded significant results.

WORKING PAPERS (1)

9708 **Jeffrey Franks:** Labor market policies and unemployment dynamics in Spain.

9709 **José Ramón Martinez Resano:** Los mercados de derivados y el euro.

9710 **Juan Ayuso and J. David López-Salido:** Are *ex-post* real interest rates a good proxy for *ex-ante* real rates? An international comparison within a CCAPM framework.

9711 **Ana Buisán y Míguel Pérez:** Un indicador de gasto en construcción para la economía española.

9712 **Juan J. Dolado, J. David López-Salido and Juan Luis Vega:** Spanish unemployment and inflation persistence: Are there phillips trade-offs?

9713 **José M. González Mínguez:** The balance-sheet transmission channel of monetary policy: The cases of Germany and Spain.

9714 **Olympia Bover:** Cambios en la composición del empleo y actividad laboral femenina.

9715 **Francisco de Castro and Alfonso Novales:** The joint dynamics of spot and forward exchange rates.

9716 **Juan Carlos Caballero, Jorge Martínez y M.ª Teresa Sastre:** La utilización de los índices de condiciones monetarias desde la perspectiva de un banco central.

9717 **José Viñals y Juan F. Jimeno:** El mercado de trabajo español y la Unión Económica y Monetaria Europea.

9718 **Samuel Bentolila:** La inmovilidad del trabajo en las regiones españolas.

9719 **Enrique Alberola, Juan Ayuso and J. David López-Salido:** When may peseta depreciations fuel inflation?

9720 **José M. González Mínguez:** The back calculation of nominal historical series after the introduction of the european currency (An application to the GDP).

9721 **Una-Louise Bell:** A Comparative Analysis of the Aggregate Matching Process in France, Great Britain and Spain.

9722 **Francisco Alonso Sánchez, Juan Ayuso Huertas y Jorge Martínez Pagés:** El poder predictivo de los tipos de interés sobre la tasa de inflación española.

9723 **Isabel Argimón, Concha Artola y José Manuel González-Páramo:** Empresa pública y empresa privada: titularidad y eficiencia relativa.

9724 **Enrique Alberola and Pierfederico Asdrubali:** How do countries smooth regional disturbances? Risksharing in Spain: 1973-1993.

9725 **Enrique Alberola, José Manuel Marqués and Alicia Sanchís:** Unemployment persistence, Central Bank independence and inflation performance in the OECD countries. (The Spanish original of this publication has the same number.)

9726 **Francisco Alonso, Juan Ayuso and Jorge Martinez Pagés:** How informative are financial asset prices in Spain?

9727 **Javier Andrés, Ricardo Mestre and Javier Vallés:** Monetary policy and exchange rate dynamics in the Spanish economy.

9728 **Juan J. Dolado, José M. González-Páramo y José Viñals:** A cost-benefit analysis of going from low inflation to price stability in Spain.

9801 **Ángel Estrada, Pilar García Perea, Alberto Urtasun y Jesús Briones:** Indicadores de precios, costes y márgenes en las diversas ramas productivas.

9802 **Pilar Álvarez Canal:** Evolución de la banca extranjera en el período 1992-1996.

9803 **Ángel Estrada y Alberto Urtasun:** Cuantificación de expectativas a partir de las encuestas de opinión.

9804 **Soyoung Kim:** Monetary Policy Rules and Business Cycles.

9805 **Víctor Gómez and Agustín Maravall:** Guide for using the programs TRAMO and SEATS.

9806 **Javier Andrés, Ignacio Hernando and J. David López-Salido:** Disinflation, output and unemployment: the case of Spain.

9807 **Olympia Bover, Pilar García-Perea and Pedro Portugal:** A comparative study of the Portuguese and Spanish labour markets.

9808 **Víctor Gómez and Agustín Maravall:** Automatic modeling methods for univariate series.

9809 **Víctor Gómez and Agustín Maravall:** Seasonal adjustment and signal extraction in economic time series.

9810 **Pablo Hernández de Cos e Ignacio Hernando:** El crédito comercial en las empresas manufactureras españolas.

9811 **Soyoung Kim:** Identifying European Monetary Policy Interactions: French and Spanish System with German Variables.

9812 **Juan Ayuso, Roberto Blanco y Alicia Sanchís:** Una clasificación por riesgo de los fondos de inversión españoles.

9813 **José Viñals:** The retreat of inflation and the making of monetary policy: where do we stand?

9814 **Juan Ayuso, Graciela L. Kaminsky and David López-Salido:** A switching-regime model for the Spanish inflation: 1962-1997.

9815 **Roberto Blanco:** Transmisión de información y volatilidad entre el mercado de futuros sobre el índice Ibex 35 y el mercado al contado.

9816 **M.ª Cruz Manzano and Isabel Sánchez:** Indicators of short-term interest rate expectations. The information contained in the options market. (The Spanish original of this publication has the same number.)

9817 **Alberto Cabrero, José Luis Escrivá, Emilio Muñoz and Juan Peñalosa:** The controllability of a monetary aggregate in EMU.

9818 **José M. González Mínguez y Javier Santillán Fraile:** El papel del euro en el Sistema Monetario Internacional.

9819 **Eva Ortega:** The Spanish business cycle and its relationship to Europe.

9820 **Eva Ortega:** Comparing Evaluation Methodologies for Stochastic Dynamic General Equilibrium Models.

9821 **Eva Ortega:** Assessing the fit of simulated multivariate dynamic models.

9822 **Coral García y Esther Gordo:** Funciones trimestrales de exportación e importación para la economía española.

9823 **Enrique Alberola-Ila and Timo Tyrväinen:** Is there scope for inflation differentials in EMU? An empirical evaluation of the Balassa-Samuelson model in EMU countries.

9824 **Concha Artola e Isabel Argimón:** Titularidad y eficiencia relativa en las manufacturas españolas.

9825 **Javier Andrés, Ignacio Hernando and J. David López-Salido:** The long-run effect of permanent disinflations.

9901 **José Ramón Martínez Resano:** Instrumentos derivados de los tipos *Overnight: call money swaps* y futuros sobre fondos federales.

9902 **J. Andrés, J. D. López-Salido and J. Vallés:** The liquidity effect in a small open economy model.

9903 **Olympia Bover and Ramón Gómez:** Another look at unemployment duration: long-term unemployment and exit to a permanent job. (The Spanish original of this publication has the same number.)

9904 **Ignacio Hernando y Josep A. Tribó:** Relación entre contratos laborales y financieros: Un estudio teórico para el caso español.

9905 **Cristina Mazón and Soledad Núñez:** On the optimality of treasury bond auctions: the Spanish case.

9906 **Nadine Watson:** Bank Lending Channel Evidence at the Firm Level.

9907 **José Viñals:** El marco general de la política monetaria única: racionalidad, consecuencias y cuestiones pendientes.

9908 **Olympia Bover and Manuel Arellano:** Learning about migration decisions from the migrants: an exercise in endogenous samplig and complementary datasets.

9909 **Olympia Bover and Pilar Velilla:** Migrations in Spain: Historical background and current trends.

9910 **Fernando Restoy:** Los mercados financieros españoles ante la Unión Monetaria.

9911 **Luis J. Álvarez and M.ª de los Llanos Matea:** Underlying inflation measures in Spain.

9912 **Regina Kaiser and Agustín Maravall:** Estimation of the business cycle: a modified Hodrick-Prescott filter.

9913 **Enrique Alberola and José Manuel Marqués:** On the relevance and nature of regional inflation differentials: The case of Spain.

9914 **Agustín Maravall:** An application of TRAMO and SEATS. Report for the «Seasonal Adjustment Research Appraisal» project.

9915 **Regina Kaiser and Agustín Maravall:** Seasonal outliers in time series.

9916 **Enrique Alberola and Humberto López:** Internal and external exchange rate equilibrium in a cointegration framework. An application to the Spanish Peseta.

9917 **José Viñals and Javier Vallés:** On the real effects of monetary policy.

9918 **Regina Kaiser and Agustín Maravall:** Short-term and long-term trends, seasonal adjustment, and the business cycle.

9919 **J. Andrés, J. D. López-Salido and J. Vallés:** Intertemporal substitution and the liquidity effect in a sticky price model.

9920 **J. Andrés, I. Hernando and J. D. López-Salido:** The role of the financial system in the growth-inflation link: The OECD experience.

9921 **Ángel Estrada and Ignacio Hernando:** Microeconomic price adjustments and inflation: Evidence from Spanish sectoral data.

9922 **Concha Artola and Una-Louise Bell:** Identifying Labour Market Dynamics using Labour Force Survey Data.

---

(1) Previously published Working Papers are listed in the Banco de España publications catalogue.

Queries should be addressed to: Banco de España
Sección de Publicaciones. Negociado de Distribución y Gestión
Telephone: 91 338 5180
Alcalá, 50. 28014 Madrid