

Deregulation and Productivity: A Dissection of the Impact of Domestic and European Regulations on Productivity of the Spanish Banking Industry

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Abstract

This paper deals with measuring TFP growth of firms using a framework in which effects of different types of deregulation are taken into account. Distinguishing features of the models are: (i) Decomposition of TFP change into external, scale, and markup (in output prices) components; (ii) Inclusion of the TFP change equation to the cost system (that includes the cost function and the cost share equations) for estimating the model; and (iii) dissection of external components into deregulation and technical change components. Deregulation component is further decomposed into domestic and European regulations. We use the Spanish banking industry as a case primarily because the Spanish banking sector went through rapid regulatory changes in recent years. Most of the changes in TFP growth for savings banks are found to be due to deregulatory measures at the domestic level (i.e., deregulation in interest rate and fees, credit control and branching limitations). On the otherhand, the European deregulatory measures had a larger effect on the performance of the commercial banks. Abolition of capital control and the introduction of a single market program were instrumental in enhancing TFP growth of commercial banks.

JEL: D24, D40, G21

Keywords: Total factor productivity, markup, deregulation, technical change.

1. Introduction

During the end of the 1970s and beginning of the 1980s, the developed countries experienced important productivity fluctuations and slowdown of economic activity.¹ Since the end of the 1980s the literature on productivity growth focused more on the analysis of the factors affecting productivity growth instead of the analysis of productivity growth per se. Past analyses of productivity growth measurement were often based on models that incorporated restrictive assumptions (constant return to scale, perfect competition and instantaneous adjustment of inputs). In contrast, the recent literature uses new models of productivity growth measurement from which it is able to obtain a more precise measure of the productivity growth residual. For instance, the importance of returns to scale on the cost side was included into the analysis by Ohta (1975), Morrison (1986) and Fuss and Waverman (1986) among others. Berndt and Fuss (1986), Hulten (1986), Morrison (1986) and Nadiri and Purcha (1990, 1996, 2000) have oriented their research to the analysis of the sub-equilibrium derivate of quasi-fixed inputs, for competitive firms. Morrison (1992) extends such analysis to the case of monopolistic firms. The impact of non-competitive behavior on the Solow residual has been the focus of a number of papers (Denny, Fuss and Waverman, 1981; Hall, 1988; Shapiro, 1987; and Morrison and Diewert, 1990).

In recent years important structural changes took place around the world as a result of the globalization of markets, the creation of economic blocks, etc. Because of these changes many sectors of the industrialized countries have gone through strong deregulation processes to accommodate to new environments. Although changes in the regulation adopted by many sectors of industrialized countries in the last few years have affected the cost-output relation of the firms and their productive performances, such effects have not been taken into account in the measurement of productivity growth. The standard microeconomic theory tells us that the presence of any binding constraints (due to regulation or otherwise) in the allocation of resources increases the cost of producing a given level of outputs or services. This is because the presence of constraints leads to inefficient (non-optimal) allocation of inputs that increases costs. Conversely, when an industry encounters slack in regulations (or is deregulated), it is expected to generate some cost savings (given the level of outputs), which might be

¹ See the Journal of Economic Perspectives (1988) for a detailed treatment.

reflected by higher productivity growth. Thus increased competition and productivity gain seem to be the two motivating forces behind deregulation. This is because from a theoretical point of view there are reasons to believe that increased competition, promoted via deregulation, will increase the productivity of the firms.²

Since deregulation is exogenous to the firm, which has effects over its productivity change, it is necessary to adjust the productivity growth residual to accommodate effects of such external factors. The effect of exogenous factors is therefore crucial for explaining the cost-output relationship and thus productivity growth. Following Morrison and Siegel (1999), it is possible to control for external factors, including a trend in the cost function, in order to accommodate disembodied technical change. However, the determinants of the shift in the cost function can be formulated more explicitly by identifying the reasons of the shift. Inclusion of the effect of these external factors on the productivity change will allow us to examine whether competition promotes productivity growth. Thus the main goal of the present paper is to link deregulation with performance of firms using a unified approach in which effects of different types of deregulation are accounted for. We use a dual cost function approach and estimate TFP change which is then decomposed into external factors (deregulation and technical change), scale, and markup (in output prices) components. Since decomposition of the parametric TFP growth is based on the definition of the Divisia index of productivity growth, the Divisia index, in theory, should be equal to the sum of these three components.³ But in practice a wide gap between the two measures is often observed. We use an empirical model for productivity growth measurement that avoids the discrepancy found in the literature between the nonparametric (the Divisia) and the parametric measures (irrespective of the functional form chosen to represent the production technology) of TFP change.

Our empirical application is focused on the Spanish banks (both savings and commercial), mainly because in recent years the Spanish banks have gone through rapid changes following a series of deregulation measures targeted at either savings banks, commercial banks, or both. We accommodate effects of different types of regulation on productivity change by allowing the production technology to change with changes in

² In a recent empirical study based approximately on 670 companies of the UK, Nickell (1996) found that a competitive environment resulting from deregulation provides incentives for growth and productivity of the firms.

³ Hulten (2000) points out that the non-parametric approach of productivity measurement (Divisia index) have to be used jointly with the parametric approach in productivity analysis in order to check the consistency of the results.

regulation. Although we use the Spanish banking data the present exercise is not limited to the Spanish banking industry.

The rest of the paper is organized as follows. Measurement and decomposition of the productivity change is introduced in section 2. Section 3 describes the methodology and the empirical model. The data for the empirical application and a briefly overview of the recent initiatives in the Spanish banking industry are described in Section 4. Empirical results are presented in Section 5. The final section contains a summary of our findings and conclusions.

2. Measuring and decomposing productivity change

The word productivity in economics is used quite broadly. Here we use TFP as the appropriate measure of productivity. In a single output case TFP growth/change

(\dot{TFP}) is formally defined as $\dot{TFP} = \dot{Y} - \sum_j S_j \dot{X}_j$, where Y is output, X_j is input ($j = 1, \dots, J$), S_j is the share of input X_j in the total cost (i.e., $S_j = w_j X_j / \sum_j w_j X_j$) -- w_j being the price of input X_j , and a dot over a variable indicates its rate of change. If there are multiple outputs the TFP growth formula is expressed as $\dot{TFP} = \sum_l R_l \dot{Y}_l - \sum_j S_j \dot{X}_j$

where $R_l = p_l y_l / \sum_l p_l y_l$ -- p_l being the price of output y_l ($l = 1, \dots, L$). Using the above definitions \dot{TFP} can be computed from the observed data. The resulting measure of \dot{TFP} is called the Divisia index of TFP growth/change, and gives us information about output growth that is unexplained by the growth of the inputs used.

In this paper we use a dual cost function approach to decompose and estimate TFP change⁴. The choice of the dual approach (cost function) presents advantages over the primal approach (production function) as well as the profit function in productivity growth analysis. First, some firms possess multi-output technology, and a cost function can handle multiple outputs quite easily. In contrast, a single equation multiple output production function cannot be estimated econometrically using the input and output data. Second, a cost function can be estimated without imposing any restriction on the

above definitions \dot{TFP} can be computed from the observed data. The resulting measure of \dot{TFP} is called the Divisia index of TFP growth/change, and gives us information about output growth that is unexplained by the growth of the inputs used.

⁴ Some of the earlier works can be found in the Cowing and Stevenson (1981) edited volume "Productivity Measurement in Regulated Industries". For some recent studies see, for example, Atkinson and Halverson (1984), Baltagi and Griffin (1988), Kumbhakar (1992), Bhattacharyya et al. (1997), among others.

implied returns to scale. This is not possible in a profit function (for which returns to scale have to be less than unity). Third, it is not necessary to assume that output markets are competitive. The cost function parameters can be consistently estimated even if output markets are non-competitive. It is also possible to derive a component of TFP change attributable to non-competitive market output (divergence of output price from marginal cost).

The traditional framework for productivity growth measurement using the dual approach assumes that firms face a cost function $C=C(y, w, t)$, where y is an output vector produced with J inputs and corresponding prices w , and t denotes technology (measured by a time counter). Assuming instantaneous adjustment, constant returns to scale and perfect competition, the residual reflect technical change (Solow, 1958). And technical change $(\frac{\partial \ln C}{\partial t})$ is identical to TFP change. However, aside from technical change, there are other factors that can be used in explaining productivity growth. First of all, the residual can be classified in terms of technological and conduct factors of the firm. Technological factors include technical change, scale economies, and the productive capacity of the firm. On the other hand, conduct factors include the behaviour hypothesis of the firm and the market structure where the firm is operating. If we observe these factors we can distinguish between internal and external factors. Internal factors to the firm are returns to scale, productive capacity, and the behaviour hypothesis. External factors are technological change and market structure⁵.

If the objective of producers is to minimize cost (given outputs) given that input markets are competitive and the constant returns to scale and perfect competition in the output market assumptions are relaxed, then, using the above definition of TFP growth (Divisia index) it is possible (Denny et al., 1981) to establish a relationship between the Divisia index (which gives information about productivity growth) and the dual cost function approach (which allows the decomposition of TFP growth) as follows:

$$TFP = TC + (1 - RTS^{-1})\dot{Y}_C + (\dot{Y}_P - \dot{Y}_C) \equiv TC + Scale + Markup, \quad (1)$$

where $\dot{Y}_C = \sum_l \left[\varepsilon_{cy_l} / \sum_l \varepsilon_{cy_l} \right] \dot{y}_l$, $\dot{Y}_P = \sum_l \frac{p_l y_l}{R} \dot{y}_l$, and $\varepsilon_{cy_l} = \partial \ln C / \partial \ln y_l$. Similarly,

technical change (TC) and returns to scale (RTS) in (1) can be obtained from a

⁵ Another external factor to the firms could be the environment where the firm takes up its activities. This type of external factor is considered at length later in the paper.

parametric cost function ($C = C(y, w, t)$) using the following definitions, viz., $TC = -\partial \ln C / \partial t$ and $RTS^{-1} = \sum_l \partial \ln C / \partial \ln y_l$. Thus the first component of TFP growth is TC and the second component is *Scale* (being related to RTS), which is zero if RTS is unity. The last component is non-zero if output markets are non-competitive. That is, if output prices depart from their respective marginal costs, $\dot{Y}_P \neq \dot{Y}_C$ then at least one of the output markets is non-competitive. The Denny et al. (1981) decomposition of TFP growth takes into account the effect of the external technical and conduct factors (technological change and markup) as well as the internal technical factor (scale economies) on productivity growth measurement.

However, some the factors explaining productivity growth are external factors that define the environment where firms operate. The firms operate in an environment, which affects their production process. This type of factor has been taken into account in the endogenous growth literature. However, this factor has been ignored from a theoretical and empirical point of view in the traditional literature of productivity growth analysis. Morrison (1986) and Morrison and Siegel (1999) are the first to include this kind of factors in the productivity growth analysis. These authors point out that such external factors can be explicitly represented in the models of production theory as shift variables that affect the cost-output relationship. The importance of the external factors used by these authors is that such factors are controlled by an outside authority, and depend of the economic policy. The fact that factors such as the environment where the firms operate can affect the cost-output relationship of the firms promoted the regulatory authorities to undertake numerous changes in the light of globalisation of markets, creation of economic blocks, etc. For example, deregulation decisions were initiated based on the assumption that increased competition, promoted by deregulatory changes, will reduce the profit margin while at the same time decrease the production inefficiency and increase innovation. All these changes are expected to increase the productivity of the firms, at least in the long run.⁶ To investigate this empirically, we accommodated different types of deregulatory changes into our model. These are allowed to affects the cost-output relationship in a quite flexible manner.

⁶ Winston (1993) and Vickers (1995) point out the caveat that exists in the literature in research oriented to analyse the relationship between an increase in competition promoted by deregulatory changes and the productivity of the firms.

Resorting to the traditional framework of TFP growth measurement, the minimum cost function will be $C = C(y, w, T)$, where y is an output vector produced with J inputs (x) prices of which are denoted by the w vector. We will assume that T denotes technology and it incorporates time trend, t , and other external factors which will be identified by deregulatory changes, z . So, we assume that the exogenous factors that shift the production technology will be $T = T(t, z)$. From a theoretical point of view, the external factors (technological change and deregulatory changes) can not be distinguished since both of them are affecting the technology in the same way (shifts in the production technology). It can be shown (Kumbhakar and Lozano-Vivas (2002)), that the decomposition of TFP growth into scale economies, markup and external factors will have the same expression as in equation 1, the only difference is that the shift of the cost function is now due to two kinds of external factors (time trend and deregulatory changes over time), viz.,

$$\dot{TFP} = EF + (1 - RTS^{-1})\dot{Y}_C + (\dot{Y}_P - \dot{Y}_C) \equiv EF + Scale + Markup, \quad (2)$$

where EF is the component due to the external factors, i.e., $EF = -[TC_t + TC_z]$.

Since decomposition of the parametric TFP growth is based on the definition of the Divisia index of productivity growth, the Divisia index, in theory, should be equal to the sum of these three components. It is important to note here that if one is interested only in TFP growth then it is not necessary to estimate the cost function econometrically. One can simply compute it from the data using a discrete approximation of the formula. However, if the interest is to decompose it into EF , scale and markup components then it is necessary to estimate the cost function econometrically. This is because estimation of RTS is necessary to measure the scale component (unless $RTS = 1$), and estimates of output elasticities are required to compute mark-ups in each market.

3. Methodology

In parametric models, TFP growth components (EF , scale and markups) can be computed using the estimated parameters of the parametric model and observed data. The sum of these components (the estimated TFP growth components that appear on the right hand side of equations (1) and (2)), quite often, diverges from the observed TFP growth (the Divisia index that appears on the left hand side of equation (1)) obtained

independently from the data. In theory, however, the Divisia index should, be equal to the sum of these three components, irrespective of the functional form chosen to represent the production technology.⁷ This is because the parametric TFP growth decomposition is based on the definition of the Divisia index of productivity growth. However, in practice a wide gap between the two measures is often observed (Capalbo, 1988 and Hulten, 2000). This gap cannot be solely explained in terms of the difference between the true and estimated parameters. The choice of functional form should not be guided by how close the estimated TFP growth rates are to those generated by the Divisia index. The two sides of the equation should match for any functional form. It is also our contention to define an empirical model for TFP growth measurement that avoids the discrepancy found in the literature between the nonparametric (the Divisia) and the parametric measures of TFP change; irrespective of the functional form chosen to represent the production technology. Perhaps the best way to avoid this divergence problem is to use the definition of the TFP growth formula as an additional equation in the econometric model. In this paper we use the TFP growth equation together with the cost system (the cost function and the cost share equations), and estimate them jointly.

3.1. The econometric model

We use a multi-product translog cost function⁸ to represent the underlying technology, which is specified as

$$\begin{aligned}
\ln C = & \alpha + \sum_{j=1}^J \beta_j \ln w_j + \sum_{l=1}^L \gamma_l \ln y_l + 0.5 \left(\sum_{j=1}^J \sum_{k=1}^J \beta_{jk} \ln w_j \ln w_k + \sum_{l=1}^L \sum_{m=1}^L \gamma_{lm} \ln y_l \ln y_m \right) \\
& + \sum_{j=1}^J \sum_{m=1}^L \zeta_{jm} \ln w_j \ln y_m + \sum_{r=1}^R \mu_r z_r + \sum_{j=1}^J \sum_{r=1}^R \beta_{rj} z_r \ln w_j + \sum_{l=1}^L \sum_{r=1}^R \beta_{rl} z_r \ln y_l \\
& + \beta_t t + 0.5 \beta_{tt} t^2 + \sum_{j=1}^J \theta_j t \ln w_j + \sum_{l=1}^L \lambda_l t \ln y_l \tag{3}
\end{aligned}$$

where w and y are input prices and outputs. Although t and z variables are related to time, it is possible to identify their effects on cost so long as the z variables are not a

⁷ TFP growth is often decomposed into two other components associated with technical and allocative inefficiencies (Kumbhakar, 2000). Again, since TFP growth remains the same the sum of the components (no matter how many components there are) should be identical to TFP growth.

⁸ Diewert (1976) shows that the implicit functional form of the Divisia/Tornqvist-Theil index is the translog.

linear function of the time trend variable. Here the z variables are the regulation dummies variables defined as⁹

$$z_s = \begin{cases} 0 & \text{before a particular deregulation measure (s) is adopted} \\ 1 & \text{thereafter} \end{cases}$$

for $s = 1, 2, \dots, S$ (S being the number of quantifiable deregulatory measures). We accommodate effects of different types of regulation on productivity by allowing the production technology to change with regulatory changes.

Since the cost function is homogeneous of degree one in input prices, we impose homogeneity restrictions by dividing all the prices and total variable cost by the price of one input. The cost share functions, obtained from Shephard's lemma, are

$$S_j = \beta_j + \sum_{k=1}^J \beta_{jk} \ln w_k + \sum_{l=1}^L \gamma_{jl} \ln y_l + \sum_{r=1}^R \beta_{rj} z_r + \theta_j t, \quad j = 1, \dots, J. \quad (4)$$

Finally using (3) explicit forms of EF, RTS , \dot{Y}_P and ε_{cy_l} can be obtained using the following definitions, viz.,

$$EF = - \left[\partial \ln C / \partial t + \sum_{s=1}^S (\ln C_t | z_{s,t+1} - \ln C_t | z_{s,t}) \right], \quad RTS^{-1} = \sum_l \varepsilon_{cy_l},$$

$$\dot{Y}_C = \sum_l \left[\varepsilon_{cy_l} / \sum_l \varepsilon_{cy_l} \right] \dot{y}_l, \quad \text{and} \quad \varepsilon_{cy_l} = \partial \ln C / \partial \ln y_l.$$

These expressions can then be used in the TFP growth formula (see equation (2)), to obtain

$$\dot{TFP} = EF + (1 - RTS^{-1}) \dot{Y}_C + (\dot{Y}_P - \dot{Y}_C) \quad (5)$$

in which the components appearing on the right hand side are expressed in terms of observed data and unknown parameters. Thus, the TFP growth equation in (5) can be used as an additional equation in the translog cost system usually defined by the cost function and (J-1) cost share equations. There are at least two advantages associated with the inclusion of the TFP growth equation. First, inclusion of the TFP growth equation does not increase the number of parameters to be estimated. Therefore, from

⁹ Block et al. (1980), Ariga et al. (1999), Gual (1999) and Bottasso et al. (2001) employ a similar approach to test the deterrent effect of prosecutions for price fixing by the department of Justice; the impact on estimated markups due to regulatory measures taken by the Fair Trade Commission against the Japanese government; the joint effect of deregulation and market integration on the structure of European banking markets; and the impact the European market program on market power and total factor productivity on a large sample of Italian firms, respectively.

an econometric point of view, parameter estimates are likely to be more efficient. Second, the sum of the TFP growth components estimated from a parametric model often diverges from the Divisia index (the observed TFP growth appearing on the left hand side of equation (4)). Use of (5) as an additional equation in estimating the parameters of the model forces the two sides of the equation to be equal (except for the error term which is assumed to have a zero mean). This means that the observed TFP growth does not deviate systematically from the sum of TFP growth components.

For estimation we append a random error term to each of these equations. To capture heterogeneity of banks associated with management, size, etc., the error term in the cost function is allowed to have a bank-specific component and a random component (independently and identically distributed across banks and over time). Given that we have the entire population of banks, we assume the bank-specific components to be fixed parameters as far as estimation is concerned. Since the cost shares are ratios, bank-specific effects are likely to be cancelled out. Due to this fact the random error terms associated with the cost share equations do not include bank-specific effects. Since the cost shares add up to unity, one of the share equations has to be dropped to avoid the singularity problem. The random error terms in equations (2)-(4) are allowed to be freely correlated, but are assumed to be independent over time and across banks. We used non-linear iterative seemingly unrelated regression (NLITSUR) procedure to estimate the parameters of the system consisting of equations (2)-(5).

4. Empirical application to the Spanish Banking System

We apply the methodology proposed to decompose and estimate the TFP growth to the Spanish banking system (SBS). For the past two decades many sectors of the industrialized countries have gone through various structural changes to accommodate fluctuations in the world economy (for example, globalization of markets and finances, the creation of economic blocks, etc.). These changes have had a particularly strong effect on the banking industry. The banking sector has been subjected to various forms of deregulation designed to increase competition in the market place.

Conventional wisdom holds that the performance of financial sectors can be improved through deregulatory policies that increase bank competition in price, product, services, and territorial rivalry (Smith (1997)). Since the banks hold a vital position in modern economies, bank regulators often implement prudent regulatory measures in order to ensure stability of the banking system. Additionally, authorities in

most of the industrialized countries have implemented various deregulation measures to foster competition (reduce market power) in the banking industry. The SBS has been strongly deregulated over the last two decades, so it will be interesting to show the effects of such deregulation measures on the productivity growth of this industry.

4.1. Data

The data used in this study comes from the annual publication “Consejo Superior Bancario” and “Anuario de la Confederación de Cajas de Ahorros”, and it covers the period 1986-2000. There has been a marked reduction in the number of savings banks due to the fact that twenty-eight mergers and acquisitions that took place during the period of our study. Our final sample consists of an unbalanced panel of 67 commercial banks (consisting of 970 observations) and 92 savings banks (879 observations) observed. We treated the merged banks as new banks in our estimation using panel data techniques.

In the banking literature a considerable disagreement exists for the definition of inputs and outputs. We have adopted the intermediation (asset) approach in modeling bank production (Sealey and Lindley, 1977). Three variable inputs, viz., purchased funds and core deposits, labor, and variable physical capital are used. Expenditures on these inputs comprise almost all banking costs. The output variables include loans (home loans, other loans, and interbank loans)¹⁰ and securities. The last category is measured from gross total assets less loans and physical capital, so that all financial assets are considered to be outputs. Expenses of each input are divided by their respective quantities to obtain the prices for each input.

Following Berger et al. (1997) we specify equity as a quasi-fixed input because insolvency risk affects bank cost and profit. On the other hand a bank's capital level directly affects cost by providing an alternative to deposits as a funding source for loans.^{11 12}

¹⁰ A change in accounting practice in 1992 forced us to aggregate all loan categories -- home loans, other loans, and interbank loans -- into a single measure of loans, thus enabling us to extend the present study through 1995. Lozano-Vivas (1997) discusses the issues regarding aggregation of these three outputs.

¹¹ See Hughes et al. (1995) and Berger and Mester (1997) for a detailed discussion on the importance of the inclusion of financial capital.

¹² It is worth noting that our measure of inputs, outputs and quasi-fixed inputs contains almost 100% of the balance sheet of the banks. Recently, Lozano-Vivas and Humphrey (2002) found that many prior studies in the banking industry have overstated productivity growth. This bias is eliminated when all outputs and inputs are included in the analysis, ensuring that the balance sheet restriction is met.

The branch variable (number of branches) is treated as a technological condition of production (Mester, 1987). Lang and Welzel (1998) argued in favor of including this variable because the banks operate in markets with varying population densities. This is also true for Spain. Another reason for its inclusion is that the studies in the banking literature show that scale economies are very high when the number of branches is not included in the cost function.

Since our empirical exercise uses the Spanish banking industry data, we identified several deregulatory changes in the Spanish banking industry (these are outlined in the next subsection and their timings are reported in Table 1). One dummy variable is defined for each of these deregulatory measures. We did this exercise separately for the savings and commercial banks.

4.2 The Spanish Banking System: A Brief History of Deregulation

The SBS consists of commercial banks (which include both private and foreign banks), savings banks, and credit cooperatives. The private commercial banks and savings banks are the two main bank types, which account for roughly 95% of total banking assets.

The banking industry has recently experienced considerable deregulatory reforms. After a series of small steps undertaken in 1969, nationwide deregulation efforts were intensified during the mid 1980s. The primary reason for this rapid domestic liberalization process was to overcome the fear that banks in Spain would be at a competitive disadvantage after the removal of barriers to inter-country competition in financial services within the European Monetary Union (EMU). The Spanish banking industry, as a member of the EMU, is affected not only by deregulation measures at the national level, but also at the European level. Thus, banks in Spain enjoy the freedom of cross-border services, single bank licensing, home country control and mutual recognition, as well as the harmonization of banking regulations imposed by the European Commission to all the EMU member countries. In addition to all these deregulation measures, the SBS undertook prudent regulatory measures in order to ensure its stability. Consequently, the SBS went through: (i) National deregulation measures, (ii) European deregulation measures, and (iii) prudent regulation measures (see Table 1).

Table 1: Deregulatory measures

National deregulatory measures					
Structural regulation		Conduct regulation		Prudent regulation	
Entry of foreign banks	Interest rate and fees	Branching limitations	Reserve and investment requirements	Minimum capital requirements	Deposit insurance
1986/1994	1987	1985 (cb) 1989 (sb)	1990/1992	1989 1992 (ED)	1977 1995/1996 (ED)
European deregulatory measures					
Structural regulation		Conduct regulation	Prudent regulation		
Control on capital flows	First Banking Directive	Second Banking Directive	Harmonization of prudent regulation		
1992	1986/1987	1992/1994	1985/1993		

(cb): commercial banks; (sb): savings banks; (ED): European Directives.

4.2.1. National deregulation measures

National deregulation measures include elimination of controls on interest rates and commissions, limits on branch expansion, reserve and investment requirements, and entry barriers. The first three of these measures are called conduct regulation measures and they give banks competitive freedom. On the other hand, the elimination of entry barriers can be classified as a structural deregulation, which permits banks to extend the scope of their business activities.

The regulatory reforms taking place since the mid 1980s were: (i) relaxation of domestic institutions' entry barriers after 1986, (ii) deregulation of interest rates and commissions in 1987, (iii) removal of limits on branch expansion, in 1985 for commercial banks and 1989 for savings banks, and (iv) phasing out reserve and investment requirements from 1989-1992.¹³

Spanish authorities blocked the entry of foreign banks until 1978. Since then, entry of foreign banks has been allowed but restricted in terms of financing, inter-bank operations, and the number of branches they could open. The objective of this restriction was to minimize foreign bank participation in the retail market. Relaxation in

¹³ For details on these issues, see Caminal, Gual and Vives (1990), Vives (1991a, 1991b), Gual and Vives (1992), Canals (1997) and Hasan, Hunter and Lozano-Vivas (1999).

the entry of foreign financial institutions took place between 1986 and 1992. After that, the establishment and operations of foreign banks were liberalized in 1993. This, in effect, abolished the discriminatory power of the Spanish authorities over branch expansion and composition of assets and liabilities of the foreign banks (Gual and Vives, 1992).

Regarding interest rates, the Bank of Spain fixed the maximum rates that the banks could pay on deposits and receive on financial assets during the regulatory stage. In 1981 interest rates on assets (not subject to investment requirements) and liabilities were liberalized, but some other restrictive regulations remained. It was in 1987 that all interest rates and commissions were finally deregulated.

Branch expansion has been an important factor in the deregulatory process. While branching of commercial banks was freely allowed in 1985, restrictions on savings banks remained in effect until 1989. Prior to 1989, savings banks were not allowed to open branches in regions other than their own.¹⁴

The SBS has traditionally been heavily regulated in terms of reserve, capital, and investment requirements. Compared to the rest of the European countries, reserve requirements in Spain have been higher. However, the government recognized that a higher reserve requirement tended to reduce the competitive strength of Spanish banks and therefore, lowered the reserve requirement from 19% in 1986 to 2% in 1993. In addition, equal investment requirements for commercial and savings banks in 1985 were gradually phased out during the period from 1989-1992.¹⁵

Overall, in the past two decades, the Spanish banking industry has gone from a strongly regulated oligopolistic system to a new environment where the banks can compete through prices and quality of services, with very little regulatory or entry restriction on institutions and markets.

4.2.2. European deregulation measures

To achieve the goal of integration of the banking market, the European Commission introduced freedom of cross-border services, single bank licensing, home

¹⁴ It is worth noting that since savings banks do not possess own funds to buy and sell in the capital markets, they are not barred from acquiring commercial banks. The commercial banks, however, were barred from acquiring savings banks. This situation gives savings banks the opportunity to expand not only by opening more branches but also by buying commercial banks.

¹⁵ Previously, savings banks were forced to invest large amounts of their assets in public debts, which resulted not only in the loss of freedom in the allocation of their resources but also less profit given that the return on public debts were below the market rate.

country control and mutual recognition, as well as the harmonization of banking regulations. Those actions led to four deregulatory measures: (i) removal of control of capital flows, (ii) First Banking Directive, FBD, (iii) Second Banking Directive, SBD, and (iv) harmonization of prudent regulations.

The removal of controls on capital flows and the introduction of the FBD and SBD led to a change in banks' competitive strength. With the removal of controls on capital flows, implemented in 1992, competition from foreign suppliers in cross-border activities increased greatly. The FBD and SBD provided support for the Single Market Program in financial and banking services. Although the objective of the FBD was to establish the necessary conditions for a common market in banking, complete removal of barriers to trade was achieved only with the passage of the SBD. The implementation of the SBD established the principle of mutual recognition. According to this single passport principle, each member state must recognize regulations of any other state. On the other hand, the SBD incorporated a broad list of banking activities so that a banking institution authorized to conduct any of its 'listed activities' in its home country is also allowed to do the same in all members states. The FBD was implemented in Spain during 1987-88, and the SBD during 1992-94.

4.2.3. Prudent regulation measures

The harmonization of prudent regulation imposed by the European Commission established a lower bound on prudent requirements. At the national level, however, some European countries adopted their own prudent legislation in order to ensure that banks operate in a safe and sound manner. In the area of prudent regulation Spanish authorities imposed (i) minimum capital requirements and (ii) deposit insurance.

The harmonization of prudent regulation supports the First and Second Banking Directives, and its main goal was to harmonize basic prudent requirements. This measure includes legislation on solvency ratios, the definition of own funds, etc. This measure affected the cost of funds as well as the competitive position of banks. It was implemented in Spain from 1985-93.

Since 1989, Spain has regulated the solvency of financial intermediaries in accordance with the Basle Agreement. As of now the ratio of equity to assets in Spain is above the recommended level imposed by the new capital adequacy regulation rules of the European Union from 1992, and is one of the highest in the European countries. The solvency ratio requirement is still used as a regulatory measure. Both the savings and

commercial banks satisfy the solvency ratio, although the sources for raising the financial capital are different for them. While commercial banks have the opportunity to increase their financial capital using equity in capital markets, savings banks can only raise their own funds by accumulating earnings.¹⁶

Banking regulation and the establishment of such safety nets as deposit insurance have been justified on the basis of market failure. However, deposit insurance can lead to moral hazard and excessive risk-taking. For this reason, deregulators have focused on reforming deposit insurance, moving towards risk-based systems and limiting coverage.¹⁷ Moreover, in order to maintain solvency of the banking sector while preventing moral hazard, regulators have resorted to increased capital requirements. Nevertheless, as Berger et al. (1995) pointed out, binding capital requirements also diminish intermediation.

To protect depositors against the loss of their deposits, Spanish banks introduced a deposits insurance scheme in 1977. This scheme accommodates the basis of the European directive on deposit insurance established in 1995-1996.

5. Results

In the introduction we stated that our goals in this paper were to (i) estimate TFP growth in such way that avoids the discrepancy found in the literature between the nonparametric (the Divisia) and the parametric measures of TFP change, irrespective of the functional form chosen to represent the production technology and, (ii) use a unified approach that captures the effects of different types of deregulation, technical change, scale and markup in output prices on productivity. That is, to link deregulation with performance of firms using a unified approach in which effects of different types of deregulation are accounted for. The first issue is addressed by appending the TFP growth equation in the cost system (the cost function and the cost share equations). The second issue is addressed by estimating the model (equations (3)-(5)) with two sets of time related variables: t as a time trend which captures the technical change, and z as a vector of deregulation dummies which accommodate effects of different types of regulation. We allowed the production technology to change with regulatory changes by introducing interaction of the z variables with the other variables in the model. The

¹⁶ This could adversely affect growth since savings banks **complied with the solvency ratio**.

¹⁷ See Vives (1998) and Dermine (1999).

definition of these two types of variables will allow the decomposition of TFP changes into external factors (deregulation and technical change).

In the empirical exercise we estimate the model (equations (3)-(5)) (i) with and without the TFP growth equation and (ii) with and without the deregulation dummies. We estimate them separately for commercial and savings banks. Each of these models is estimated using the non-linear iterative seemingly unrelated regression (NLITSUR) technique. Most of the estimated parameters in each model are found to be statistically significant at the 5% level of significance.¹⁸ The joint significance of the TFP growth equation and deregulatory dummies for both the savings and commercial banks is then tested using the likelihood ratio (LR) test. The LR test rejects exclusion of the TFP growth equation and deregulation dummies for both savings and commercial banks at the 1% level of significance. We thus report results only from the models that include both the TFP growth equation as well as the deregulation dummies.

First we present the results on TFP growth obtained from the raw data using the Divisia Index followed by the results on TFP growth obtained from the estimated model (equations (3)-(5)). Finally, we show the results of TFP growth and its components. Particularly, we want to know whether the deregulation measures have any effect on the productivity growth of Spanish banks.

5.1. *TFP growth (Divisia Index and parametric approach estimation)*

TFP growth estimated from the raw data using the Divisia index are reported in Tables 2 and 3 for savings and commercial banks, respectively. The results show that savings banks have a higher mean growth per year in the aggregate output than commercial banks. The output growth is around 6.79% for savings banks during the period, where the contribution of input growth to output growth is approximately 76%, while TFP growth accounts for 24% of output growth. Since TFP growth is measured as the changes in aggregated output growth over time not explained by changes in aggregated input growth, it can be observed that the mean value (by year) of TFP growth is 1.63% for savings banks. Table 3 shows that the output growth of commercial banks is 4.5%, two percentage points lower than the savings banks output growth. For them input growth (TFP growth) contributes nearly 56% (44%) to output growth. The TFP growth per year for commercial banks is 2.05%. Thus, it can be observed that

¹⁸ The estimated parameters are available from the authors upon request.

although savings banks have a higher output growth per year, the improvement in terms of TFP growth is higher for commercial banks. The TFP changes for both types of institutions are positive over the period 1986-2000. However, aggregate input growth contributed more than productivity growth to the growth of output for both types of institutions. These results are consistent with the results obtained in most of the productivity analysis studies (Wulog et al., 2000).

Table 2. Contributor factors to the Total Output Growth: Percentage Contribution 1986-2000. (Savings Banks)

	Mean	S. D.
Aggregated Input Growth	5.16	0.0469
TFP (Divisia Index)	1.63	0.0191
Aggregated Output Growth	6.79	0.0534

Table 3. Contributor factors to the Total Output Growth: Percentage Contribution 1986-2000. (Commercial Banks)

	Mean	S. D.
Aggregated Input Growth	2.60	0.0840
TFP (Divisia Index)	2.05	0.0412
Aggregated Output Growth	4.65	0.0913

As noted in section 3, if one is interested only in TFP growth then it is not necessary to estimate the cost function econometrically. One can simply compute it from the data using a discrete approximation of the formula. However, if the interest is to decompose TFP growth into EF, scale and markup components then econometric estimation of the cost function becomes a necessity. This is because estimation of RTS is necessary to measure the scale component (unless $RTS = 1$) and estimates of output elasticities are required to compute markups in each market and such information is not in the data.

The results about TFP growth using the econometric cost model (equations (2)-(5)) proposed in this paper are presented in Tables 4 and 5 for savings and commercial banks, respectively. Moreover, since one of the goals of the paper is to avoid the discrepancy found in the literature between the nonparametric (the Divisia) and the parametric measures of TFP change, irrespective of the functional form chosen to represent the production technology, it will be interesting to compare the TFP growth results obtained from the Divisia index with those obtained using the parametric

approach. As can be seen from the mean values, the TFP growth results are almost the same irrespective of using the non-parametric (Divisia index) or parametric approach (cost model). These results hold if we analyze the evolution of TFP growth over time, see Tables 6 and 7 and Figures 1 and 2. Since, we estimate the model (equations (3)-(5)) with and without the TFP growth equation and the LR test rejects exclusion of TFP growth equation for both savings and commercial banks at the 1% level of significance, the results suggest that our estimation strategy avoids the discrepancy found in the literature between the nonparametric (the Divisia) and the parametric measures of TFP change.

Table 4. Estimated and Observed TFP. Savings Banks

	Mean	S. D.
TFP (Divisia)	1.63	0.0191
TFP (Estimated: Dual Approach)	1.65	0.0147

Table 5. Estimated and Observed TFP. Commercial Banks

	Mean	S. D.
TFP (Divisia)	2.05	0.0412
TFP (Estimated: Dual Approach)	2.09	0.0391

*Table 6. Estimated and Observed TFP.
Savings Banks*

Years	TFP (Divisia Index)	TFP (Estimated)
1987	0.02492	0.02473
1988	0.03141	0.02916
1989	0.02957	0.02957
1990	0.00950	0.00785
1991	-0.00212	0.00140
1992	-0.00219	-0.00254
1993	0.00632	0.00860
1994	0.01109	0.01332
1995	0.01418	0.01461
1996	0.01849	0.01819
1997	0.02144	0.02058
1998	0.02423	0.02287
1999	0.02832	0.02735
2000	0.03020	0.02896
Mean	0.01638	0.01652

*Table 7: Estimated and Observed TFP.
Commercial Banks*

Years	TFP (Divisia Index)	TFP (Estimated)
1987	0.03107	0.03089
1988	0.03846	0.03645
1989	0.04591	0.04103
1990	0.02687	0.02995
1991	0.01615	0.01877
1992	0.00861	0.00810
1993	-0.01383	-0.01214
1994	-0.00327	-0.00429
1995	0.00585	0.01138
1996	0.01826	0.02129
1997	0.02757	0.03184
1998	0.03486	0.03750
1999	0.04433	0.04376
2000	0.04810	0.04656
Mean	0.02053	0.02087

5.2 TFP growth and its components

TFP growth and its components (EF, scale and markup) are reported in Tables 8 and 9 for savings and commercial banks, respectively. The second columns of Table 8 and 9 reports the mean values (by year) of estimated TFP growth, for savings and commercial banks, respectively. We find that TFP growth increased from 2.47% in 1987 to 2.89% in 2000 for savings banks. The overall mean TFP growth for the savings banks is 1.65% per year. Commercial banks showed a somewhat higher increase in TFP growth (2.09% per year). Thus, on average, positive TFP growth is observed for both savings and commercial banks. These findings are consistent with recent results obtained by Kumbhakar et al. (2001) for the case of Spanish savings banks.¹⁹

Table 8. TFP Growth and its Components. Savings Banks

Years	TFP (ESTIMATED)	EXTERNAL FACTORS (EF)	SCALE	MARKUP
1987	0.02473	0.00354	0.01383	0.00736
1988	0.02916	0.00168	0.01345	0.01403
1989	0.02957	0.01199	0.01478	0.00280
1990	0.00785	-0.00120	0.00705	0.00201
1991	0.00140	-0.00655	0.00311	0.00484
1992	-0.00254	-0.01429	0.00677	0.00498
1993	0.00860	0.00311	0.00539	0.00011
1994	0.01332	0.00640	0.00785	0.00092
1995	0.01461	0.00529	0.00861	0.00071
1996	0.01819	0.00995	0.00860	0.00036
1997	0.02058	0.01311	0.00824	0.00038
1998	0.02287	0.01489	0.00888	0.00045
1999	0.02735	0.01815	0.01023	0.00051
2000	0.02896	0.01932	0.00912	0.00052
Mean	0.01652	0.00501	0.00895	0.00262

¹⁹ Kumbhakar et al. (2001) estimated a profit function and calculated only technical change and technical efficiency change for savings banks. Note that TC is only one component of TFP growth.

Table 9. TFP Growth and its Components. Commercial Banks

Years	TFP (ESTIMATED)	EXTERNAL FACTORS (EF)	SCALE	MARKUP
1987	0.03089	0.00364	0.00846	0.01879
1988	0.03645	0.00538	0.00875	0.02233
1989	0.04103	0.01306	0.00837	0.01961
1990	0.02995	0.01723	0.00543	0.00728
1991	0.01877	-0.00793	0.00610	0.00318
1992	0.00810	-0.00609	0.00653	0.00296
1993	-0.01214	-0.00974	-0.00139	-0.00100
1994	-0.00429	-0.00461	0.00040	-0.00008
1995	0.01138	0.00978	0.00185	0.00026
1996	0.02129	0.01413	0.00052	0.00664
1997	0.03184	0.02015	0.00060	0.01109
1998	0.03750	0.02322	0.00487	0.00941
1999	0.04376	0.02710	0.01198	0.00469
2000	0.04656	0.02577	0.01069	0.01010
Mean	0.02087	0.00730	0.00360	0.01011

The external factors (the joint effect of technical change and deregulation changes) exercise a higher effect on the TFP growth of commercial banks rather than savings banks. There appears to be a downward shift in the cost function from 1990-1992 (1991-1994) for savings banks (commercial banks). An upward shift in the cost function, *ceteris paribus*, is observed for the rest of the years for both savings and commercial banks. The mean EF for the entire period is 0.50% (0.73%) per year for savings (commercial) banks. A declining trend in EF is observed for savings banks until 1992 after which the trend is reversed. The mean EF for commercial banks, however, took a different path, increasing up to 1990, then decreasing until 1994, and finally increasing over the remainder of the period.

The scale component is found to be the most important factor in explaining the TFP growth for savings banks (fourth column of Table 8). On the other hand, this component is quite small for commercial banks (the overall mean is 0.36%), although it is positive for most years²⁰. The scale component is slightly higher for savings banks (the overall mean being 0.89%). The scale component contributed positively to TFP growth in every year for savings banks while it had an adverse effect on commercial banks in 1993.

²⁰ Note that RTS and the rates of change in outputs affect the scale component. Scale economies (diseconomies) and positive (negative) rates of change in output affect the scale component positively.

The last component of TFP growth is the markup factor, reported in the last column of Tables 8 and 9. If output markets are competitive (i.e. $\partial C/\partial y_i = p_i$) then $(\dot{Y}_P - \dot{Y}_C) = 0$, which in turn implies that the markup component is zero. Thus, a non-zero value of the markup component indicates the presence of non-competitive behavior in output markets. On the whole the contribution of markup factors is positive for both savings and commercial banks (the mean being 1.01% for commercial banks and 0.26% for savings banks). For commercial banks the markup component is the driving force of TFP growth.

The average value over the period of the components of the TFP growth is showed in Tables 10 and 11, where it is decomposed the EF in technical change and the deregulatory effects.

Table 10. Average TFP Growth and its Components: Savings Banks

	Mean	S. D.
TFP (Estimated: Dual Approach)	1.65	0.0147
External Effects (EF)	0.50	0.0098
EF: Technological Change	0.39	0.0095
EF: Deregulation Change	0.11	0.0015
Scale+Markup	1.15	0.0135
Scale	0.89	0.0086
Markup	0.26	0.0108

Table 11. Average TFP Growth and its Components: Commercial Banks

	Mean	S. D.
TFP (Estimated: Dual Approach)	2.09	0.0391
External Effects (EF)	0.73	0.0136
EF: Technological Change	0.37	0.0130
EF: Deregulation Change	0.36	0.0094
Scale+Markup	1.36	0.0373
Scale	0.36	0.0132
Markup	1.00	0.0358

Overall, the contribution of the three factors to TFP growth is positive, however, the joint contribution of the scale and markup effects is higher than the contribution of EF. Around two thirds of the productivity growth is due to scale and markup effects for both types of institutions. It can be observed that the technical change tends to take a residual value when other factors are accounted for in the productivity growth analysis. Around 23% (18%) of the productivity growth of the savings (commercial) banks are explained by technical change. In terms of the deregulatory changes effect it can be observed that for both types of institutions the deregulation measures have a positive

contribution to TFP growth. However, this positive contribution has been higher for commercial rather than savings banks. Approximately 50% (22%) of the EF component are due to deregulatory change effects for commercial banks (savings banks). Those results seem to suggest that deregulation has been more effective for commercial than for savings banks in terms of improvement of productivity. Thus, we conclude that deregulation measures, in general, helped banks increase their performance (measured in terms of TFP growth).

We now examine the results in the light of regulatory changes. The idea is to check the impact of different types of regulations on TFP growth and price behavior of Spanish banks.

Given the strategy used to control for deregulation by introducing dummy variables, it is possible to examine what type of deregulation has the most impact on productivity growth. We find that the national deregulatory measures have the most effect on the savings banks cost compared to the European deregulatory measures²¹. Commercial banks have shown stronger effects from the implementation of the European deregulatory measures, as opposed to the national deregulatory measures. These results suggest that while commercial banks seem to have more adjusted to face national deregulations, savings banks have shown a more adaptation to national deregulations.

6. Summary and Conclusions

In this paper we examined the effect of changes in regulatory environment on the performance of financial institutions. We used a dual cost function approach to estimate TFP growth, which is used as an indicator of performance. We specified the dual production technology in such a way that allowed different types of deregulation measures to affect productivity change. Furthermore, we used the definition of TFP growth (the Divisia index) as an additional equation while estimating the dual multiple output translog cost system. By doing so, we avoided the discrepancy found in the literature between the nonparametric and parametric measures of TFP change. We chose the Spanish banking industry as an empirical exercise the banking industry has gone through rapid changes in recent years as a result of a series of deregulation measures.

²¹ Specifically, the European deregulatory measures produced negligible effects on the overall growth of TFP for savings banks.

TFP growth results obtained from the data (the Divisia Index) are very close to those obtained from the cost system estimation.

Our results show that the deregulatory initiatives altered the structure of production of the markets in which banks operate. In order to adjust to the regulatory process savings banks altered their structure of production more deeply than the commercial banks. Results also indicate that deregulation measures led to an increase in TFP change for commercial banks and savings banks. Thus, we conclude that deregulations, in general, helped Spanish banks to increase their performance (measured in terms of TFP growth).

Most of the changes in TFP growth for savings banks are due to deregulatory measures at the domestic level (i.e. deregulation in interest rate and fees, credit control and branching limitations). The effects of these domestic deregulatory measures on the savings banks were found to be different from the commercial banks. The European deregulatory measures had a larger effect on the performance of the commercial banks than the savings banks. The combination of the abolition of capital control and the introduction of a single market program created pressures for increasing TFP of commercial banks.

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Figure 1: Estimated and Observed TFP (Savings Banks)

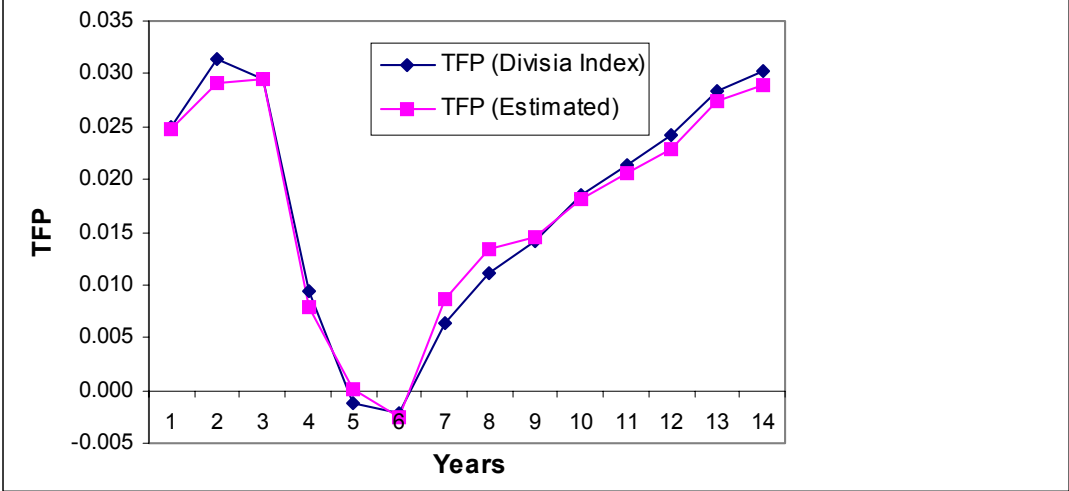


Figure 2: Estimated and Observed TFP (Commercial Banks)

