SIZE, GROWTH AND BANK DYNAMICS

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Enrique Benito

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Enrique Benito

BANCO DE ESPAÑA AND UNIVERSIDAD CARLOS III DE MADRID

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(**) Address for correspondence: Enrique Benito; c/ Alcalá 48, 28014 Madrid, Spain. Tel: +34 91 338 8581; fax: +34 91 338 6104; e-mail: enrique.benito@bde.es.

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Abstract

This paper investigates the size distribution of the whole population of Spanish commercial, savings and cooperative banks from a dynamic perspective over the 1970-2006 period. To investigate the evolution of the size distribution, we determine whether the data satisfies the Law of Proportionate Effect (LPE) using panel unit root tests. We find that the size-growth relationship is not stable over time but changes depending on the competitive environment of banks (liberalization, deregulation and integration). When Spanish banking was highly regulated, we find that smaller banks grew faster than their larger counterparts. In recent years, however, we find that larger banks grow at the same rate or faster than smaller banks, a result that lends towards LPE acceptance. Thus, our study corroborates the conditioned nature of the size-growth relationship and the size distribution of banks, as emphasized by recent studies for the US banking system. Results imply that the size distribution of Spanish banks will become more skewed in next years, and concentration will tend to increase.

JEL: G21, L11, C23.

Key words: Size distribution; Law of proportionate effect; Panel unit root tests.

1 Introduction

The European and Spanish banking industries have experienced significant changes during the last decades. The liberalization and deregulation processes during the 1980's and the 1990's, the technological progress, the introduction of a single currency and the recent waves of M&A all have led to a progressive decline in the number of institutions and increased concentration of banking assets among the largest banks[1]. In addition, as a response to new competitive pressures, banks are now geared towards maximizing shareholder value by improving efficiency and strengthening customer relationships.

All these changes are expected to have a significant impact on the structure, the size distribution and the dynamics of the banking industry. However, few studies have examined the dynamic nature of the size distribution. This is true even though the size distribution of banks is of fundamental interest to bankers and policy makers given that size determines bank's risk taking [Demsetz and Strahan (1997)], credit availability [Peek and Rosengren (1996)], lending relationships [Stein (2002); Berger et ál. (2005)], or lending specialization [Delgado et ál. (2007)].

In this paper, we investigate the size distribution of Spanish banks from a dynamic perspective over the 1970-2006 period. The case study is particularly relevant because in Spain there is a significant diversity in bank size and ownership forms (i.e. commercial for profit banks, not-for-profit savings banks, and credit cooperatives), with no clear market dominance of one form over the others. Moreover, Spain has not been an exception to the deregulation and consolidation processes [Caminal et ál. (1993); Salas and Saurina (2003)]. The result has been an intense merger activity during the last two decades involving banks of all sizes and ownership forms. Ownership and size diversity have increased over time since savings banks and credit cooperatives today represent half of the market share of Spanish retail banking, compared with less than one third in 1970. The time period considered offers a unique opportunity to study the evolution of the size distribution from a period when Spanish banking was strongly regulated (with administratively fixed interest rates, compulsory investment coefficients, foreign entry restrictions and high asymmetry among different ownership forms), to a period in which competitive conditions press towards efficient decisions and savings banks outperform commercial banks in competitive credit markets.

To investigate the evolution of the size distribution, we determine whether the data satisfies the Law of Proportionate Effect (LPE). According to the LPE, firm growth and industry concentration are driven by unsystematic and random factors. This hypothesis, which was originally devised by Gibrat (1931)[2], implies that firm size and growth are unrelated, so that small and large firms share the same chance of growing at any given rate in any particular period. If the LPE holds for a particular industry, then concentration is expected to increase over time and the empirical size distribution will tend to become highly skewed[3]. Our approach is based on Tschoegl (1983), who tests three propositions that all together make up a 'strong form' of the LPE, namely that 1) the growth rate of each bank is

1. According to the ECB (2002; 2006), the number of banks in the EU fell over the period 1998-2005 from approximately 9200 to slightly more than 7100. The average share in total assets of the 5 largest institutions however, rose from 50.3% to 54.2%.

2. The LPE is also commonly known as Gibrat's Law.

3. Sutton (1997) provides a simple proof of the argument using the lognormal distribution.

independent of its size; 2) there is no persistence in bank's growth in two consecutive periods; and 3) the variability of growth rates is independent of the banks' size.

Although there is extensive empirical evidence on the validity of the LPE for several different settings[4], only a few studies have examined the size-growth relationship in the banking industry. Moreover, the existing evidence is not exempted from limitations. First, the vast majority of the existing studies estimate cross-sectional regressions of growth over some period as dependent variable, and initial size and (in some cases) persistence in growth rates as explanatory variables. This procedure often fails to exploit all the available information whenever data is available in a time series format. In addition, Goddard, Wilson and Blandon (2002) show that cross-sectional parameter estimates are biased towards LPE acceptance and the test suffers from a loss of power if there are heterogeneous individual firm effects. As a result, a few recent studies have incorporated panel data based tests to investigate the size-growth relationship in banking. Second, the existing studies only consider banks that survive during the entire estimation period, excluding institutions that failed, merged or were acquired. If banks need to achieve a minimum size to fully exploit economies of scale, small banks may prioritize growth in order to attain this scale. Therefore, average growth among small banks may tend to be higher than among large banks. In addition, this growth prioritization may make small banks to exit with higher probability than their larger counterparts if they fail to attain the minimum size in a short period of time. In fact, several studies show that exit rates tend to decline with size in different industries[5]. Thus, this procedure may generate a sample censoring bias which may have important implications for the testing results[6]. Third, previous studies cover a relatively small proportion of the banking system, so their samples are unlikely to be perfectly representative of the population with respect of relevant characteristics such as size or ownership form. Finally, existing studies usually cover short periods of time, so they are unable to investigate how the size distribution evolves over time through the liberalization, deregulation and integration processes.

This paper attempts to fill the previous gaps by investigating the size-growth relationship using an unbalanced panel comprised by the whole population of Spanish commercial, savings and cooperative banks. We test the validity of the LPE over the whole sample period (1970-2006) and over different sub-periods that correspond to different states in the deregulation and integration processes, to analyze of the evolution of the size distribution. The size-growth relationship is estimated using the panel unit root test devised by Breitung and Meyer (1994) and an Ordinary Least Squares (OLS) test. Using Monte Carlo simulations, Bond et ál. (2005) show that these two tests are the most powerful for testing unit roots in micro panels across a set of alternative tests. Since our panel includes institutions that exit over the estimation periods, the potential sample selection bias is eliminated.

We find evidence that when the banking system was highly protected, smaller banks grew faster than large banks. However, as deregulation and integration processes occur, larger banks tend to grow at a faster pace and the LPE tends to hold over time. In recent years, however, we find some evidence that larger banks tend to grow at higher rates. Thus, our study corroborates the dynamic nature of the size-growth relationship and the size

4. Sutton (1997) and Geroski (1999) provide comprehensive reviews of the empirical and theoretical literature on firm growth and the LPE.

5. See Hall (1987), Evans (1987a; 1987b), Dunne et al. (1989), Dunne and Hughes (1994) and Fariñas and Moreno (2000).

6. See Sutton (1997) for an exhaustive explanation of the sample censoring bias.

distribution. Our findings imply that the size distribution of banks will become more skewed and concentration will increase in the following years.

The rest of the paper is organized as follows. Section 2 briefly summarizes the existing literature and states the main propositions to be tested. Section 3 contains an overview of the transformation of the Spanish banking system and the deregulation process it has undergone during the last four decades. Section 4 explains the data used and the econometric methodology. Section 5 presents the empirical results. Finally, section 6 concludes.

2 Literature overview

The majority of explanations on increasing levels of concentration and bank scale rely on systematic differences across institutions that lead banks obtaining advantages over others. These advantages may include economies of scale and scope, efficiency gains attained through size or the adoption of entry-deterring strategies [Berger et ál. (1993); Berger et ál. (1999)].

A plausible alternative explanation rests on the assumption that industry concentration may tend to emerge over time naturally, as a result of random growth. Systematic factors do not play a differentiating role since they are distributed randomly over the population of firms. This idea is embodied in the Law of Proportionate Effect (LPE) and was originally devised by Gibrat (1931). According to the LPE, firm size is unrelated to growth, implying that small and large firms share the same chance of growing at any given rate in any particular period. The factors that influence firm's growth, such as growth of demand, managerial talent, innovation, organizational structure… are distributed across firms in a manner which is essentially random. Over time this stochastic process will generate a size distribution of firms which exhibits a positive skew, with a few large firms, rather more medium-sized firms, and a large number of small firms. Previous research has found that this process accords well with the actual size distribution of firms observed in many industries. Gibrat (1931) investigates the implications if each firm's growth in any year is determined randomly, and is therefore independent of its size and its growth in previous years. He shows that this non-relationship between growth and firm size has important consequences for changes in concentration and market structure over time. If the LPE holds for a particular industry, the size distribution will tend to become skewed, increasing concentration over time.

The following stochastic model results appropriate to describe observed growth or decline of firms as the result of the chance product of a large numbers of factors acting independently of each other:

$$S_{it} = S_{it-1}^{\beta} \exp(\mu_{it}) \tag{1}$$

where S_{it} is the size of firm *i* at time *t*, β is the parameter of the size effect, and μ_{it} is firm *i*'s draw form the common distribution of growth rates, and is hypothesized to be distributed $\mu_{it} \sim N(\alpha_i + \delta_t, \sigma^2)$, and hence $\mu_{it} = \alpha_i + \delta_t + \varepsilon_{it}$.

In his study of size and growth among the world's largest banks, Tschoegl (1983) identifies three testable propositions which all together make up a 'strong form' of the LPE and constitute the hypothesis that all the banks' growth rates follow a random walk and are identically distributed.

P.1. The growth rate of each bank is independent of its size

If P1 holds, the size distribution will become highly skewed and concentration will increase over time. This result implies β=1, and is strictly due to the workings of chance, requiring no assumptions about monopoly advantages, economies of scale or managerial effectiveness. β<1 implies that smaller banks tend to grow faster on average than large banks, a result consistent with diseconomies of scale or political costs to growth. Over time the size of all banks will tend to converge towards some value that might be bank specific if there is heterogeneity in α_i. Similarly, if β>1, implies that large banks grow more quickly than smaller banks, possibly through efficiency advantages arising from scale and scope economies or with a growth orientation in the larger banks. The level of concentration will increase over time even more rapidly than if β=1.

P.2. There is no persistence in bank's growth in two consecutive periods

P2 can be restated as $cov(\varepsilon_{it}, \varepsilon_{it-1}) = 0$. Whenever P2 does not hold, a positively serially correlated growth indicates that advantages acquired in one period carry over to the next. On the contrary, consistent negatively serially correlated growth implies the existence of some process that systematically reverses fortune. Technological improvements and high quality management have been identified as major sources of persistent above average growth in banks [Tschoegl (1983)].

P.3. The variability of growth rates is independent of the banks' size

P3 corresponds to $E(\varepsilon_{it}^2) = \sigma_t^2$. Low variability in growth rates may be explained by diversification or scale advantages that reduce uncertainty. Heteroscedastic growth rates, however, imply that these advantages are contingent on bank's size. As Tschoegl (1983) points out, P3 has also important implications for public policy and the safety net. According to Merton (1977), a deposit insurer effectively issues a put option, whose social cost depends on the variance rate per unit of time for the logarithmic changes in the value of assets. If banks reduce (increase) the variability of their growth rates one would expect that this would reduce (increase) their risk other things being equal.

If the above three propositions hold, taking logs and rearranging equation (1) becomes

$$\ln S_{it} - \ln S_{it-1} = \alpha_i + \delta_t + \varepsilon_{it} \tag{2}$$

implying that logarithmic bank growth rates follow a random walk with drift.

There is extensive empirical evidence on the validity of the LPE for several different settings. However, evidence for the banking industry is scarce. Alhadeff and Alhadeff (1964) compare the growth of the largest 200 US commercial banks over the period 1930-1960. The authors find that smaller banks tend to grow faster than their larger counterparts. However, they also show that top banks that survived throughout the sample period grew faster than the system as a whole and attributed this to mergers among the largest banks. Rhoades and Yeats (1974) and Yeats et ál. (1975) analyze the size and growth relationship for different sized US banks over the periods 1960-1971 and 1960-1963 respectively. They find that larger banks tend to grow more slowly than small banks. Tschoegl (1983) investigates the validity of the LPE in the 1970s for a sample of the 100 larger international banks in each year. His analysis of the three propositions described earlier suggests that size and growth are unrelated, that growth rates variability declines with size and that there is a positive but insignificant relationship between growth rates in subsequent periods. More recently, Wilson and Williams (2000) investigate the relationship between size and growth for a sample of European banks from France, Germany, Italy and the UK over the period 1990–1996. Their sample comprises about 100 commercial, savings and cooperative banks per country, so they cover a very small proportion of the banking industry for each country. The authors find no relationship between bank size and growth for France, Germany and the UK. Yet, the LPE is rejected in Italy since small banks grow faster than large banks. Smaller banks are also found to have experienced more variability in growth rates than larger banks. This suggests that diversification advantages may make large banks less susceptible to abnormal high fluctuations in growth. Janicki and Prescott (2006), in a study similar in spirit to ours, investigate the validity of the LPE and study the dynamics of the bank size distribution using a sample of US commercial banks using data from 1960 to 2005. Their findings are broadly supportive of the LPE for the whole sample. Interestingly, when the sample is broken into different size categories, they find evidence for acceptance of the LPE for the 1960s and 1970, before the deregulation and liberalization process, but not for the 1990s and the 2000-2005 periods, where largest banks seem to grow faster than the small banks.

All the previous studies estimate cross-sectional regressions of growth over some period as dependent variable and initial size and (in some cases) persistence in growth rates as explanatory variables. However, this procedure often fails to exploit all the available information whenever data is available in a time series format. Goddard, Wilson and Blandon (2002) also show that cross-sectional parameter estimates are biased towards LPE acceptance and the test suffers from a loss of power if there are heterogeneous individual firm effects. As a result, recent studies have incorporated panel data-based tests to investigate the size-growth relationship. Goddard, Mckillop and Wilson (2002) investigate the growth of US credit unions during the 1990s using cross-section and panel techniques. They find that small credit unions grew slower and tended to have more variable growth than their larger counterparts. They also find negative persistence in growth rates. This may suggest that credit unions curtail growth until they retain sufficient earnings to satisfy capital requirements. The authors also conduct multivariate analyses and show that several structural and operational variables may also help to explain future growth. Goddard et ál. (2004) study growth and profitability in a sample of 583 commercial, savings and cooperative banks operating in France, Germany, Italy, Spain and the UK over the period 1992 to 1998. Their results show no evidence of any relationship between size and growth, but they find a positive persistence in growth rates. They also find evidence that profit is a good predictor of future growth.

3 Deregulation and consolidation in Spanish banking

During the last 30 years, the European countries have implemented several regulatory changes that have transformed the European banking industry. Several efforts have been put forward to reach the necessary harmonization level required for the establishment of a unique and competitive European market of financial services. The deregulation processes of the 70s and 80s, the liberalization of capital flows, the Second Banking Directive in the early 90s, and the establishment of the Euro in several Member States, definitely contributed to boost this process. More recently, the EU has launched its Financial Services Action Plan (FSAP) which has dismantled most legal barriers to provide a favourable environment for the development of a Single European Financial Market.

Spain has not been an exception to the deregulation and consolidation processes [Caminal et ál. (1993); Salas and Saurina (2003)]. As a result, the Spanish banking system has undergone through a deep transformation during the last four decades. Overall, deregulation has transformed both the behaviour of banks (liberalization of interest rates, fees and commissions…) and the industry structure and distribution (entrance of new competitors, removal of artificial barriers between commercial, savings and cooperative banks…). In the 1970s, the situation corresponded to a strongly regulated oligopoly, with administratively fixed interest rates, compulsory investment coefficients and entry restrictions to foreign banks. The high risk concentration of banks as well as an investment policy not guided by efficiency and profitability, together with the economic crisis of the mid-70s, made banks to face serious troubles. During this period, the relative importance of public banking increased due to the financing needs of local governments and households after the crisis. Two consequences for the industry can be remarked from this episode: First, banks decreased their stake in industrial portfolios and increased their participation in government securities. Second, banks transferred the cost of the crisis to final clients by increasing the spread between asset and liability rates. Despite all these problems, this period was essential for the transformation of the Spanish banking industry in the following decades.

During the 1980s, a series of important deregulation measures were introduced. In 1985, capital requirements as a function of asset risk are enacted, savings banks are free to open branches in their traditional regions, and the investment coefficients for commercial and savings banks are equalized. In 1987, interest rates and controls on fees are liberalized. In 1989, a calendar to phase out the investment coefficient is settled and savings banks are allowed to open branches nationwide, ten years later than commercial banks. In 1990, liquidity rules were liberalized. In 1992, capital adequacy requirements were adapted to the EU rules.

All these policy measures led to a highly liberalised situation in the early 1990s and a more competitive arena. Consequently, the industry suffered a very intense merger activity in the following years aimed to increase size for competing in the European markets and preserve market power. Figure 1 shows the fraction of banks that merged in Spain as a proportion of the operating banks and the total number of bank mergers over the last 38 years. It turns out that there is a significant amount of cyclical variation. Until 1989 there were some punctual peaks in M&A over the 70s. However, the strong consolidation process starts in the early 90s, when the liberalization process is finished. This trend can be characterized by four facts [Gual (1993)]. First, M&A increase the concentration of the industry, although the strong growth of small and medium-sized institutions and the entrance of new competitors tend to reduce it. Second, this process only involves Spanish banks aiming to improve efficiency through national scale economies. Political forces can limit the entrance of foreign institutions to keep under control a sector which is considered strategic. Third, the consolidation rationalizes the sector structure, leading to the closure of several branches that became redundant due to increased competition. Finally, during the deregulation process the main target entities were small to medium size banks, and large M&A operations were avoided.

Figure 1 exhibits two significant peaks in 1990 and 2000. The first peak corresponds to the expansion of savings banks. The deregulation measures introduced in the 80s, led Spanish banks to a significant interest in diversifying their risk, achieve scale economies and defend their regional market shares [Gual (1993)]. The result is an accelerated M&A process in the early 1990s, basically involving savings banks that operated in the same geographical locations. As a result, the number of saving banks operating in Spain drop from 78 in 1989 to 54 in 1992. In the following years, the amount of deposits held by savings banks raised considerably and exceeded the deposits of commercial. On the lending side, however, the differences between commercial and savings banks vanished later, over the 2000-2006 period. By the end of the century, public banking in Spain had virtually disappeared. In 2000 there is another peak which corresponds to an important period of consolidation in Spanish commercial banking led by the strong economic period and the liquidity holdings that Spanish banks accumulated in previous years. In 1999, the two larger Spanish commercial banks are created as a result of two national mega mergers.

Over the 2000-2006 period, the European integration process governs consolidation. Even though market integration in Spain is taking place mostly indirectly through interbank flows and cross-border investments, there is a gradual entrance of foreign banks through the opening of subsidiaries and branches. In fact, the process increasingly takes place through the opening of branches rather than subsidiaries. The strong regional presence and significant market share of savings and cooperative banks makes it difficult for foreign banks to establish in Spain and thus might slow down this process. M&A activity remains high during the whole period, with a significant number of operations involving mainly cooperative banks and foreign subsidiaries and branches.

In summary, the strong reestructuration of the Spanish banking system over the last decades is a clear response to the deregulation process and the new competitive conditions. In the rest of the paper, we will try to assess the extent of this impact and its consequences for the evolution of the size distribution.

4 Data and methodology

4.1 Data

To investigate the dynamics of the bank size distribution, we use a dataset which includes individual bank level data drawn from the confidential balance sheet statements declared annually (in December) to the Banco de España by the whole population of Spanish banks over the period 1970-2006. Reliable data for cooperative banks is available only since 1980, when they started to be legally obliged to declare their statements to the Banco de España. Thus, we conduct two different analyses. First, we study the evolution of the size-growth relationship over the 1970-2006 period for commercial and savings banks excluding cooperative banks. Then, we conduct the analysis for commercial, savings and cooperative banks over 1980-2006. This approach allows us to analyze the influence of cooperative banks on the evolution of size distribution through the liberalization process and exploit all the available information. Our final dataset is an unbalanced panel comprising all the institutions that enter and exit over the different estimation periods[7].

We use three measures of size: total assets less contra-accounts (acceptances, letters of credit, securities held on behalf of customers…), total loans and total deposits. All data is in nominal terms and is converted to Euros. Table 1 shows the summary statistics for assets, loans and deposits nominal size measures for the years 1970, 1980, 1990, 2000 and 2006. The total population of commercial banks increases during the first two decades, but decreases over the 90s and 2000s. The population of savings and cooperative banks, however, decreases along the years considered. As can be expected, nominal size figures increase considerably along time. The average size of savings banks is much higher than that of commercial banks during the last two decades, while the contrary occurs in the 70s and 80s. Average size of cooperatives is much lower.

Table 2 reports summary data on growth for the three size measures considered. These data refers to banks that survived the end-point of each sub-period considered. The higher average growth rates are reached over the 1970s and 1980s in assets and deposits and over the 1970s and 1990s in loans. Commercial and savings banks show the highest and the lowest standard deviations in growth rates respectively.

4.2 Methodology

Taking the log of equation (1) yields the following stochastic growth model for observations of bank size and growth:

$$s_{it} - s_{it-1} = \alpha_i + \delta_t + (\beta - 1)s_{it-1} + \varepsilon_{it} \tag{3}$$

where s_{it} is the log size of bank *i* at time *t*. α_i and δ_t allow for individual bank and time effects respectively. The parameter β determines the relationship between size and annual growth. ε_{it} is a random disturbance, normal and IID with $E(\varepsilon_{it}) = 0$ and $\text{var}(\varepsilon_{it}) = \sigma_\varepsilon^2 > 0$.

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7. Although our unbalanced panel includes banks that exit, the exit event is not included 'per se' in the estimations. Thus, our analysis should be interpreted as conditional on the survival of banks in the different estimation periods. We thank an anonymous referee for pointing this out to us.

Chesher (1979) shows that if a lagged growth term is not included in equation (3), the estimate of β is inconsistent. Thus, we modify the equation to take into account the possibility of first-order serial correlation:

$$s_{it} - s_{it-1} = \alpha_i + \delta_t + (\beta - 1)s_{it-1} + \rho\varepsilon_{it-1} + u_{it} \tag{4}$$

According to Tschoegl (1983), we consider that the LPE holds whenever β=1. If β=1 and there exists non-zero persistence of growth (ρ≠0) or heteroscedasticity in growth rates ($\sigma_{\varepsilon}^{2} = \sigma_{\varepsilon(it)}^{2}$), we assume the growth model is based on a ‘weak’ form of the LPE.

The majority of previous empirical studies estimate (4) using a cross-section approach to test the LPE. However, this procedure requires the assumption that specific bank effects are homogeneous ($\alpha_i = \alpha$). As Goddard, Wilson and Blandon (2002) point out, there is little basis in theory to anticipate homogeneity, and several reasons to expect heterogeneity a priori. Different banks may differ in the level of importance to size in their objective functions. If long run average costs are flat or inverted U-shaped, institutions with different objective functions can operate at different scales with similar average costs, and thus bank sizes may mean-revert towards different equilibrium values.

Breitung and Meyer (1994) and Goddard, Wilson and Blandon (2002) show that if there are heterogeneous bank effects but equation (4) is estimated assuming homogeneity in α_i, the resulting estimator of β is upward biased and inconsistent, and the LPE tests suffers from a dramatic loss of power. Intuitively, if log size is mean-reverting but the individual bank means are widely dispersed, the size distribution at *t*-1 conveys little information about which banks are above or below their own means at *t*-1, and therefore about which are expected to experience above or below average growth between *t*-1 and *t*. Accordingly, the cross sectional estimator will be close to unity. However, in this case it would be wrong to interpret this finding as supportive of the LPE, because the individual log bank sizes are stationary and mean-reverting, and there is no tendency for industry concentration to increase over time.

Recently, some papers have incorporated panel data techniques to investigate the size-growth relationship using panel unit root tests. This approach allows us to exploit all the available information from the dataset, and account for the possibility of heterogeneous bank effects.

For the purposes of panel estimation, we use the modified specification:

$$s_{it} - s_{it-1} = \alpha_i(1-\rho) + \delta_t + (\beta - 1)s_{it-1} + \rho(s_{it-1} - s_{it-2}) + \eta_{it} \tag{5}$$

where $\eta_{it} = \varepsilon_{it} + \rho(1-\beta)s_{it-2}$.

Equation (5) allows us to test the three propositions outlined in section 2. The analysis of the relationship between size and growth (P1) consists of testing the null hypothesis of $H_0 : \beta - 1 = 0$, with the alternative that $H_1 : \beta - 1 \neq 0$. To do so, we use the panel unit root test devised by Breitung and Meyer (1994) and an Ordinary Least Squares (OLS) test. Using Monte Carlo simulations, Bond et ál. (2005) show that these two tests are the most powerful for testing unit roots in micro panels across a set of alternative tests.

The hypothesis of no persistence in growth rates (P2) can be tested as $H_0 : \rho = 0$ under the alternative that $H_1 : \rho \neq 0$. Finally, following Goddard, Mckillop and Wilson (2002), we investigate the existence of homoscedastic growth rates (P3) by applying a standard heteroscedasticity test to the residuals of each estimated equation. A Lagrange multiplier (LM) test based on an auxiliary regression of the squared residuals on the squared lagged size measure produces a heteroscedasticity test statistic distributed χ_1^2 under the null hypothesis of homoscedasticity. When the null is rejected, the sign of the estimated coefficient on the squared initial size measure in the auxiliary regression indicates the direction of the relationship between bank size and the variability of growth.

If we assume homogeneity ($\alpha_i = \alpha$), (5) can be estimated by pooling the data across banks and over time, an using OLS with time dummies to allow for fixed time effects. As long as this underlying assumption is correct, the resulting estimator $\hat{\beta}_{OLS}$ is unbiased. The OLS test is based on the corresponding t-statistic on $\hat{\beta}_{OLS} - 1$ and is asymptotically normal. However, if the individual effects are heterogeneous, the resulting estimator is again biased and inconsistent.

As a response, Breitung and Meyer (1994) modified the OLS test using the following transformation:

$$s_{it} - s_{it-1} = \alpha_i(1-\rho) + \delta_t + (\beta - 1)(s_{it-1} - s_{i0}) + \rho(s_{it-1} - s_{it-2}) + \xi_{it} \qquad (6)$$

where $\xi_{it} = \eta_{it} + \alpha_i(1-\rho) + (\beta - 1)s_{i0}$. The corresponding estimator is denoted by $\hat{\beta}_{BM}$ and is unbiased under the null that β=1. Under the alternative that $\beta \neq 1$, $\hat{\beta}_{BM}$ is upward biased, with a bias equal to $\beta + (1-\beta)/2$. However, its properties remain unaffected by heterogeneity in α_i.

5 Empirical results

To investigate the evolution of the size distribution, empirical results are reported for different estimation periods. First, for commercial and savings banks, we provide estimates for the full sample period 1970–2006, the sub-periods 1980-2006, 1990-2006, the decades 1970-1979, 1980-1989, 1990-1999 and the period 2000-2006. Then, we report estimates for the whole sample of commercial, savings and cooperative banks for the periods 1980-2006, 1990-2006, the two decades 1980-1989, 1990-1999 and the period 2000-2006. In the conducted estimations, the logarithmic size and growth variables based on the assets, deposits and loans size measures are calculated from nominal data. The effects of inflation as well as any factor which is common to all banks are captured entirely by the intercept and the time dummies. The estimation of the parameters is therefore unaffected by the choice between nominal or real size definitions.

5.1 Commercial and savings banks (1970-2006)

Table 3 reports the results of the tests for commercial and savings banks over the full sample period, 1970-2006, and the 1980-2006 and 1990-2006 periods for the three size measures considered. The intercept and the coefficients of the dummy variables are not reported. The estimate of β provides the test for P1, that growth rates and size are independent. For the 1970-2006 and 1980-2006 periods, both the OLS and Breitung-Meyer (B-M) tests reject the LPE for each of the measures considered, with the exception of the B-M test for the loans measure, which provides a non-significant estimate over the 1980-2006 period. The clear pattern is that small banks tend to grow faster than their smaller counterparts. If we consider the period 1990-2006 instead, all the β estimates are closer to one than in the previous periods, and the B-M tests are not significant for none of the size measures, providing support for the LPE. Overall, it seems that as we reduce the weight of the past in the sample, the results indicate an increasing rate of growth for larger banks relative to smaller banks.

The estimate of ρ provides the tests for P2, that growth rates in two consecutive periods are independent of each other. In general, one would expect to find positive persistence in banking, implying that the advantages acquired in one period, carry over to the next. The assets and loans measures show positive and significant persistence, except for the assets size measure in the 1990-2006 period where we found no relationship between consecutive growth rates. On average, banks that achieve above average growth in the credit market in one period tend to grow faster in the next. However, the persistence in deposits is found to be negative in all the sub-periods considered, probably reflecting the intense and growing competition in Spanish deposit markets. This result is consistent with recent studies that find an increase in competition in Spanish [Carbó et ál. (2005); Ayuso and Martínez (2006)] and European deposit markets [Bikker (2003)].

The conducted LM tests reject the null hypothesis of homoscedastic growth at the 1% level in all the estimations and periods. Overall, the negative estimated coefficients on the squared lagged size variables indicate an inverse relationship between size and the variability of growth. Large banks may benefit from diversification advantages that make them less vulnerable to abnormal high fluctuations in growth [Wilson and Williams (2000)]. Similarly, Jovanovic (1982) argues that larger firms are likely to be older than smaller firms and may benefit from learning economies of scale enabling them to avoid costly mistakes. Tschoegl (1983) and Goddard, Mckillop and Wilson (2002) find a similar result in their studies.

In order to further investigate the evolution of the size-growth relationship over time, the whole sample period is divided into four sub-periods: 1970-1979, 1980-1989, 1990-1999 and 2000-2006. As we pointed out in section three, each decade virtually corresponds to different situations of the deregulation, liberalization and integration processes. The corresponding results are reported in table 4.

Over 1970-1979, both tests provide contradictory results. While the OLS test rejects the LPE for the three size measures with $\hat{\beta}_{OLS}<1$, the coefficients for the B-M test are not significant, in accordance with the LPE. The strong regulations that existed in this period and the economic crisis in the late 70s might explain this unclear pattern. While commercial banks had freedom to open branches nationwide from 1974 onwards, savings banks had severe restrictions to expansion, even in their own traditional regions, increasing growth costs and generating a high heterogeneity in growth rates across different institutions. For the 1980-1989 period, $H_0{:}\beta=1$ is rejected in favour of $H_1{:}\beta\neq1$ at the 1% level by both tests. Since all the size-growth estimates are less than unity, small banks tend to grow faster than large banks on average. In this decade, commercial banks still benefit from expansion advantages but to a lesser extent than in the previous decade. In fact, in 1985, the investment coefficients for commercial and savings banks are equalized and savings banks are free to open branches in their local regions. Later, in 1987, interest rates and commissions are fully liberalized. This permitted banks to set deposit and loan rates in response to market conditions and to compete for deposit market share and banking relationships.

During the 1990-1999 period, the OLS test rejects the LPE for the three size measures with $\hat{\beta}_{OLS}<1$. However, the coefficients for the B-M test are not significant, in accordance with the LPE. This evidence suggests that size and growth are still negatively related but to a lower extent than in the 80s. The strong consolidation among savings banks in the early 90s may have allowed large institutions to increase their growth rate. Finally, over 2000 to 2006, both tests show evidence that size and growth are unrelated or positively related, implying, in the latter case, that larger banks grow faster than the smaller ones. The OLS test provides insignificant estimates (and closer to one) for all the size measures. The B-M test, however, provides evidence that larger banks grow faster than the smaller in total assets and total loans, but not in total deposits, where size and growth appear to be independent. The result that larger banks grow faster than the smaller, has been reported in some previous studies and stems, primarily, from the greater role played by growth through acquisitions and mergers among the larger banks [Sutton (1997)]. In fact, integration processes have been tenser during this decade and have accelerated the growth of larger banks.

Overall, the results seem to indicate that the LPE tends to hold over time, as liberalization and deregulation processes occur. Stronger evidence for this result is found using the B-M test rather than with the OLS test. In fact, the two tests differ in the moment of time when size and growth are unrelated. Nonetheless, the obtained results imply that the larger banks tend to increase their rate of growth through time, obtaining efficiency gains and benefiting from scale and scope economies. This result is consistent with a growth orientation in the larger institutions. Certainly, the European integration process and the consequent recent waves of M&A fostered this trend. After 1998, there is a general increase of the average size of the M&A in Spain, a phenomenon paralleled in the EU. This fact shows the increased concern of banks during the last decade with size and the need to become large players due to competitive pressures [Cabral et ál. (2002)]. However, the fact that the vast majority of mergers are domestic may make small institutions disappear in favour of the larger ones. In this respect, the importance of savings banks in several EU countries, including Spain, which create a barrier to foreign banks by reducing the number of institutions available for acquisition, may have fostered these effects [Belaisch et ál. (2001)].

The dynamic evolution of the persistence follows different patterns depending on the size measure employed in the estimations. For the asset size measure, growth persistence is positive but decreasing for the periods 1970-1979, 1980-1989 and 1990-1999. In the period 2000-2006 we find no persistence in asset growth rates. Even though one may expect positive serial correlation in banking, this result is not surprising at all. Liberalization progressively reduces entry barriers and technology advantages become more available to all banks, independently of size. In addition, new advantages may increasingly come from other sources not reflected in the balance sheet such as loan commitments and other off-balance sheet items as well as customer relationships.

Both loans and deposit measures show positive persistence in the 70s. However, the trends of both measures diverge in subsequent decades. The loans measure shows negative and significant persistence in the 80s but follows a decreasing trend in the following periods. In 2000-2006, the coefficients turn out to be positive and highly significant, indicating that advantages in loan markets are carried over time. Overall, this view is consistent with the increased importance of relationship lending on several scores. Information advantages, long-term contractual relationships and improved monitoring activity, can provide market power and make it difficult for new banks to gain market share[8]. The persistence in the deposits measure follows the opposite pattern again, from positive but insignificant in the 1980-1980 and 1990-1999 periods, to negative and significant coefficients in the 2000-2006 period.

Finally, homoscedasticity is again rejected for all the size measures and decades. The negative coefficients indicate higher growth variability in small firms. In addition, heteroscedasticity tends to amplify over time showing that banks are increasing their risk as a response to competitive pressures.

5.2 Commercial, savings and cooperative banks (1980-2006)

Table 5 presents the estimation results for the whole population of commercial, savings and cooperative banks over the 1980-2006 and 1990-2006 periods. For the 1980-2006 period, the OLS tests supports the proposition that size and growth are negatively related for all the size measures. The larger banks in the sample grow in average more slowly than the smaller ones. This result is confirmed by the B-M test for the assets and deposits measures, but not for the loans measure whose coefficient turns out to be insignificant, implying that size and growth are unrelated. In the 1990-2006 period, OLS estimates are highly significant for all the size measures, but B-M estimates are not significant. These results turn out to be similar to those attained with the previous sample, which did not include cooperative banks, and confirm the dynamics towards conformity with the LPE over time, especially with the B-M test. Furthermore, estimated coefficients are slightly higher in all periods and size measures.

8. See Boot (2000) for an extensive discussion of the costs and benefits of relationship lending.

The results on persistence are similar to those attained without cooperatives, with positive and significant persistence in total assets and negative and significant persistence in the deposits size measure. However, persistence effects are now more pronounced since we find higher coefficients in assets and loans and lower (more negative) coefficients in deposits for both the 1980-2006 and 1990-2006 periods. In fact, the estimated coefficient in assets is now significant at the 5% level.

As can be expected, the Lagrange-Multiplier tests reject the null hypothesis of homoscedastic growth with an inverse relationship between size and growth variability. Heteroscedasticity also increases over time. However, the variability of growth rates when cooperative banks are not included in the estimations more than doubles those of the full sample. This result is somewhat surprising given that cooperative banks are fairly small on average and one would expect higher degrees of growth variability in smaller banks. A plausible explanation for this finding is that Spanish cooperative banks tend to specialize more in relational lending than commercial banks. In practice, credit cooperatives lend to closer and smaller borrowers and make more use of collateralized loans than commercial banks [Delgado et ál. (2007)].

The analyses for the 1980-1989, 1990-1999 and 2000-2006 periods, reveal the same pattern that large banks increase their rate of growth over time relative to small banks, but this effect occurs now at a higher pace. Regardless the chosen size measure almost all the size-growth estimates are strictly higher when cooperative banks are included in the sample. The results are shown in table 6. As before, the 1980-1989 estimates reveal that small banks tend to grow slower than larger banks. Over 1990-1999, all the estimates tend to get closer to one, and B-M tests are insignificant. Finally, over the 2000-2006 period, all the B-M estimates turn out to be higher than one and significant at the 5% level, implying that larger banks grow more rapidly than their smaller counterparts.

The estimates of ρ including credit cooperatives turn out again to be quite similar to those attained in the previous section. The persistence in assets follows the same decreasing pattern over time which indicates that scale economies advantages erode quickly due to new competitive pressures. As expected, the ρ estimates for loans are slightly higher when cooperative banks are included in the sample in almost all periods. Cooperatives lend to closer and smaller borrowers and hence should engage in closer lending relationships carrying lending advantages from one period to the next. The fact that the estimates for 2000-2006 are not significant is consistent with the recent view that competition in Spanish loan markets has decreased over time. Finally, the estimates for the deposits size measure evolve from positive but not significant in the 80s to negative and significant over 2000-2006.

Finally, homoscedasticity is again rejected for the sub periods 1990-1999 and 2000-2006, where the negative and highly significant coefficients indicate higher growth variability in small firms. This result is also found for 1980-1989 for the deposits measure, but not for the assets and loans measures. Again, the fact that heteroscedasticity increases over time confirms that banks progressively increase their risk as financial integration occurs and competition increases.

6 Summary and conclusions

We have estimated the size-growth relationship for the whole population of Spanish commercial, savings and cooperative banks over the 1970-2006 period, and different sub-periods corresponding to different scenarios of the liberalization, deregulation and integration processes. Three different size measures have been used: total assets, total loans and total deposits. The panel data estimation technique used to test the hypotheses overcomes several limitations of the classical methodology based on cross-sectional regressions.

Rather than a time-invariant size-growth relationship, our findings point to the existence of different relationship as the banking industry goes through a liberalization and consolidation process. When Spanish banking was highly regulated, we find that smaller banks grew faster than their larger counterparts, indicating that there were diseconomies of scale, monopoly rents and political costs to grow [Tschoegl (1983)]. In recent years, however, we find that larger banks tend to grow at the same rate or faster than smaller banks, a phenomenon consistent with the importance of economies of scale and scope to gain efficiency and the recent waves of M&A. Thus, our study corroborates the conditioned nature of the size-growth relationship and the size distribution of banks, as emphasized by Berger et ál. (1995), Ennis (2001), Jones and Critchfield (2005) and Janicki and Prescott (2006) for the US banking system. Concretely, the dynamic pattern observed points towards the acceptance of the LPE over time. Thus, our findings imply that the size distribution of Spanish banks will become more skewed in next years, and concentration will tend to increase.

Evidence suggests that bank-specific growth persistence also follows a dynamic pattern, but this pattern depends on the selected size measure, highlighting the different characteristics of the banking business. Liberalization and consolidation tend to erode size advantages when measured by total assets. The fact that liberalization progressively reduces entry barriers and technological advantages may increasingly become more available to all banks may explain this result.

The fact that size advantages measured by total assets erode quickly, contrasts with the general concern with size shown by banks in recent years and the general increase of the average size of the M&A deals that occurs after 1998 in Europe. An alternative explanation for merger activity is based on the expected efficiency gains through profitability improvements. Recent studies support this view for the European banking industry[9].

Persistence in loans growth rates tends to increase through liberalization, a finding that is consistent with the increased importance of relationship lending in modern banking and with recent studies that show that competition in Spanish lending markets has decreased over time. Spanish savings and cooperative banks tend to specialize more in relational lending than commercial banks. However, whether relationship banking has potential benefits or costs for borrowers and the overall economy remains an open issue.

Persistence in deposits growth rates tends to decrease over time, and becomes negative in recent years. The fierce competition with respect to funding has been identified in

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9. See Focarelli et ál. (2002), Diaz et ál. (2004) and Campa and Hernando (2006).

recent studies at the Spanish and European settings. The introduction of internet banking may have been a crucial boost factor.

The decline of variability of growth rates with size confirms that larger banks are more capable of diversifying away part of their total risk. However, variability tends to increase over time, indicating that banks are more prone to taking risks as competitive pressures tend to erode market share. The new Basel Capital Accord will be enacted soon as a comprehensive measure to improve on the existing rules by aligning regulatory capital requirements more closely to the underlying risks that banks face. Certainly, the new Accord will have a substantial impact on the competitive forces that will affect the banking industry in the future and the manner in wich banks assess and manage their risks.

As has been pointed out earlier, the evolution of the bank size distribution depends, ultimately, on the nature of the size-growth relationship. Our analyses demonstrate that this relationship changed as deregulation proceeded, so future research should concentrate on gaining a deeper understanding of the economic process by which liberalization and deregulation influence the growth rates of different sized banks.

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Figure 1. Fraction of banks that merged by year (blue bars) and total number of bank mergers (red line).

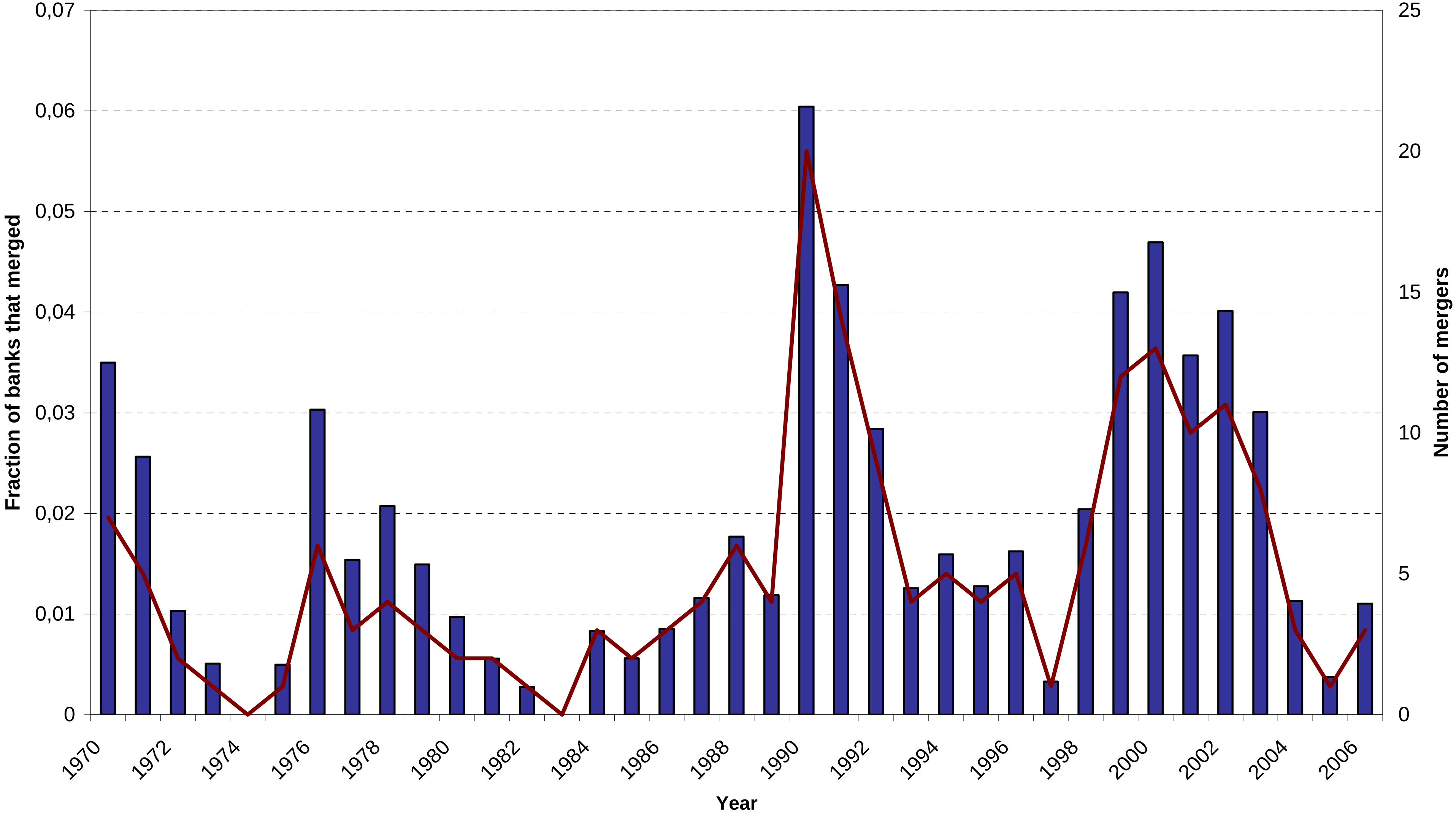

Table 1. Descriptive Statistics. Nominal Size.

	1970			1980			1990			2000			2006		
	N	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.
Assets															
Total	*199*	71	182	*361*	300	908	*331*	1387	4025	*277*	4053	17338	*272*	8750	31088
Commercial Banks	*111*	86	225	*125*	602	1411	*158*	1891	5013	*139*	4811	22777	*142*	9251	37391
Savings Banks	*88*	51	100	*81*	365	570	*66*	1788	2361	*48*	7154	10593	*47*	17137	24151
Credit Unions	-	-	-	*155*	22	45	*107*	446	2879	*90*	1656	7806	*84*	4232	20486
Loans															
Total	*199*	36	106	*361*	154	502	*331*	632	1746	*277*	2245	8371	*272*	5875	19120
Commercial Banks	*111*	51	138	*125*	340	800	*158*	918	2302	*139*	2549	10804	*142*	5624	21760
Savings Banks	*88*	19	29	*81*	143	216	*66*	913	1412	*48*	5091	8131	*47*	15224	24483
Credit Unions	-	-	-	*155*	11	20	*107*	48	117	*90*	335	780	*84*	1078	2812
Deposits															
Total	*199*	51	139	*361*	204	653	*331*	836	2469	*277*	2248	8512	*272*	4613	15699
Commercial Banks	*111*	59	172	*125*	379	1016	*158*	984	2914	*139*	2219	10612	*142*	3946	17899
Savings Banks	*88*	40	75	*81*	293	440	*66*	1688	2945	*48*	5881	8658	*47*	12950	19163
Credit Unions	-	-	-	*155*	16	31	*107*	91	203	*90*	415	966	*84*	1074	2680

Figures in millions of euros.

Table 2. Descriptive Statistics. Growth.

	1970-1979			1980-1989			1990-1999			2000-2006		
	N	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.	*N*	Mean	S.D.
Assets												
Total	*201*	1.982	1.007	*337*	1.222	1.221	*285*	0.922	1.132	*272*	0.806	1.266
Commercial Banks	*119*	2.099	1.098	*149*	0.871	1.692	*142*	0.871	1.570	*142*	0.898	1.726
Savings Banks	*82*	1.813	0. 835	*78*	1.541	0.372	*51*	0.964	0.300	*47*	0.807	0.175
Cooperative Banks	-	-	-	*110*	1.470	0.556	*92*	0.979	0.351	*83*	0.646	0.340
Loans												
Total	*201*	2.109	0.991	*337*	1.084	1.410	*285*	1.161	1.635	*272*	0.935	2.046
Commercial Banks	*119*	2.302	1.184	*149*	0.570	1.849	*142*	0.960	2.303	*142*	0.946	2.901
Savings Banks	*82*	1.834	0.511	*78*	1.575	0.568	*51*	1.253	0.248	*47*	1.013	0.184
Cooperative Banks	-	-	-	*110*	1.403	0.838	*92*	1.406	0.462	*83*	0.869	0.256
Deposits												
Total	*201*	1.280	1.387	*337*	1.228	2.384	*285*	0.521	2.736	*272*	0.948	2.914
Commercial Banks	*119*	2.036	1.359	*149*	0.810	3.402	*142*	0.079	3.797	*142*	1.248	3.983
Savings Banks	*82*	0.184	0.050	*78*	1.619	1.210	*51*	0.919	0.229	*47*	0.748	0.297
Cooperative Banks	-	-	-	*110*	1.518	0.569	*92*	0.998	0.355	*83*	0.565	1.047

Figures are based on annual logarithmic growth rates calculated for banks that are operative the last year of each period.

Table 3. Estimation results for commercial and savings banks.

	Assets		Loans		Deposits	
	OLS	B-M	OLS	B-M	OLS	B-M
1970-2006						
$\hat{\beta}$	0.9769**	0.97551**	0.9764**	0.9888*	0.9779**	0.9773**
	(-7.85)	*(-6.97)*	*(-6.12)*	*(-2.43)*	*(-5.81)*	*(-4.75)*
$\hat{\rho}$	0.0619**	0.0675**	0.0406**	0.0385**	-0.0380**	-0.0316**
	(5.53)	*(5.97)*	*(3.22)*	*(2.98)*	*(-3.28)*	*(-2.63)*
Heterosc.	-0.0024**	-0.0025**	-0.0065**	-0.0067**	-0.0169**	-0.0170**
	330.18	*27.85*	*61.84*	*63.81*	*192.60*	*140.23*
1980-2006						
$\hat{\beta}$	0.9756**	0.9646**	0.9783**	0.9989	0.9798**	0.9837**
	(-5.90)	*(-6.66)*	*(-4.45)*	*(-0.17)*	*(-4.64)*	*(-3.00)*
$\hat{\rho}$	0.0579**	0.0744**	0.0417**	0.0325*	-0.0310*	-0.0275*
	(4.30)	*(5.36)*	*(2.76)*	*(2.05)*	*(-2.26)*	*(-1.99)*
Heterosc.	-0.0046**	-0.0046**	-0.0111**	-0.0113**	-0.0204**	-0.0206**
	45.90	*46.88*	*91.82*	*92.11*	*132.68*	*134.15*
1990-2006						
$\hat{\beta}$	0.9780**	0.9927	0.9808**	1.0070	0.9826**	0.9872
	(-5.62)	*(-0.98)*	*(-3.28)*	*(0.80)*	*(-3.36)*	*(-1.52)*
$\hat{\rho}$	0.0314	0.0345	0.0977**	0.0833**	-0.0634**	-0.0608**
	(1.85)	*(1.88)*	*(4.82)*	*(3.78)*	*(-3.66)*	*(-3.27)*
Heterosc.	-0.0050**	-0.0052**	-0.0121**	-0.0124**	-0.0201**	-0.0202**
	66.19	*65.07*	*65.23*	*65.50*	*99.82*	*100.11*

**/* indicate that the coefficient is significantly different from zero at the 1%/5% level. OLS and B-M refer to the ordinary least squares and Breitung-Meyer unit root tests. *t*-statistics are shown beneath in brackets. The reported *t*-statistics for $\hat{\beta}$ refer to the coefficient (β-1). 'Heterosc' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics. Intercept and time dummy variables are not reported.

Table 4. Estimation results for commercial and savings banks.

	Assets		**Loans**		**Deposits**	
	OLS	B-M	OLS	B-M	OLS	B-M
1970-1979						
$\hat{\beta}$	0.9708**	1.0012	0.9704**	0.9948	0.9748**	0.9834
	(-8.36)	*(0.16)*	*(-7.87)*	*(-0.51)*	*(-4.56)*	*(-0.96)*
$\hat{\rho}$	0.0715**	0.0743**	0.1497**	0.1705	0.1575**	0.1965**
	(3.85)	*(3.58)*	*(-6.81)*	*(6.89)*	*(4.54)*	*(5.12)*
Heterosc.	-0.0012**	-0.0013**	-0.0014**	-0.0015**	-0.0032*	-0.0033*
	143.38	*32.83*	*28.48*	*30.30*	*4.12*	*4.27*
1980-1989						
$\hat{\beta}$	0.9733**	0.9201**	0.9658**	0.9483**	0.9507**	0.9473**
	(-2.87)	*(-4.17)*	*(-3.14)*	*(-2.86)*	*(-4.24)*	*(-3.22)*
$\hat{\rho}$	0.0889**	0.1495**	-0.0528*	-0.0284	0.0133	0.0373
	(-2.87)	*(4.64)*	*(-1.96)*	*(-0.93)*	*(0.53)*	*(1.29)*
Heterosc.	-0.0054*	-0.0053**	-0.0099**	-0.0101**	-0.0237**	-0.0245**
	5.86	*5.86*	*14.99*	*15.98*	*30.68*	*32.70*
1990-1999						
$\hat{\beta}$	0.9584**	0.9786	0.9724*	1.0322	0.9784*	1.0239
	(-6.39)	*(-1.53)*	*(-2.15)*	*(1.91)*	*(-2.60)*	*(1.62)*
$\hat{\rho}$	0.0595*	0.0776*	-0.0416	-0.0833**	-0.0222	-0.0459
	(2.15)	*(-1.53)*	*(-1.52)*	*(-2.65)*	*(-0.85)*	*(-1.56)*
Heterosc.	-0.0049**	-0.0055**	-0.0120**	-0.0121**	-0.0181**	-0.0181**
	36.89	*39.93*	*50.02*	*50.79*	*80.28*	*79.48*
2000-2006						
$\hat{\beta}$	0.9893	1.0456**	0.9845	1.0426*	0.9958	1.0379
	(-1.52)	*(2.69)*	*(-1.92)*	*(2.06)*	*(-0.54)*	*(1.72)*
$\hat{\rho}$	0.0122	-0.0382	0.2456**	0.1782**	-0.0584*	-0.1037**
	(0.46)	*(-1.19)*	*(6.61)*	*(3.73)*	*(-2.00)*	*(-2.85)*
Heterosc.	-0.0060*	-0.0060**	-0.0142**	-0.0146**	-0.0209**	-0.0212**
	5.48	*22.99*	*17.79*	*17.71*	*28.43*	*27.91*

**/* indicate that the coefficient is significantly different from zero at the 1%/5% level. OLS and B-M refer to the ordinary least squares and Breitung-Meyer unit root tests. *t*-statistics are shown beneath in brackets. The reported *t*-statistics for $\hat{\beta}$ refer to the coefficient (β-1). 'Heterosc' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics. Intercept and time dummy variables are not reported.

Table 5. Estimation results for commercial, savings and cooperative banks.

	Assets		Loans		Deposits	
	OLS	B-M	OLS	B-M	OLS	B-M
1980-2006						
$\hat{\beta}$	0.9875**	0.9716**	0.9831**	1.0017	0.9827**	0.9850**
	(-5.83)	*(-6.56)*	*(-5.84)*	*(0.37)*	*(-4.95)*	*(-3.83)*
$\hat{\rho}$	0.0585**	0.0738**	0.0464**	0.0378*	-0.0319**	-0.0281*
	(5.37)	*(6.58)*	*(3.88)*	*(3.00)*	*(-2.83)*	*(-2.39)*
Heterosc.	-0.0015**	-0.0015**	-0.0043**	-0.0044**	-0.0144**	-0.0146**
	13.54	*14.29*	*38.01*	*38.74*	*115.34*	*116.85*
1990-2006						
$\hat{\beta}$	0.9870**	0.9952	0.9848**	1.0071	0.9853**	0.9881
	(-4.54)	*(-0.78)*	*(-3.82)*	*(0.99)*	*(-3.40)*	*(-1.64)*
$\hat{\rho}$	0.0325*	0.0339*	0.0993**	0.0862**	- 0.0657**	-0.0627**
	(2.29)	*(2.22)*	*(5.98)*	*(4.77)*	*(-4.42)*	*(-3.92)*
Heterosc.	-0.0025**	-0.0025**	-0.0065**	-0.0066**	-0.0178**	-0.0180**
	37.13	*37.13*	*42.04*	*42.04*	*112.10*	*112.52*

**/* indicate that the coefficient is significantly different from zero at the 1%/5% level. OLS and B-M refer to the ordinary least squares and Breitung-Meyer unit root tests. *t*-statistics are shown beneath in brackets. The reported *t*-statistics for $\hat{\beta}$ refer to the coefficient (β-1). 'Heterosc' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics. Intercept and time dummy variables are not reported.

Table 6. Estimation results for commercial, savings and cooperative banks.

	Assets		Loans		Deposits	
	OLS	B-M	OLS	B-M	OLS	B-M
1980-1989						
$\hat{\beta}$	0.9853**	0.9301**	0.9767**	0.9610**	0.9666**	0.9481**
	(-3.74)	*(-4.90)*	*(-4.96)*	*(-2.97)*	*(-4.68)*	*(-4.09)*
$\hat{\rho}$	0.0843**	0.1472**	-0.0376	-0.0128	0.0081	0.0408
	(4.24)	*(5.99)*	*(-1.89)*	*(-0.55)*	*(0.43)*	*(1.82)*
Heterosc.	-0.0001	-0.0001	-0.0009	-0.0009	-0.0088**	-0.0089**
	0.00	*0.00*	*0.54*	*0.54*	*11.01*	*11.55*
1990-1999						
$\hat{\beta}$	0.9767**	0.9808	0.9801**	0.9803	0.9807**	1.0251
	(-5.75)	*(-1.66)*	*(-2.83)*	*(-1.79)*	*(-2.80)*	*(1.95)*
$\hat{\rho}$	0.0600**	0.0766**	-0.0345	-0.0756**	-0.0226	-0.0470
	(2.60)	*(2.94)*	*(-1.52)*	*(-2.89)*	*(-1.00)*	*(-1.85)*
Heterosc.	-0.0021**	-0.0020**	-0.0060**	-0.0060**	-0.0153**	-0.0153**
	15.41	*16.36*	*27.73*	*28.19*	*72.97*	*72.49*
2000-2006						
$\hat{\beta}$	0.9970	1.0222*	0.9850*	1.0427*	0.9974	1.0387*
	(-0.61)	*(2.36)*	*(-2.46)*	*(2.37)*	*(-0.41)*	*(2.07)*
$\hat{\rho}$	0.0142	-0.0103	0.2446**	0.1784**	-0.0574*	-0.1028**
	(0.64)	*(-0.43)*	*(8.13)*	*(4.62)*	*(-2.33)*	*(-3.33)*
Heterosc.	-0.0037**	-0.0037**	-0.0087**	-0.0089**	-0.0195**	-0.0197**
	18.23	*16.69*	*13.71*	*13.71*	*36.57*	*36.19*

**/* indicate that the coefficient is significantly different from zero at the 1%/5% level. OLS and B-M refer to the ordinary least squares and Breitung-Meyer unit root tests. *t*-statistics are shown beneath in brackets. The reported *t*-statistics for $\hat{\beta}$ refer to the coefficient (β-1). 'Heterosc' is the estimated coefficient on the lagged squared size variable in the auxiliary regression used to obtain the heteroscedasticity LM test statistic, shown beneath in italics. Intercept and time dummy variables are not reported.

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Unidad de Publicaciones
Alcalá, 522; 28027 Madrid
Telephone +34 91 338 6363. Fax +34 91 338 6488
e-mail: publicaciones@bde.es
www.bde.es