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FACTORS EXPLAINING THE INTEREST MARGIN IN THE BANKING SECTORS OF THE EUROPEAN UNION

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Abstract

This study analyses the interest margin in the principal European banking sectors (Germany, France, the United Kingdom, Italy and Spain) in the period 1993-2000 using a panel of 15,888 observations, identifying the fundamental elements affecting this margin. Our starting point is the methodology developed in the original study by Ho and Saunders (1981) and later extensions, but widened to take banks' operating costs explicitly into account. Also, unlike the usual practice in the literature, a direct measure of the degree of competition (Lerner index) in the different markets is used. The results show that the fall of margins in the European banking system is compatible with a relaxation of the competitive conditions (increase in market power and concentration), as this effect has been counteracted by a reduction of interest rate risk, credit risk, and operating costs.

Key words: margins, competition

JEL Classification: G21, L11

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1. Introduction[*]

The banking sector plays a fundamental role in economic growth, as it is the basic element in the channelling of funds from lenders to borrowers. In this sense, it is important that this work of intermediation by the banks is carried out with the lowest possible cost in order to achieve greater social welfare. Obviously, the lower the banks' interest margin, the lower the social costs of financial intermediation will be.

In this context, one part of the literature on banking has concentrated on analysing the elements determining the interest margin. The pioneering study by Ho and Saunders (1981), starting from the conception of banking firms as mere intermediaries between lenders and borrowers, finds that the interest margin has two basic components: the degree of competition of the markets and the interest rate risk to which the bank is exposed. This model has been extended in several studies: Allen (1988) widens it to permit the existence of different types of credits and deposits; McShane and Sharpe (1985) change the source of interest rate risk, situating it in the uncertainty of the money markets instead of the interest rates on credits and deposits, as in the original study by Ho and Saunders (1981); Angbanzo (1997) extends the model to take into account credit risk as well as interest rate risk.

This study analyses the interest margin in the principal European banking sectors, identifying the fundamental elements affecting this margin. The starting point for analysing the determinants of the interest margin is the original model of Ho and Saunders (1981) and later extensions by other authors, but widened to take banks´operating costs explicitly into account. Also, unlike the usual practice in the literature described above, we will use direct measurements of the degree of competition in the different markets, calculated by means of concentration indices or Lerner indices of market power.

The reduction of the interest margin that has occurred in recent years in the banking sectors of the European Union is usually interpreted as a result of the growth of competition. However, in the light of the theoretical model, banking margins do not depend only on the intensity of competition, but also on other factors such as interest risk, credit risk, the evolution of operating costs, etc. A decrease in banking margins is therefore compatible with a decrease in the degree of competition if the effect of the

latter is counteracted by the effect of the evolution of the other determinants of the interest margin.

In recent years many studies have been published[1] which analyse the evolution of competition in the banking sectors of Europe in the context of phenomena like deregulation, globalisation, increased concentration due to mergers, etc. These studies concentrate, in general, on analysing the effect of market concentration on competition, considering neither the impact on margins nor the effect of variables other than competition which also affect banking margins, and therefore intermediation costs.

Of special interest because of the methodology and sample used is the study by Saunders and Schumacher (2000), who apply the original model of Ho and Saunders (1981) to analyse the determinants of the interest margin in six countries of the European Union and in the United States during the period 1988-95. Our study differs from Saunders and Schumacher (2000) in several aspects: a) we introduce the influence of operating costs into the modelling of the interest margin; b) we use direct measurements of market power; c) the determinants of the interest margin are analysed in a single stage; d) it extends the period of study until the year 2000, though it is centred on the principal European countries (Germany, France, United Kingdom, Italy and Spain); and e) the sample consists of a panel data of 1,826 banks (in 2000), as opposed to the 614 of Saunders and Schumacher's study.

The results of analysing the contribution of the different factors explaining the interest margin may be useful in the design of specific measures of economic policy. Thus, if a significant part of the evolution of the interest margin is explained by the volatility of interest rates and the credit risk instead of the market power of firms, public policies should be aimed at achieving a climate of financial stability. If, on the contrary, market power is the factor that most helps to explain the variability of the interest margin, public initiatives must be aimed at encouraging competition among banks. Obviously, depending on the contribution of the other variables explaining the interest margin (quality of management, operating costs, etc.), the specific measures of economic policy must be oriented towards specific aspects of banking business.

In this context, the study is structured as follows. Section 2 briefly describes the methodology used to identify the determinants of the interest margin. Section 3 develops the empirical specification of the model to be estimated and of the variables, and the sample used is described in section 4. Section 5 presents the empirical results of the estimation. Finally, section 6 contains the main conclusions of the study.

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[1] Corvoisier and Gropp (2002), De Bandt and David (2000), Bikker, and Haaf (2002), among others.

2. The determinants of the interest margin

The starting point for analysing the determinants of the interest margin is the model of Ho and Saunders (1981). Different versions of the model have been estimated for the specific case of the United States in Ho and Saunders (1981), Allen (1988) and Angbazo (1997); and for a sample of seven OCDE countries (six European ones plus the United States) in Saunders and Schumacher (2000).

In this models, a bank is viewed as a risk-averse dealer in the credit market[2], acting as an intermediary between demanders and suppliers of funds. The planning horizon is a single period during which the bank sets interest rates at the beginning of the period, before any deposits or loans are made, remain constant for the whole period. The banks, who are risk averse and have to deal with demands for loans, and offers of deposits, that reach them asymmetrically in time, must set interest rates on loans (r_L) and deposits (r_D) optimally so as to minimise the risk deriving from the uncertainty of interest rates in the money markets to which they have to resort in the event of excessive demand for loans or insufficient supply of deposits. For this, they set their interest rates as a margin relative to the interest rate of the money market (r), i.e.:

$$r_D = r - a \qquad (1)$$

$$r_L = r + b$$

a and b being the margins relative to the money market interest rate set by the banks for deposits and loans, respectively. Hence the unit margin or spread s can be expressed as follows:

$$s = r_L - r_D = a + b \qquad (2)$$

The intuition of the model is as follows. Let us suppose that a new deposit reaches the bank before any new demand for loans. In this event, the bank will temporarily invest the funds received in the money market at an interest rate r, assuming a risk of reinvestment at the end of the period if money market interest rates fall. Similarly, if a new demand for loans reaches the bank before any new deposit, the bank will obtain the funds in the money market, and will therefore face a risk of refinancing if interest rates rise. Furthermore, the return of loans is uncertain because of the probability that some of them will not be repaid, i.e. due to the credit risk. Consequently

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[2] The assumption of risk averse behaviour on the part of banks has been justified extensively in the literature (see, among others, McShane and Sharpe, 1985; and Angbazo, 1997).

the bank will apply a margin to loans (*b*) and deposits (*a*) that will compensate for both the interest rate and credit risk.

The initial wealth of the bank is determined by the difference between its assets – loans *(L)* and net money market assets *(M)*- and its liabilities – deposits *(D)*:

$$W_0 = L_0 - D_0 + M_0 = I_0 + M_0 \tag{3}$$

$L_o - D_o$ being the net credit inventory (I_0).

The criticism by Lerner (1981) of the original model of Ho and Saunders (1981) is taken up incorporating into the model the productive nature of the banking firm by including the production costs associated with the process of intermediation between deposits and loans. Thus, the operating costs of a banking firm are assumed to be a function of the deposits captured (*C(D)*) and the loans made (*C(L)*), so that the costs of the net credit inventory can be expressed as *C(I)=C(L)-C(D)*.

With all these assumptions, the final wealth of the bank will be:

$$\begin{aligned}
W_T &= (1 + r_I + Z_I)I_0 + M_0(1 + r + Z_M) - C(I_0) \\
&= I_0 + I_0 r_I + I_0 Z_I + M_0 + M_0 r + Z_M M_0 - C(I_0) \\
&= W_0(1 + r_w) + I_0 Z_I + M_0 Z_M - C(I_0)
\end{aligned} \tag{4}$$

where $r_I = \dfrac{r_L L_0 - r_D D_0}{I_0}$ is the average profitability of the net credit inventory,

$r_w = r_I \dfrac{I_0}{W_0} + r \dfrac{M_0}{W_0}$ is the average profitability of the bank's initial wealth and

$Z_I = Z_L \dfrac{L_0}{I_0} + Z_D \dfrac{D_0}{I_0} = Z_p \dfrac{L_0}{I_0}$ is the average risk of the net credit inventory[3]. Z_M and Z_L

reflect the uncertainty faced by the banks, which is of two kinds: interest rate risk, distributed as a random variable Z_M-$N(0, \sigma^2_M)$, and credit risk – the profitability of the loan is uncertain and is distributed as a random variable Z_L-$N(0, \sigma^2_L)$. In order to take into account the interaction between credit risk and interest rate risk the joint distribution of the two disturbances is assumed to be bivariate normal with non-null covariance (σ_{LM}).

Banks are maximizers of expected utility. The bank's utility function is approximated using the Taylor expansion around the expected level of wealth $(\overline{W} = E(W))$:

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[3] It is assumed that the deposits are an activity that is not subject to any kind of risks. Hence, $Z_D=0$.

$$EU(W) = U(\overline{W}) + U'(\overline{W})E(W - \overline{W}) + \frac{1}{2}U''(\overline{W})E(W - \overline{W})^2 \qquad (5)$$

where it is assumed that the bank's utility function is continuous doubly differentiable with $U'>0$ and $U''<0$ and therefore that the bank is risk averse[4].

When a new deposit D is made, remunerated at a rate r_D, the bank, if it does not grant an additional credit, will invest the funds thus captured in the money market, obtaining a return $(r+Z_M)D$. Bearing in mind that $W - \overline{W} = L_0 Z_L + M_0 Z_M$, and given the existence of operating costs in the capture of deposits $C(D)$, substituting the new value of the final wealth in (5) we find that the increase in expected utility associated with the new deposit will be[5]:

$$\Delta EU(W_D) = EU(W_T) - EU(W)$$
$$= U'(\overline{W})\left[aD - C(D)\right] + \frac{1}{2}U''(\overline{W})\left[(aD - C(D))^2 + (D + 2M_0)D\sigma^2_M + 2L_0 D\sigma_{LM}\right] \qquad (6)$$

Similarly, if a new request for credit is made for which there is also a cost of production $C(L)$, the increase in expected utility would be:

$$\Delta EU(W_L) = EU(W_T) - EU(W)$$
$$= U'(\overline{W})\left[bL - C(L)\right] + \frac{1}{2}U''(\overline{W})\begin{bmatrix} (bL - C(L))^2 + (L + 2L_0)L\sigma^2_L + (L - 2M_0)L\sigma^2_M \\ + 2(M_0 - L_0 - L)L\sigma_{LM} \end{bmatrix} \qquad (7)$$

As in the other models we assume that credits and deposits are made randomly according to a Poisson process, the probability of granting a credit or capturing a deposit being a decreasing function of the margins applied by the bank:

$$\Pr_D = \alpha_D - \beta_D a$$
$$\Pr_L = \alpha_L - \beta_L b \qquad (8)$$

The problem of maximisation is therefore as follows:

$$Max_{a,b}EU(\Delta W) = (\alpha_D - \beta_D a)\Delta EU(W_D) + (\alpha_L - \beta_L b)\Delta EU(W_L) \qquad (9)$$

The first order conditions with respect to a and b are[6]:

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[4] If the bank were risk neutral, the bank would be an expected wealth maximizer.
[5] See the appendix.
[6] It is assumed, following Ho and Saunders (1981) and subsequent extensions, that the second order terms of the margins and costs of the Taylor's expansion of expressions (6) and (7) are negligible.

$$a = \frac{1}{2}\frac{\alpha_D}{\beta_D} + \frac{C(D)}{D} - \frac{1}{4}\frac{U''(\overline{W})}{U'(\overline{W})}[(D + 2M_0)\sigma^2_M + 2L_0\sigma_{LM}]$$

$$b = \frac{1}{2}\frac{\alpha_L}{\beta_L} + \frac{1}{2}\frac{C(L)}{L} - \frac{1}{4}\frac{U''(\overline{W})}{U'(\overline{W})}[(L + 2L_0)\sigma^2_L + (L - 2M_0)\sigma^2_M \quad (10)$$
$$+ 2(M_0 - L_0 - L)\sigma_{LM}]$$

so the optimal interest margin *s* is equal to:

$$s = a + b = \frac{1}{2}\left(\frac{\alpha_D}{\beta_D} + \frac{\alpha_L}{\beta_L}\right) + \frac{1}{2}\left(\frac{C(L)}{L} + \frac{C(D)}{D}\right)$$
$$- \frac{1}{4}\frac{U''(\overline{W})}{U'(\overline{W})}[(L + 2L_0)\sigma^2_L + (L + D)\sigma^2_M + 2(M_0 - L)\sigma_{LM}] \quad (11)$$

Therefore, according to the theoretical model used, the determinants of the interest margin are as follows:

a) The competitive structure of the markets. This depends on the elasticity of the demand for loans and the supply of deposits (β), such that the less elastic the demand for credit (or supply of deposits), the less will be the value of β, and the bank will be able to apply high margins if it exercises monopoly power. Consequently, the ratio α/β proxies the possible monopoly profits implicit in bank margins.

b) Average operating costs. The extension of the model realized in this paper yield the inclusion of an additional term, the average operating costs, in the explanatory equation of the interest margin. Consequently, firms that incur high unit costs will logically need to work with higher margins to enable them to cover their higher operating costs. Observe that, even in the absence of market power and of any kind of risk, a positive margin will be necessary in order to cover operating costs.

c) Risk aversion, expressed by the coefficient of absolute risk aversion, *-U´´(W)/U´(W)*, where on the assumption that the bank is risk averse, *U´´(W)<0*, the former expression is greater than zero. Obviously, the more risk-averse banks will charge higher margins[7].

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[7]In the risk-neutral case (the bank is wealth maximizer), the interest margin would depend only on market power and operating costs.

d) The volatility of money market interest rates (σ^2_M). The more volatile they are, the greater will be the market risk, and it will therefore be necessary to operate with higher margins, as the banks will require a higher premium at the margin.

e) The credit risk, captured by the variable σ^2_L. The greater the uncertainty or the volatility of the return expected on the loans granted (risk of default), the greater will be the margin with which the bank works.

f) The covariance or interaction between interest rate risk and credit risk σ_{LM}.

g) The average size of the credit and deposit operations undertaken by the bank (captured by the term $L+D$) and the total volume of credits ($L+2L_0$). The model predicts that the unit margins are an increasing function of the average size of operations. The justification is that, for a given value of credit risk and of market risk, an operation of greater size would mean a greater potential loss, so the bank will require a greater margin. Likewise, the potential loss will be greater for those banks in which the volume of credits granted is greater.

The assumptions made in deriving the interest margin from the theoretical model set out provide a margin that could be called "pure". Obviously, in practice there exist other variables that explain the interest margin, capturing the influence of aspects - institutional, regulatory, etc. – which potentially distort the pure margin and are difficult to incorporate into the theoretical model. Specifically, the additional variables considered in the literature are:

h) The payment of implicit interest: the bank, instead of remunerating deposits explicitly by paying an interest rate, offers various "free" banking services.

i) The opportunity cost of keeping reserves. The maintenance of bank reserves remunerated at an interest rate below that of the market involves costs whose magnitude will depend on the volume of reserves and on their opportunity cost. The sign is expected to be positive, as the greater the volume of liquid reserves, the greater the opportunity costs, so a greater interest margin is needed.

j) The quality of management. As shown by Angbanzo (1997), good management implies selecting highly profitable assets and low-cost liabilities, so a positive relationship is to be expected between the quality of management and the interest margin.

3. Empirical approach

<u>Empirical approach</u>

There are two empirical approaches to the model of Ho and Saunders (1981) and its subsequent extensions. On the one hand, in Ho and Saunders (1981) and Saunders and Schumacher (2000) the empirical estimation of the determinants of the interest margin follows a two-stage process. In the first stage, the effect of the explanatory variables of the interest margin not explicitly introduced into the theoretical model is controlled in order to obtain an estimate of the "pure" margin. The second stage analyses the relationship between this "pure" margin and the variables posited by the theoretical model. The application of this approach has the advantage that it allows a "pure" interest margin to be estimated, though it requires a time series long enough to be able to estimate the pure margin.

On the other hand, McShane and Sharpe (1985) and Angbazo (1997) use a single-stage approach, including in the explanation of the interest margin both the variables of the theoretical model and the additional variables or imperfections that reflect other aspects not incorporated into the modelling of the pure margin.

Since the period studied in this paper covers the years 1993 to 2000, the availability of annual observations for 8 years makes it impossible to apply the two-stage methodology, so we use the single-stage methodology.

<u>Variables</u>

The estimation of the theoretical model developed in the previous section for the specific case of the banking sectors of the European countries considered requires the variables of the model to be proxied empirically as a function of the statistical information available in the data base.

According to the theoretical model presented, there are seven variables that determine the interest margin: the structure of the market, unit operating costs, the banks' degree of risk aversion, the volatility of market interest rates, credit risk, the covariance between the latter and market risk, the average size of operations and the volume of credits granted. The three imperfections mentioned above are also included. Each of these variables is proxied empirically as follows:

a) Market structure

To proxy the competitive structure of the market two alternative variables will be used. First, the degree of concentration of the market in which the banks compete, proxied by the Herfindahl index (HERF), is used. This index, defined as the sum of the squares of the market shares, is proxied on the assumption that competition takes place on a national scale, as only in the case of big banks and in wholesale markets could a greater than national market be assumed[8]. Total assets are used as a proxy of banking activity.

Second, an alternative indicator of the degree of competition in banking markets is the estimation of the Lerner index (LERNER), widely used in the specific case of banks[9]. This index, defined as the difference between the price and the marginal cost, divided by the price, measures the capacity to set prices above the marginal cost, being an inverse function of the elasticity of demand and of the number of banks[10]. The values of the index range from 0 (perfect competition) to 1 (monopoly). The empirical approach to the Lerner index is based on the procedure used in Maudos and Pérez (2001) and Fernández de Guevara et al. (2001) where the prices are calculated by estimating the average price of bank production (proxied by total assets) as a quotient between total revenue and total assets. Algebraically, the Lerner index is

$$LERNER_i = \frac{p_i - MC_i}{p_i} \tag{12}$$

where the product price p_i=total revenue (interest income+other operating income)/total assets and MC_i is the marginal cost of producing an additional unit of output. The marginal cost is estimated on the basis of the following translogarithmic cost function:

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[8] As the European Commission acknowledges (FSAP, 1999), banking markets, especially in retail markets, are still highly segmented in European countries. For that reason, an objective of the Financial Services Action Plan is to achieve a single financial market integrated at European level in 2005.

[9] See Prescott and McCall (1975) for the US banks, Shaffer (1993) for the Canadian banks, Ribon and Yosha (1999) for the case of Israel, Angelini and Cetorelli (1999) for Italian banks, Maudos and Pérez (2001) for the case of Spain and Fernández de Guevara et al (2001) for a sample of major European countries.

[10] See Freixas and Rochet (1997), chapter 3.

$$\ln C_i = \alpha_0 + \ln TA_i + \frac{1}{2}\alpha_k \left(\ln TA_i\right)^2 + \sum_{j=1}^{3} \beta_j \ln w_{ji} +$$

$$+\frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{jk} \ln w_{ji} \ln w_{ki} + \frac{1}{2}\sum_{j=1}^{3} \gamma_j \ln TA_i \ln w_{ji} + \mu_1 Trend + \mu_2 \frac{1}{2} Trend^2 + \qquad (13)$$

$$+\mu_3 Trend \ln TAi + \sum_{j=1}^{3} \lambda_j Trend \ln w_{ji} + \ln u_i$$

where C_i are the bank's total costs (financial and operating), TA_i total assets, and w_i the price of the factors of production as defined below:

-w_1 = price of labour: personnel costs / total assets[11].

-w_2 = price of physical capital: operating costs (except personnel costs)/ fixed assets.

-w_3 = price of deposits: financial costs /deposits[12].

The costs function is estimated introducing fixed individual effects in order to capture the influence of variables specific to each bank. We also include a trend (*Trend*) to capture the influence of technical change leading to shifts in the cost function over time. As usual, the estimation is done under the restrictions of symmetry and degree one homogeneity in the prices of inputs.

b) Operating costs

Average operating costs are proxied as a quotient between operating expenses and total assets (AOC).

c) Degree of risk aversion

Following the approach used by McShane and Sharpe (1985), the ratio equity / total assets[13] is used as a proxy variable for the degree of risk aversion (RISKAVER). According to the theoretical model, a positive relation is expected between this variable and the interest margin, as those firms that are most risk averse will require a higher

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[11] The data base used –BankScope- does not offer information on the number of workers, so the average price of the labour factor is proxied as a quotient between personnel costs and total assets.

[12] Specifically, deposits correspond to the heading *customer and short term funding* in BankScope database.

[13] The equity /assets ratio is a measure of capitalisation, presenting limitations as a measure of risk aversion given the influence of regulation on minimum equity. The results obtained in relation to this variable must therefore be interpreted with caution.

margin in order to cover the higher costs of equity financing compared to external financing[14].

d) Volatility of market interest rates

Uncertainty in the money markets is reflected in the theoretical model by the variance of market interest rates (σ^2_M). The empirical proxying of this variable is consequently based on a measurement of the volatility of market interest rates such as the standard deviation (SD). Specifically, we will use the annual standard deviation of daily interest rates of three alternative types, attempting to approximate the average period of maturity of the assets and liabilities in the banks' balance sheets[15]:

- The three-month interest rate in the inter-bank market (SD3M).

- Return on medium term public debt in national markets: treasury bonds with three-year maturity period (SD3Y).

- Return on long term public debt in national markets: treasury bonds with ten year maturity period (SD10Y).

On the basis of daily interest rate data we have calculated the corresponding annual deviations in each of the countries analysed[16].

e) Credit risk

The risk of non-repayment or default on a credit (credit risk) requires the bank to apply a risk premium implicitly in the interest rates charged for the operation. Ideally, the credit risk could be proxied by variables such as problem loans and the provisions for insolvencies. Unfortunately, Bankscope database only offers these variables for a very small number of banks[17], so credit risk will be proxied initially by the loans/total assets ratio (CRERISK). It is to be expected that firms specialising in the granting of

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[14]A more adequate measure of risk aversion would be the capital held in excess of regulatory capital (capital buffer), but unfortunately the variable capital adequacy ratio is available only for a small number of banks (12% of the sample) because this ratio can not be calculated by looking at the balance sheet of a bank but has to be calculated internally by the bank (at their option they may publish this ratio in their annual report).

[15] It has not been possible to obtain information on daily interest rates with other maturities.

[16] The information was facilitated by the Bank of Spain.

[17] For example, the variable *non-performing loans* is only available for 10% of the banks of the sample (for Germany, this variable is not available for any year of the sample). In the case of *loan loss provisions*, the variable is also available for a small group of banks (for Germany there are only 11 observations), albeit more numerous than the one for the variable problem loans (28% of the sample). We will therefore check the robustness of the results using the variable loan loss provisions/loans as a proxy for credit risk.

loans are more exposed to credit risk, so this variable is expected to have a positive influence on the interest margin.

f) Interaction between credit risk and market risk

Interaction between credit risk and market risk (SD*CRERISK). As a proxy for this variable we use the product of the measurement of credit risk and the rate of interest, i.e. CRERISK and each of the variables of credit risk (SD3M, SD3Y, SD10Y).

g) Average size of operations/ volume of loans

Although the theoretical model shows the importance of the average size of operations as a determinant of the interest margin, the information contained in Bankscope does not permit this variable to be proxied empirically. In accordance with the theoretical model, however, the volume of loans granted (in logarithms) is included as an explanatory variable (SIZE).

The additional variables other than those determining the "pure" interest margin, are proxied as follows:

h) Implicit interest payments

Following Ho and Saunders (1981), Angbanzo (1997) and Saunders and Schumacher (2000) we will use the variable operating expenses net of non-interest revenues, expressed as a percentage of total assets (IIP). A positive sign is expected.

i) Opportunity costs of bank reserves

This variable is proxied by the ratio of liquid reserves / total assets (RESER), using the cash variable (*cash and due from banks*) as a proxy for bank reserves.

j) Quality of management

As mentioned earlier, high quality management translates into a profitable composition of assets and a low-cost composition of liabilities. The quality or efficiency of management is proxied by the cost to income ratio (EF) which is defined as the operating cost necessary to generate one unit of gross income. An increase in this ratio implies a decrease in the efficiency or quality of management, which will translate into a lower interest margin. So a negative sign is expected.

Finally, the net interest margin, defined as the difference between revenue and financial costs in relation to total assets (NIM) is used as the dependent variable.

4. Description of the sample

The information used to estimate the model is taken from the *Bureau Van Dijk's BankScope* data base, using unconsolidated financial statements, or consolidated ones if the former were not available. The analysis is conducted on individual banks. The sample contains a total of 15,888 observations corresponding to a number of banking firms that varies from 1,436 in 1993 to 1,796 in 2000. By countries, in 2000 Germany represents 64.5% of the total number of observations, Italy 19.4%, France 10.3%, Spain 3.6% and the United Kingdom 2.4%.

The sample used is less than the total number of observations in the data base, as the information has been filtered using two criteria: a) we eliminate those banks for which any of the variables necessary for estimating the explanatory model of the interest margin is not available; b) we have also eliminated the banks whose input prices (necessary for estimating the cost function) vary from the average for each country and year by more than two and a half times the standard deviation.

Table 1 shows the descriptive statistics both of the interest margin and of its explanatory variables for the whole sample of the European countries considered. In the case of the variable being studied– the net interest margin – there has been a reduction of 34% in the period analysed, to 1.28% in 2000. The competitive structure of the markets, proxied by the Lerner index, has not followed a uniform pattern. A reduction of market power occurred from 1993 to 1995, and an increase thereafter, such that the value of the index in 2000 (16.80) was higher than that of 1993 (15.84), so an increase in competitive conditions was not verified. This result is similar to the evidence contributed by Fernández de Guevara et al. (2001) for the same European countries. In the case of market concentration, proxied by the Herfindahl index, the time evolution of the variable is similar to the Lerner index, falling until 1995 and increasing thereafter to such an extent that the concentration in 2000 (0.036) was practically similar to that of 1993 (0.035). The increase in concentration in the second half of the 1990s may be due to the process of mergers and acquisitions among European banks, which may also be behind the explanation of the increase in market power [18].

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[18] Bikker and Haaf (2002), using a broad sample of countries (European and non- European), analyse the relationship between competition and concentration, their results showing that competition decreases as

The volatility of interest rates decreased greatly regardless of the interest rate used, the degree of inequality among countries in long term public debt rates being lower. Risk aversion increased in the years analysed, though it must be borne in mind that it is being proxied by the equity/assets ratio, so an increase was occurring in the levels of bank capitalisation in Europe. Credit risk, proxied by the loans/assets ratio, decreased from the mid-1990s onwards. Average costs decreased over the period studied, showing the effort made by European banks. The opportunity cost of reserves (liquidity) in 2000 was at a similar value to 1993, while the payment of implicit interest decreased during the period considered[19]. Finally, the cost to income ratio was fairly stable around an average level of 63%.

5. Results

The explanatory equation of the interest margin is estimated introducing fixed effects with the aim of capturing the influence of specific characteristics of each individual, using the within-group estimator[20]. Time effects are also introduced to capture the influence of variables specific to each year, as well as dummy variables specific to each country and to each institutional type of banking firm (banks, savings banks, cooperatives and others).

Table 2 shows the results of the estimation of the explanatory equation of the interest margin for the pool of the five European countries considered. The different columns correspond to different empirical approaches to market structure (Lerner index *versus* Herfindahl index), and the volatility of interest rates (inter-bank, medium or long term debt). The results obtained show that in general all the variables are statistically significant and present the signs predicted by the theoretical model. Thus, market power, proxied by the Lerner index, affects the interest margin positively, and is highly significant. Interest rate risk also presents the expected positive sign, showing that firms that assume greater market risk work with higher interest margins. Likewise, the banks that assume greater credit risk present higher interest margins, though the explanatory capacity of this variable is less than that of interest rate risk. Risk aversion also presents the expected positive sign.

market concentration increases. Consequently, the increased concentration following the wave of banking mergers in Europe, may negatively affect competition.

[19] As verified by the European Central Bank (2000), in recent years the importance of non-interest income is increasing to the detriment of interest income. Consequently, the explicit collection of payments for banking services in the form of commissions means a smaller volume of implicit payments.

The explanatory capacity of operating costs deserves special mention. The high statistical significance of this variable shows the importance of introducing it into the theoretical explanation of the interest margin as done in the paper. Therefore, there could be a possible omitted variable bias of studies that ignore its importance[21] As the theoretical model predicts, the banks that bear higher average operating expenses need to operate with higher margins to enable them to offset their higher transformation costs.

With regard to the other variables introduced *ad hoc* into the regression – variables that do not appear in the explanation of the pure interest margin -, quality of management presents the expected negative sign (a higher value of the variable implies lower efficiency), and is highly significant. Implicit payments also present the predicted positive sign, so that the banks that charge for their services more implicitly through lower remuneration of liabilities, present higher interest margins. In the case of the opportunity cost of reserves, the results show the expected positive sign, though the variable is not statistically significant.

Finally, dummy variables were introduced into the regression for each country[22], to capture the possible importance of institutional differences (commercial banks, savings banks, credit cooperatives, and others[23]) and time effects. The results show the importance of the time effects that capture the influence of other variables specific to each time period; the value of the effects decreases as a consequence of the fall observed in interest margins. In no case is the institutional characteristic significant, and the country effect is significant only in the case of Italy (and negative in relation to Spain, the country of reference).

Table 3 shows the economic significance of the interest margin determinants measured by the implicit elasticities evaluated at sample means. More specifically, the

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[20] The Hausman test allows the null hypothesis of absence of correlation between individual effects and the explanatory variables to be rejected in all cases, the GLS estimator of the random effects model being inconsistent.

[21] Following the suggestion of one of the referees, we have re-estimated all the regressions omitting the operating costs variable. In this case, all the variables show the signs expected and the adjusted R^2 shows a slight reduction. Given the importance of operating costs as a determinant of the interest margin, the results clearly show the bias produced in the estimation of the effect of the remaining determinants of the interest margin. Thus, the elasticities associated with the parameters estimated are reduced once the effect of average operating costs is introduced into the estimation, of special note being the reduction of around 70% in the elasticity associated with quality of management (EF), credit risk (CRERISK) and opportunity costs of bank reserves (RESER).

[22] The country of reference is Spain.

[23] The "others" category includes the following types of firms: *investment bank/securities house, medium & long term credit bank, non-banking credit institution, real estate/mortgage bank, and specialised government credit institution*. The reference group is "others".

table captures the effect on the interest margin of a 10% increase in its determining factors. With these results, the evolution of the interest margin in the banking sectors of the European Union responds more to variations in the quality of management, variations in the costs of production, and variations in the market power of the banking firms than to the uncertainty faced by banks (interest rate risk and credit risk). In the particular case of operating costs, a 10% reduction in average operating costs would enable the interest margin to be reduced by 43%, its reduction in the period analysed being one of the most important factors in explaining the fall of the interest margin in the banking sector of the European Union.

To test the robustness of the results, columns (2) to (4) of table 4 present the results of the regression of the explanatory equation of the interest margin using: a) alternative variables to interest rates risk (columns (2) and (3); and b) the Herfindahl index as a measure of the competitive conditions in banking markets (column 4). The results are robust to the indicator of competitive structure of the markets, and to the interest rate used to measure the rate risk[24].

With the aim of testing for differences among countries in the explanatory power of the variables determining the interest margin, we estimated the explanatory equation of the interest margin separately for each of the banking sectors considered. The results of the estimation, which appear in table 4[25], allow us to observe that in the five countries analysed, the competitive structure of the markets, proxied by the Lerner index, is highly significant in explaining the interest margin[26]. Likewise, average costs and management quality are also significant and of the expected sign in the five countries. In the specific case of credit risk and of implicit interest payments, significant results are obtained in most cases. On the other hand, the opportunity cost of the reserves is significant only in Spain and the United Kingdom, while interest rate risk is significant only in the Spanish banking sector.

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[24]In the case of credit risk, the loan loss provisions/total loans ratio is not statistically significant in any of the specifications used (results not shown), though the sample is unrepresentative (only 4,458 observations) because this variable is available for only a small group of banks (for Germany, there are only 11 observations).

[25] Table 4 reports the results corresponding to the base case (column 1 of table 2). The results with alternative specifications of the explanatory variables (HERF, SD3Y and SD10Y) are available upon request to the authors.

[26]However, the influence of concentration is not significant in any case. The non- significance of concentration may be due to the lack of variability of the Herfindahl index (this variable takes a common value every year for all banks of the same country).

6. Conclusions

The financial structure of European economies, unlike that of the USA, is characterised more by bank financing than by direct financing in the markets. With this in mind, various measures have been implemented in recent years to deregulate financial markets (e.g. the second banking directive) and to integrate them (e.g. the European Commission's Financial Services Action Plan) which have contributed to the reduction in the interest margins of Europe's banking sectors.

Starting from the model of Ho and Saunders (1981) and later extensions by other authors, this study analyses the determinants of the interest margin of the European banking sector on the basis of a broad sample of banks in Germany, Spain, Italy, France and the United Kingdom in the period 1993-2000. The model shows that the "pure" interest margin depends on the competitive conditions of the market, the interest rate risk, the credit risk, the average operating expenses and the risk aversion of banking firms, as well as on other variables not explicitly introduced into the model (opportunity cost of reserves, payment of implicit interest and quality of management).

The study contributes to the existing literature in various directions. Firstly, it introduces into the modelling of the interest margin the influence of operating costs; secondly, it uses direct measures of market power to capture competitive conditions; thirdly, unlike the study by Saunders and Schumacher (2000), it analyses the determinants of the interest margins of European banks in a single stage, both extending the period of study to the year 2000 (instead of 1995) and using a much broader sample of banks (1,826 banks in 2000, as against the 614 in Saunders and Schumacher).

The results obtained show that the variables posited by the theoretical model as explanatory of the interest margin are in general significant and of the predicted signs. The results obtained permit us to conclude that:

a) Despite the deregulatory measures taken by the European Union in the 1990s, no increase in the competitive rivalry among banks can be appreciated. In this respect, the increase in the degree of concentration of European banks as a consequence of the wave of mergers that took place in the 1990s may have caused a reduction in the pressure of competition, and therefore, an increase in the market power of firms, which in turn causes upward pressure on interest margins.

b) Nevertheless, the adverse consequences of diminishing competitive rivalry have been counteracted by the effect of the fall in operating costs and credit risk. Although the lower volatility of market interest rates has contributed to the reduction of interest margins, the effect has been very small.

c)   The change in the income structure of European banks has meant an increase in the importance of banking commissions and a reduction in the implicit payment of interest, which in turn has led to a reduction of the interest margin.

d)   One of the most significant variables in the explanation of the interest margin is the level of average production costs. In this respect, the containment of average costs experienced in European banking in recent years has been a decisive factor in enabling interest margins to be reduced. This supports the extension of the model done in this study, explicitly including operating costs as a variable endogenous to it.

In the light of the evidence obtained, the continuity of the process of reduction of margins will be conditioned by the implementation of measures to incentivise above all the increase in the degree of competition (e.g. greater penetration by foreign banks or the development of alternative distribution channels for banking services such as internet banking, making markets more "contestable"), by banks' efforts to reduce their average costs and to improve their efficiency levels, and by achieving a climate of financial stability that will reduce the risk faced by banking firms.

The implications for economic policy that can be drawn from the results of this study start with the fact that the reduction of interest margins was originated by factors which, in part, were driven by several years of a favourable economic situation, due (a) to a phase of economic growth which made reductions of costs possible in a context of growth of banking business and created an environment of low credit risk; and (b) to convergence in the economies of the euro zone, propitiating an environment of macroeconomic stability in which financial markets have shown low volatility. These factors seem to have offset a process of reduction of the levels of competition in Europe's banking sectors, possibly influenced by the process of mergers and acquisitions. To the extent that the cyclical situation of the European economies has changed, the factors that in the past favoured the reduction of margins, may begin to exert pressure in the opposite direction. This phenomenon should cause a review of the effectiveness of the public policies implemented during recent years in the matter of competition, as this may be a fundamental factor in avoiding possible increases in the interest margins of Europe's banking systems which would, in turn, make the process of financial intermediation more costly for society as a whole.

Appendix

Taking into account equation (5), the expected utility of the bank is[27]:

$$EU(W) = U(\overline{W}) + U'(\overline{W})E(L_0 Z_L + M_0 Z_M) + \frac{1}{2}U''(\overline{W})E(L_0 Z_L + M_0 Z_M)^2$$
$$= U(\overline{W}) + \frac{1}{2}U''(\overline{W})\left(L_0^2\sigma^2{}_L + M_0^2\sigma^2{}_M + 2L_0 M_0\sigma_{LM}\right) \tag{A.1}$$

When a new deposit, *D*, is made, the banking firm has to pay $r_D D$ and operating costs *C(D)*, and will obtain a return $(r+Z_M)D$ in the money market. In this way, the bank's final wealth will be:

$$W_T = (1 + r_I + Z_I)I_0 - (1 + r_d)D + (1 + r + Z_M)M_0 + (1 + r + Z_M)D - C(I_0) - C(D)$$
$$= W_0(1 + r_w) + L_0 Z_L + aD + (M_0 + D)Z_M - C(I_0) - C(D) \tag{A.2}$$

and the expected utility after the new deposit has been made is given by the following expression:

$$EU(W_T) = U(\overline{W}) + U'(\overline{W})E(W - \overline{W}) + \frac{1}{2}U''(\overline{W})E(W - \overline{W})^2$$
$$= U(W) + U'(\overline{W})\left[aD - C(D)\right] + \frac{1}{2}U''(\overline{W})[(aD - C(D))^2 + L_0\sigma^2{}_L \tag{A.3}$$
$$+ (M_0 + D)\sigma^2{}_M + 2L_0(M_0 + D)\sigma_{LM}]$$

Given the level of wealth after the arrival of the new deposit, the increase in expected utility is as follows:

$$\Delta EU(W_D) = EU(W_T) - EU(W) = U'(\overline{W})\left[aD - C(D)\right]$$
$$+ \frac{1}{2}U''(\overline{W})\left[(aD - C(D))^2 + (D + 2M_0)D\sigma^2{}_M + 2L_0 D\sigma_{LM}\right] \tag{A.4}$$

In the same way, if the bank grants a new credit for an amount *L* it will receive an income $r_L L = (r + b + Z_L)L$, and incur operating costs *C(L)* and costs of financing the granting of credits $(r + Z_M)L$.

Analogously to the receiving of deposits, the increase of the bank's expected utility due to the granting of an additional credit will be:

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[27] $\overline{W} = E(W) = E\left(W_0(1 + r_w) + L_0 Z_L + Z_M M_0 - C(I_0)\right) = W_0(1 + r_w) - C(I_0)$

$$\Delta EU(W_T) = EU(W_T) - EU(W) = U'(\bar{W})[bL - C(L)]$$
$$+ \frac{1}{2}U''(\bar{W})\left[(bL - C(L))^2 + (L + 2L_0)L\sigma^2_L + (L - 2M_0)L\sigma^2_M + 2(M_0 - L_0 - L)L\sigma_{LM}\right]$$

(A.5)

Bearing in mind the probabilities of granting credits or capturing deposits reflected in equation (8), the problem of maximization of (9) can be written:

$$Max_{a,b}EU(\Delta W) = (\alpha_D - \beta_D a)\left[U'(\bar{W})[aD - C(D)] + \frac{1}{2}U''(\bar{W})\begin{bmatrix}(aD - C(D))^2 + (D + 2M_0)D\sigma^2_M \\ + 2L_0 D\sigma_{LC}\end{bmatrix}\right]$$

$$+ (\alpha_L - \beta_L b)\left[U'(\bar{W})[bL - C(L)] + \frac{1}{2}U''(\bar{W})\begin{bmatrix}(bL - C(L))^2 + (L + 2L_0)L\sigma^2_L + (L - 2M_0)L\sigma^2_M \\ + 2(M_0 - L_0 - L)L\sigma_{LM}\end{bmatrix}\right]$$

(A.6)

The first order conditions with respect to *a* and *b* give rise to the margins of expression (10).

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Table 1. Variable definitions and sample means

Symbol	Definition	1993	1994	1995	1996	1997	1998	1999	2000
NIM %	· Interest margin, defined as the difference between financial revenue and financial costs in relation to total assets	1.94	1.94	1.78	1.69	1.55	1.53	1.37	1.28
LERNER %	· Lerner index of market power	15.84	14.77	14.38	14.96	15.97	15.19	16.61	16.80
HERF	· Herfindahl index of national market concentration	0.035	0.029	0.026	0.028	0.029	0.031	0.033	0.036
AOC %	· Average operating costs	1.67	1.65	1.58	1.54	1.48	1.49	1.43	1.36
RISKAVER %	· Degree of risk aversion, proxied by the ratio equity/total assets	4.24	4.45	4.36	4.34	4.18	4.30	4.38	4.50
SD3M	· Standard deviation of 3-month interest rate in the inter-bank market	1.04	0.35	0.47	0.29	0.25	0.19	0.33	0.58
SD3Y	· Standard deviation of 3-year interest rate of the public debt	0.75	0.71	0.77	0.42	0.36	0.38	0.52	0.24
SD10Y	· Standard deviation of 10-year interest rate of the public debt	0.57	0.71	0.44	0.39	0.25	0.43	0.57	0.16
CRERISK %	· Credit risk, proxid by the loans/total assets ratio	50.48	50.83	50.38	49.68	48.37	48.63	45.34	46.89
SD3M*CRERISK	· Interaction between credit risk (CRERISK) and market risk (SD3M)	0.52	0.18	0.24	0.14	0.12	0.09	0.15	0.27
SD3Y*CRERISK	· Interaction between credit risk (CRERISK) and market risk (SD3Y)	0.29	0.36	0.22	0.20	0.12	0.21	0.26	0.08
SD10Y*CRERISK	· Interaction between credit risk (CRERISK) and market risk (SD10Y)	0.38	0.36	0.39	0.21	0.17	0.19	0.23	0.11
SIZE	· Size, proxied by the volume of loans granted (in logarithms)	13.20	13.22	13.25	13.12	13.04	13.08	13.03	13.21
IIP%	· Implicit payments, defined as the ratio of operating expenses net of non-interest revenues to total assets	0.83	1.04	0.94	0.87	0.72	0.73	0.62	0.50
RESER %	· Opportunity costs of bank reserves, proxied by the ratio of liquid reserves/total assets	0.90	0.83	0.74	0.75	0.69	0.86	1.03	0.89
EF %	· Efficiency (cost to income ratio) as a measure of quality of management	59.02	63.20	63.57	63.28	62.24	63.07	63.86	61.50
Number of firms		1,436	1,752	1,974	2,208	2,222	2,279	2,221	1,796

Source: BankScope (Bureau Van Dijk) and own elaboration.

Table 2. Determinants of the interest margin. 1993-2000

Total sample

Dependent variable: net interest margin (NIM)

	(1)		(2)		(3)		(4)	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
LERNER	0.0312	40.1901	0.0320	41.2046	0.0340	43.8228		
HERF							0.0384	8.8455
SD3M	0.0021	10.0358					0.0014	6.2306
SD3Y			0.0021	8.0749				
SD10Y					0.0043	14.9227		
CRERISK	0.0010	2.0384	0.0014	2.6735	0.0033	6.3669	0.0036	6.7698
SD*CRERISK	-0.0005	-1.4888	0.0006	1.2435	-0.0010	-2.0593	0.0000	0.0779
SIZE	-0.0007	-7.3659	-0.0008	-8.0637	-0.0008	-7.9290	-0.0011	-9.8847
RISKAVER	0.0284	19.0836	0.0276	18.6302	0.0273	18.6284	0.0326	20.5863
AOC	0.4612	55.0686	0.4583	54.9539	0.4451	53.7494	0.4960	55.6477
EF	-0.0190	-36.4234	-0.0190	-36.7214	-0.0182	-35.4821	-0.0341	-91.8070
IIP	0.4654	83.1024	0.4615	82.7148	0.4631	84.0629	0.3890	69.1152
RESER	0.0046	1.6074	0.0069	2.4442	0.0087	3.0984	0.0064	2.1047
FRANCE	-0.0017	-0.7760	-0.0023	-1.0244	-0.0026	-1.1648	-0.0024	-0.9894
GERMANY	0.0013	0.5726	0.0011	0.4941	0.0010	0.4515	0.0009	0.3552
ITALY	-0.0069	-3.0563	-0.0046	-2.0696	-0.0035	-1.5929	-0.0065	-2.7060
UK	0.0018	0.7846	0.0022	0.9960	0.0033	1.4906	0.0042	1.7556
COMMERCIAL BANKS	0.0006	0.2594	0.0005	0.2173	0.0004	0.1672	0.0006	0.2600
SAVING BANKS	-0.0010	-0.4486	-0.0011	-0.4813	-0.0012	-0.5276	-0.0012	-0.4835
CO-OPERATIVE BANKS	0.0002	0.0786	0.0002	0.0692	0.0001	0.0357	0.0004	0.1660
TE(1994)	0.0012	11.0950	0.0000	0.3477	-0.0006	-7.2878	0.0015	13.2459
TE(1995)	0.0006	5.4951	-0.0005	-6.1079	0.0000	-0.4782	0.0011	9.2793
TE(1996)	0.0004	3.5386	-0.0001	-1.2192	-0.0003	-3.5880	0.0009	6.8979
TE(1997)	-0.0003	-2.8222	-0.0008	-8.6662	-0.0006	-6.4681	0.0000	0.3049
TE(1998)	-0.0010	-7.8349	-0.0016	-16.3667	-0.0020	-22.8096	-0.0007	-4.9967
TE(1999)	-0.0021	-18.2430	-0.0028	-30.6336	-0.0034	-38.8613	-0.0016	-12.8509
TE(2000)	-0.0027	-26.1662	-0.0023	-21.1184	-0.0021	-20.2032	-0.0024	-22.1583
Number of observations	15,888		15,888		15,888		15,888	
Adjusted R^2	0.9624		0.9627		0.9636		0.9571	
Hausman Test (p-value)	330	0.0000	3,096	0.0000	3,333	0.0000	1,278	0.0000
LM Heterokedasticity (p-value)	1,405	0.0000	1,408	0.0000	1,401	0.0000	1,999	0.0000

Note: The excluded dummy categories are SPAIN (dummy variable indicating operation in a national banking sector), OTHERS (dummy variable indicating institutional type of banking firm), TE(1993) (time effects).

Source: BankScope (Bureau Van Dijk) and own elaboration.

Table 3. Economic significance of the interest margin determinants

Determinant	(1)
LERNER	29.67
SD3M	0.06
CRERISK	3.04
SD*CRERISK	-0.01
SIZE	-0.60
RISKAVER	7.53
AOC	43.00
EF	-72.59
IIP	22.22
RESER	0.23

Note: The data in the table indicate the percentage variation of
the interest margin in response to a 10% increase in its
determinants, evaluated at average sample values.

Table 4. Determinants of the interest margin. 1993-2000

Regressions by countries
Dependent variable: net interest margin (NIM)

	France		Germany		Italy		Spain	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
LERNER	0.0795	26.6108	0.0591	97.5258	0.0452	35.9097	0.0492	11.0154
SD3M	0.0003	0.2021	-0.0004	-0.2331	0.0023	1.2589	0.0042	3.6533
CRERISK	0.0007	0.5513	0.0018	5.2846	0.0046	3.8935	-0.0012	-0.5644
SD*CRERISK	0.0014	2.9686	0.0000	0.0435	0.0007	0.7548	-0.0017	-1.5765
SIZE	-0.0008	-4.2652	0.0008	10.8604	-0.0019	-6.3448	0.0004	1.2328
RISKAVER	-0.0066	-1.4227	0.0409	26.5629	0.0044	1.3359	0.0551	12.1041
AOC	0.1617	7.9250	0.2418	40.4262	0.3167	20.0274	0.3565	7.6525
EF	-0.0070	-4.3662	-0.0100	-29.5313	-0.0254	-23.8109	-0.0260	-9.1909
IIP	1.0056	75.4550	0.8125	137.4370	0.8001	53.7234	1.0152	26.3167
RESER	-0.0033	-0.3670	0.0016	1.0220	-0.0139	-0.9501	0.0191	2.0877
COMMERCIAL BANKS	0.0015	0.6276	0.0018	2.3831	0.0024	1.4584	0.0005	0.2477
SAVING BANKS	0.0015	0.6118	-0.0002	-0.2458	-0.0020	-1.2467	-0.0002	-0.0880
CO-OPERATIVE BANKS	-0.0005	-0.2049	-0.0002	-0.2227	-0.0045	-2.7784	0.0017	0.8691
TE(1994)	0.0008	0.3279	-0.0008	-1.1273	0.0003	0.2107	0.0037	1.9558
TE(1995)	0.0000	-0.0272	-0.0014	-2.3407	0.0006	0.6003	0.0039	1.9840
TE(1996)	-0.0001	-0.0360	-0.0022	-2.1320	-0.0005	-0.6908	0.0022	1.4612
TE(1997)	-0.0006	-0.2327	-0.0025	-2.8304	-0.0007	-0.4181	0.0014	0.7432
TE(1998)	-0.0010	-0.3935	-0.0030	-2.6739	-0.0029	-3.2459	0.0000	0.0014
TE(1999)	-0.0021	-0.9099	-0.0034	-4.6357	-0.0035	-2.0609	-0.0018	-0.9224
TE(2000)	-0.0023	-1.1873	-0.0031	-9.3445	-0.0045	-3.6828	-0.0018	-1.0783
Adj R^2	0.9862		0.9855		0.9795		0.9864	
Hausman Test (p-value)	232.3240	0.0000	852.3339	0.0000	1,767.3868	0.0000	119.0577	0.0000
LM Heterokedasticity (p-value)	1,337.0962	0.0000	507.6940	0.0000	150.4497	0.0000	8.0869	0.0045

Note: see tables 1 and 2
Source: BankScope (Bureau Van Dijk) and own elaboration.