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Changes in determinants of the interest margin in today's economy

Elisabeth Bustos-Contell[a] 🔟, Salvador Climent-Serrano[b] 🔟 and Gregorio Labatut-Serer[a] 🔟

[a]Department of Accounting, University of Valencia, Valencia, Spain; [b]Department of Financial and Actuarial Economics. Faculty of Economics, University of Valencia, Valencia, Spain

ABSTRACT

This study examined the interest margin following the significant drop in its contribution to credit institutions' total income. Balance sheet variables, income statement and annual report variables, and external variables were studied separately. Variables that had not previously been studied in the literature were considered, and determinants that had already been studied were revisited after the reduction in the interest margin. The diversification of investment in associated companies and investment in fixed and variable income are causes of this decrease in the interest margin. Higher fees and commissions offset this decrease. Greater size and market power have reduced the interest margin. Regulations stipulated in the Basel III Accord regarding liquidity may adversely affect the solvency ratio. Results were obtained using econometric analysis of panel data. The analysis consisted of four separate regressions: one for balance sheet variables, one for income statement and annual report variables, one for external factors and one for annual effects.

1. Introduction

Following the demand-driven crash of 1929 and the supply-driven oil crisis of 1973, the global economy has been profoundly shaken by a third major crisis, which originated in the financial sector (Rodrik, 2015). This crisis has cast doubt over the sustainability of the financial system. The numerous causes include structural changes in the revenue streams of credit institutions – more specifically, the sharp drop in the interest margin associated with their intermediation activities. Figure 1 shows the evolution of the interest margin of Spanish credit institutions from 1985 to 2015. The interest margin with respect to assets fell from more than 4% to 1%, and the interest margin with respect to gross income fell from 90% to 50%.

Intermediation is indispensable to market economies. The financial system is responsible for channelling monetary flows from economies with surpluses to those

CONTACT Salvador Climent-Serrano ✉ Salvador.climent@uv.es
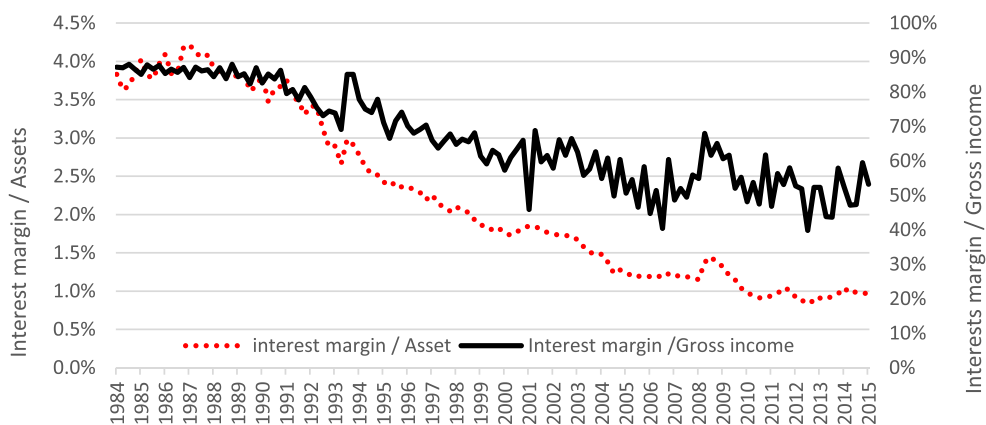
Figure 1. Evolution of the interest margin of Spanish banks and lenders.
Source: Compiled by the authors using data from the Bank of Spain.

with deficits. Therefore, one of the functions of the credit institutions is to attract savers' funds and then offer these funds to those seeking financing. Understandably, the interest paid to savers in a market economy is lower than that charged to debtors. This difference is known as the interest margin, and it provides one of credit institutions' main revenue streams.

The vast literature on the interest margin reflects its importance. In 1945, Samuelson (1945) explained how an increase in the interest rate could affect the banking system. In 1981, Ho and Saunders (1981) conducted the first study of the determinants of the interest margin. Since then, countless studies of the interest margin have been performed. In recent years, however, the major change in the contribution of the interest margin to total revenue is likely to have changed the fundamentals regarding its determinants. This change, the recent emergence of new variables, the scarcity of the literature and the importance of the interest margin to the financial system and the market economy justify the need for further research in this area.

The aim of this article was to identify the current determinants of the interest margin. The method used in this article built on the methodology applied in previous studies whilst making two novel contributions to enrich the existing literature (Ho and Saunders, 1981; Chortareas, Garza-García, and Girardone, 2012; Entrop et al., 2015; along with Hännikäinen, 2015); Islam and Nishiyama, 2016; Felício et al., 2018; Seba and Jitendra, 2019; Cruz-Garcia, de Guevara, and Maudos, 2019; Franc-Dąbrowska, Mądra-Sawicka, and Ulrichs, 2019).

First, four separate regression models were built, one comprising balance sheet variables, one comprising income statement and annual report variables, one comprising external factors and one including annual effects to assess the effect of the state of the economy in each year. This approach showed the separate effects of these four broad groups of variables on the interest margin whilst avoiding problems of multicollinearity between them. Second, seven new variables, never before included in studies in this area, were considered to complete the set of variables that might affect the interest margin. Most of these variables have only recently been adopted for use by financial institutions.

This article advances the literature in three ways: by showing the determinants of the interest margin following a major reduction in the interest margin, by including seven new variables to enrich the set of variables that might influence the interest margin, and by showing the effects of specific groups of variables separately from the effects of other groups of variables. If variables from different groups, such as equity, gross domestic product (G.D.P.), and fees and commissions, were considered in the same regression, they would mutually influence one another, thereby altering the total effect on the interest margin. For instance, we can reasonably expect a decrease in G.D.P. not to have the same effect on a credit institution with a high level of equity as on a credit institution with problems of solvency. By performing a separate regression for each of the four major areas of influence, the effects could be observed independently.

The principal findings of the study include the following. Larger credit institutions have smaller margins, so there are economies of scale. The increase in leverage with wholesale funding increases the interest margin. An increase in fees and commissions enables a reduction in interest margins. An increase in the rate of default decreases the interest margin. An increase in the market power of credit institutions results in lower interest margins. Commercial banks have higher interest margins than savings banks.

The importance of economic interest margin is given, besides the concepts already commented in previous paragraphs, by its influence on the efficiency of the own banks (Heti Suryani Fitri, Sri Mulyantini, & Jubaedah, 2019). Another sign of its importance is highlighted by Seba and Jitendra (2019), by emphasising the importance of the interest margin with respect to the adequacy of the commercial banks capital and its relation with the interest margin. On the other hand, and continuing with the importance of the latter in relation to the banks, Lin et al. (2019) assert that the banking entities financially rescued have a higher interest margin. Furthermore, a greater financial statements transparency is linked to specific reductions in interest margins according to Birchwood, Brei, and Noel (2017). Following Cruz-Garcia et al. (2019), the expansive measures undertaken by central banks have a negative impact in the interest margin. Another important point about interest margins lies in its impact on profitability, given that in the words of Birchwood et al. (2017), for each year that interest margins are kept low, profitability decreases six basis points. In a similar way, Saaskilahti (2018) states that these interest margins depend on the market interests.

The rest of the study is organised as follows. Section 2 provides a brief literature review. Section 3 describes the model and the variables used in the model. Section 4 presents detailed analysis of the results and discusses their consequences. Section 5 shares the implications of the findings. Section 6 presents the conclusions of the study.

2. Literature review

To adapt the literature review to the methodology adopted in this study, this section provides the theoretical framework for the variables included in the study based on the proposals of different authors. These variables are arranged into four groups.

2.1. Balance sheet variables

2.1.1. Size

The literature offers two theories regarding the expected effect of size on interest margin. According to Dietrich (2016), Fungáčová and Poghosyan (2011), Ho and Saunders (1981) and Poghosyan (2010), larger size leads to economies of scale and therefore lower margins. According to Afanasieff, Lhacer, and Nakane (2002), Demirgüç-Kunt and Huizinga (1999), Hawtrey and Liang (2008), Maudos and Fernández de Guevara (2004) and Williams (2007), banks with more extensive branch networks have higher production costs, which are reflected in a higher interest margin.

2.1.2. Liquidity

Lin et al. (2012) proposed two theories. The first is that banks must increase their margins to offset the interest they do not receive due to greater liquid assets. The second is that, because liquid assets yield no return, greater fixed assets mean lower interest revenue and a lower interest margin. This second theory is also supported by Fungáčová and Poghosyan (2011).

2.1.3. Equity

The ratio of equity to assets is traditionally used as a proxy for risk aversion. According to Angbazo (1997), Fungáčová and Poghosyan (2011), Ho and Saunders (1981), Kasman et al. (2010), Lin et al. (2012), Maudos and Fernández de Guevara (2004), Maudos and Solís (2009), Saunders and Schumacher (2000) and Williams (2007), an increase in equity increases the average cost of funds for financing. Therefore, credit institutions need a higher interest margin to offset the higher cost of capital. Another theory, based on a different line of argument that nonetheless leads in the same direction, has been expounded by Demirgüç-Kunt, Laeven, and Levine (2003), who affirmed that better capitalized banks have lower costs of financing and therefore greater margins. Zhou and Wong (2008) are amongst the few scholars who have reported that an increase in equity decreases interest margins.

2.2. Income statement and annual report variables

2.2.1. Administrative expenses

According to Altunbas, Evans, and Molyneux (2001), Fungáčová and Poghosyan (2011), Kasman et al. (2010), Maudos and Fernández de Guevara (2004), credit institutions that have high operating costs tend to transfer these costs to customers through an increase in interest margins. Therefore, interest margins are higher.

2.2.2. Rate of default

According to Fungáčová and Poghosyan (2011), Kasman et al. (2010), Lin et al. (2012) and Williams (2007), credit institutions with a high rate of default require a high interest margin to offset the higher risk of non-payment.

2.3. External variables

2.3.1. Market power

Like Chortareas et al. (2012), Dietrich (2016), Kasman et al. (2010), Nguyen (2012) and Williams (2007), we used the Herfindahl–Hirschmann index (i.e., the sum of the squares of the ratio of the total assets of each bank to the total assets of the sector). All authors agree that greater market power means higher interest margins.

2.3.2. Harmonised index of consumer prices (H.I.C.P.)

The relationship between inflation and interest margin depends on whether inflation is predicted or unforeseen. If inflation is predicted, the credit institution can adjust its interest rates to match the forecasts. Some scholars such as Brock and Rojas (2000), Claeys and Vennet (2008), Demirgüç-Kunt and Huizinga (1999), Martínez Peria and Mody (2004) and Trujillo-Ponce (2013) have reported a positive link between inflation and profitability. However, if inflation is unforeseen, credit institutions cannot adjust interest rates to inflation. There may therefore be a negative relationship between inflation and interest margin (Claeys & Vennet, 2008; Kasman et al., 2010).

2.3.3. Interest rate

According to Williams (2007), a higher interest rate means a higher margin.

2.3.4. Gross domestic product (G.D.P.)

The economic cycle is thought to be closely linked to the profitability of credit institutions. In periods of expansion, profitability should increase, with the opposite occurring in periods of recession. Therefore, the sign of the coefficient should be positive (Claeys & Vennet, 2008; Drakos, 2002). However, other scholars (Carbó Valverde & Rodríguez Fernández, 2007; Claeys & Vennet, 2008; Gelos, 2006; Kasman et al., 2010; Martínez Peria & Mody, 2004) have argued that the interest margin is countercyclical.

2.3.5. Ownership structure: savings banks (public) versus commercial banks (private)

The sign of this variable cannot be predetermined. However, given the circumstances in Spain regarding the recapitalisation of savings banks, the sign is expected to be positive (Climent-Serrano, 2012).

3. Data and method

3.1. Sample

Most studies of the interest margin have focused on just one country, although some have used multi-country samples. We focused solely on Spanish credit institutions. This approach was suitable given the huge number and diversity of variables and the major difficulties in performing multi-country studies. These difficulties include differences in the structure and organisation of financial statements and financial

systems, the variation in financial regulations, and the frequent regulatory changes that take place at different times in different countries.

These difficulties are compounded by an operational hurdle in that the commercial databases that are typically used in academic research have major limitations in terms of their coverage of financial institutions. To justify our choice of sample without casting aspersions over the quality of the database, BankScope covers just 47.56% of credit institutions in Spain, 24.68% in the U.K., 11.41% in Portugal, 48.72% in France, and 18.99% in Luxembourg (Foos, Norden, & Weber, 2010).

According to Beck and Demirgüç-Kunt (2009) and Bhattacharya (2003), the study of several countries with the aforementioned limitations leads to bias in the variables associated with market structure. Furthermore, variations in the coverage of the database over time may affect the results of any comparisons (Ibáñez-Hernández, Peña-Cerezo, & Araujo de la Mata, 2014). Therefore, in this type of study, it is crucial to focus on a single country. Despite this single-country focus, the results are applicable to all countries, after accounting for context-specific features, because the evolution of the interest margin is similar in most developed countries.

To gather data on the credit institutions, we used the annual accounts and reports of the 47 savings banks that existed in 2004, the 14 largest commercial banks and the two largest credit cooperatives over the period 2004 to 2014. This sample covered more than 97% of all assets in the Spanish financial system. All other data were gathered from the Bank of Spain and the Spanish National Employment Office (I.N.E.M.).

3.2. Method

Data were available for 21 to 76 credit institutions, depending on the year, across the 11 time periods (2004–2014) considered in this study. For example, in 2004, there were 76 credit institutions, but by 2014, there were just 21. This data availability meant that we were able to examine both the temporal and cross-sectional dimensions of the sample through an econometric model of non-balanced panel data. This approach provided a data set that was more informative than a cross-sectional data set would have been. The data set used in this study had greater variability, less collinearity and more degrees of freedom than a cross-sectional data set. We were therefore able to estimate the econometric linear regression model more efficiently and control for endogeneity and individual unobserved heterogeneity (Arellano & Bonhomme, 2012).

We estimated four econometric models using panel data. We estimated the first three fixed effects models using ordinary least squares after first performing the Hausman test for homogeneity. Using a fixed effects model means that the residuals are decomposed into two parts: a fixed part (ω_i) that is constant for each individual and a random part (ε_{it}). This is equivalent to observing a general trend using regression by assigning each individual with a different intercept on the y-axis.

The values of the Durbin–Watson statistic for the three models indicate the potential existence of first-order autocorrelation of the residuals. The value of this statistic

was approximately 1.5. Therefore, we estimated three models using the AR(1) system. The variable AR(1) was significant, which indicated a certain degree of inertia of the dependent variable. The fourth model was estimated using the generalised method of moments (G.M.M.) described by Arellano and Bond (1991).

The fees and commissions variable was one of the variables that changed the most. We therefore performed specific analysis of fees and commissions by fitting a quadratic equation and conducting graphical analysis. The aim was to study the trend.

Each of the variables included in the econometric models exerted an influence on the rest of the variables considered in the regression. Thus, when heterogeneous variables such as G.D.P. variation, solvency and fees and commissions were included, the model yielded a result in which the variation of one of these variables depended on the others. However, it may be assumed that a decrease in G.D.P. would have a different effect depending on each credit institution's solvency. We therefore built four econometric models to estimate the effect of each variable within four separate groups: balance sheet variables, income statement and annual report variables, external variables and annual effects. The use of these groups avoided multicollinearity problems.

As specified in the introduction, the two novel contributions of this study to the literature on this topic are the study of different variables in four groups and the inclusion of seven new variables. The theory that supports these contributions is described below.

3.3. Model 1 (balance sheet variables)

The composition of the balance sheet explicitly determines the revenue of credit institutions. The composition of the balance sheet has changed substantially since Ho and Saunders (1981) published their initial research, particularly in relation to Spanish and European credit institutions that combine traditional commercial banking and investment banking activities. Therefore, the results are expected to differ from those for when the interest margin was virtually the only source of revenue.

Four new variables have been included in this model. These variables have a major bearing on the structure of the balance sheet. However, we have not found any literature on these variables. These variables are described below.

3.3.1. Investment in associated companies and variable income

Increasing these investments reduces investment in loans. Because loans as a percentage of assets falls, so should the interest margin.

3.3.2. Investment in fixed income

Revenues from assets invested in fixed income are considered in the calculation of the interest margin. Thus, the effect on the interest margin should depend on whether the return from fixed income investments is greater than or less than the return on loans.

3.3.3. Financing through wholesale debt

This type of financing increases leverage. Investment increases, but deposits do not. Therefore, the margin should also increase. Model 1, which includes the balance sheet variables studied in the literature review and the new variables, is defined below:

$$
\begin{aligned}
Margen\ de\ interés_{balance} = {} & \omega_i + \beta_{it} + \beta_{it}\ \log\ activo + \beta_{it}\ Liquidez \\
& +\beta_{it}\ Empresas\ participadas + \beta_{it}\ Inversión\ en\ renta\ fija \\
& +\beta_{it}\ Inversión\ en\ renta\ v + \beta_{it}\ Financiación\ mayorista \\
& +\beta_{it}\ Fondos\ propios + \beta_{it}\ inercia + \varepsilon_{it}
\end{aligned}
$$

3.4. Model 2 (income statement and annual report variables)

The way in which the balance sheet is managed is reflected by the results in the income statement. We studied the results of the management (rather than the composition) of the balance sheet using the results shown in the income statement. The modification of the structure of the balance sheet has changed the sources of revenue. Moreover, it is increasingly common to receive payment for services rendered. This situation is new, so fees and commissions increasingly represent a higher percentage of revenue.

This model includes three new variables. Fees and commissions, return on capital and associated companies. The first two variables have been included in some studies as non-financial income, but a breakdown is not provided. To the best of our knowledge, no study has considered the third variable (i.e., risk-weighted assets).

3.4.1. Fees and commissions

One of the credit institutions' responses to the decrease of the margin is the increase of revenue through fees and commissions, so we should observe an inverse relationship.

3.4.2. Return on Capital and associated companies

Greater investment in this type of asset means lower investment in loans. Therefore, interest margin revenue should decrease.

3.4.3. Risk-weighted assets

This variable is the ratio that credit institutions use to calculate the resources they need to cover the solvency ratio. The price of assets (i.e., the interest that credit institutions receive) is inversely related to risk. The most solvent assets have a lower weighting and therefore lower interest and lower margin. Increasing quality decreases the ratio and decreases the interest margin. There should be a direct relationship.

3.4.4. Rate of default

There is a discrepancy with the theories identified during the literature review. A different relationship is predicted. Credit institutions with higher rates of default are expected to no longer receive interest from doubtful loans. Therefore, the interest margin should be lower.

3.4.5. Earnings before tax

The control variable of earnings before tax was also included. Higher margins should mean greater earnings.

Model 2 (income statement and annual report variables) is defined as follows:

$$
\begin{aligned}
Margen\ de\ interés_{PyG} = {}& \omega_i + \beta_{it} + \beta_{it}\ Comisiones \\
& + \beta_{it}\ Rendimientos\ de\ capital\ y\ participadas \\
& + \beta_{it}\ Gastos\ de\ administración\ \beta_{it}\ Morosidad \\
& + \beta_{it}\ Activos\ poderados\ por\ riesgo \\
& + \beta_{it}\ BAT\ ROA + \beta_{it}\ inercia + \varepsilon_{it}
\end{aligned}
$$

3.5. Model 3 (external variables)

The economic and market situation undoubtedly affects credit institutions and therefore the interest margin.

3.5.1. Market power

The relationship described by other authors – namely, that greater market power should mean a greater interest margin – would normally be the case. However, given the nature of the process of mergers in Spain, the relationship may be different. Mergers have taken place across regions. Thus, whilst market share might have increased nationally, actual market power has not. This is because the geographical coverage has increased, whilst the market share within the same region has not. This has, however, brought economies of scale. Therefore, an increase in market power might actually lead to a lower interest margin. To account for this effect, the regional market power index must be calculated as it was by Cai, Xu, and Zeng (2016) for Chinese credit institutions.

Model 3 (external variables) is defined as follows:

$$
\begin{aligned}
Margen\ de\ interés_{V.\ externas} = {}& \omega_i + \beta_{it} + \beta_{it}\ Herfindahl\ e\ Hirschman \\
& + \beta_{it}\ IPCA + \beta_{it}\ Bono\ a\ 10\ años + \beta_{it}\ PIB\ nominal \\
& + \beta_{it}\ Estructura\ de\ propiedad + \beta_{it}\ inercia + \varepsilon_{it}
\end{aligned}
$$

3.6. Model 4 (annual effects)

To complete this study, we performed a regression based on events during the study period. Two situations may have affected the interest margin: first, the financial crisis of 2007 and 2008 and, second, the huge number of corporate transactions in 2010 together with the massive injection of public funds in 2011 and 2012. According to Chen and Lin (2016), the injection of public funds entails a decrease in interest margins.

The G.M.M. described by Arellano and Bond (1991) was used to determine the annual effects. Period dummy variables with period fixed effects were included.

Model 4 (annual effects) is defined as follows:

$$Margen\ de\ interés_{efectos\ anuales} = \beta_{it}\ Margen(t-1) + \ \beta_{it}\ 2006 + \ \beta_{it}\ \ 2007$$
$$+ \beta_{it}\ 2008 + \ \beta_{it}\ 2009\ + \beta_{it}\ 2010 + \ \beta_{it}\ 2011$$
$$+ \beta_{it}\ 2012 + \beta_{it}\ 2013\ + \ \beta_{it}\ 2014_{it}\ + \varepsilon_{it}$$

Table 1 summarises the variables, their structure, the expected effect and the observed effect.

We first studied the seasonality of the series using the unit root test (Levin, Lin, & Chu, 2002). A unit root was detected for two variables: fixed income and earnings before tax. We solved this problem by taking the logarithm for the fixed income and the first difference for earnings before tax. The unit roots were thereby eliminated. The problems of autocorrelation of the dependent variable were removed using AR(1) system estimation for the first three models and the G.M.M. for the fourth model. Table 2 shows the values of the Durbin–Watson statistic, which confirmed the absence of autocorrelation. The regressions were estimated using White's model with robust standard errors to control for heteroscedasticity. Multicollinearity was tested for by estimating the variance inflation factor (V.I.F.). As Table 3 shows, all values were below 10, corroborating the absence of multicollinearity. Table 2 shows the descriptive statistics for the variables.

4. Results

The results of the four estimated regressions appear in Table 4.

4.1. Balance sheet variables

We observed a certain degree of inertia in the interest margin (28.9%). The sign for size was negative, implying that larger institutions had lower margins. We verified Fungáčová and Poghosyan (2011) economies of scale hypothesis. Institutions with greater liquidity had lower interest margins. We confirmed the theory proposed by Fungáčová and Poghosyan (2011) and Lin et al. (2012) regarding fixed assets.

Taking control through investment in associated companies also resulted in a lower margin. The hypothesis proposed in this research was confirmed. Banks that allocated a high percentage of their investment of assets to associated companies invested less in loans to customers and therefore had lower margins. The same results were observed for fixed and variable income. The hypotheses proposed in this article regarding these two variables were also corroborated. As expected, an increase in leverage through wholesale funding increased the interest margin. An increase in equity (greater solvency) increased the margin. The theory proposed in the literature review was corroborated.

Table 1. Variables included in the models.

Variable	Description	Expected effect based on literature	Observed effect based on results
Dependent variable			
Interest margin	Difference between interest received and the interest paid divided by total assets		
Balance sheet variables			
Size	Logarithm of assets	+/-	−
Liquidity	Liquidity as a percentage of total assets (%)	+/-	−
Equity	Equity as a percentage of total assets (%)	+	+
Associated companies	Associated companies as a percentage of total assets (%)	−	−
Investment in fixed income	Investment in fixed income as a percentage of total assets (%)	+/-	−
Investment in variable income	Investment in variable income as a percentage of total assets (%)		−
Wholesale debt financing	Wholesale debt financing as a percentage of total assets (%)	+	+
Income statement and annual report variables			
Administrative expenses	As a percentage of total assets (%)	+	+
Default rate	Non-performing loans as a percentage of total assets (%)	- (+)	−
Fees	Fees as a percentage of total assets (%)	−	−
Earnings from investment capital and affiliates	Earnings from investment capital and affiliates as a percentage of total assets (%)	−	−
Risk-weighted assets	Obtained from annual report	+	+
Profit before tax	As a percentage of total assets (%)	+	+
External variables			
Market power	Herfindahl–Hirschmann Index	+	−
HICP	Annual rate of change in Harmonised Index of Consumer Prices	+/-	−
Interest rate	10-year sovereign bond rate	+	−
GDP	Annual rate of change in GDP	+/-	−
Ownership structure	Dummy variable that takes the value 1 for banks and 0 for savings banks	+	−
Annual effects			
2006			−
2007			+
2008			−
2009			−
2010			−
2011			+
2012			+
2013			−
2014			−

4.2. Income statement and annual report variables

Fees and commissions provide the main revenue stream used by credit institutions to offset the drop in income due to the decrease in interest margins. Figure 2 shows fees and commissions as a percentage of assets and a percentage of gross margin. The graph of fees and commissions as a percentage of assets shows a decrease in fees and commissions when the economy grew and an increase in fees and commissions when the economy contracted. However, the most significant data related to fees and

Table 2. Descriptive statistics.

Balance sheet variables	Mean	Median	Maximum	Minimum	SD	Observations
Interest margin	0.016	0.016	0.031	0.001	0.005	512
Size	16.703	16.680	20.962	12.336	1.610	512
Liquidity	0.068	0.059	0.263	0.009	0.043	512
Associated companies	0.009	0.004	0.235	0.000	0.027	512
Investment in fixed income	0.106	0.096	0.421	0.000	0.072	512
Investment in variable income	0.044	0.030	0.270	0.001	0.042	512
Wholesale debt financing	0.123	0.104	0.417	0.004	0.092	512
Equity	0.061	0.059	0.167	−0.059	0.024	512
Income statement and annual report variables						
Fees	0.005	0.005	0.015	0.001	0.002	423
Earnings from investment capital and affiliates	0.001	0.001	0.037	−0.021	0.004	423
Administrative expenses	0.013	0.012	0.027	0.006	0.004	423
NPLs	0.029	0.021	0.162	0.001	0.030	423
Risk-weighted assets	0.632	0.667	1.245	0.000	0.134	423
Earnings before tax	−0.002	−0.001	0.163	−0.167	0.018	423
External variables						
Market power	14.726	14.953	20.303	12.608	1.881	512
HICP	0.026	0.031	0.041	−0.002	0.014	512
Interest rate	0.041	0.038	0.055	0.018	0.008	512
GDP	0.030	0.017	0.076	−0.034	0.043	512

Source: Compiled by the authors.

Table 3. Variance inflation factor.

Model 1	VIF	Model 2	VIF	Model 3	VIF
Log assets	1.51	Fees and commissions	1.21	Herfindahl-Hirschmann	1.73
Liquidity	1.09	Earnings from investment capital and affiliates	1.05	HICP	2.13
Associated companies	1.14	Administrative expenses	1.31	10-year debt	2.01
Investment in fixed income	1.65	Default rate	1.57	Nominal GDP	1.77
Investment in variable income	1.27	Risk-weighted assets	1.29	Ownership structure	2.92
Wholesale funding	1.48	Earnings before tax/assets	1.21		
Equity	1.4				
AR(1), Inertia	1.28		1.14		1.74

Source: Compiled by the authors.

commissions as a percentage of gross margin, which grew from 2004 onward and which could be fitted by a quadratic equation with an R^2 value of 0.42. Growth was strong between 2008, the year of the financial crisis, and 2011, the year of public bail-outs. The results of the regression also confirmed that the credit institutions used fees and commissions to offset the loss of revenues due to the decrease in interest margin, thereby confirming the theory proposed in this article.

Earnings from investment capital and affiliates had a negative sign. This result was expected because, as these earnings increase, the interest margin decreases. In this case, the hypothesis based on the literature review was also accepted.

Administrative expenses had a positive sign, so credit institutions that invested more in human resources had greater interest margins. We thus observed the same results as those reported by other authors.

Credit institutions with higher rates of default ceased to receive interest on doubt-ful loans. Accordingly, the interest margin decreased. In this case, the results were not consistent with those reported by Fungáčová and Poghosyan (2011), Kasman et al. (2010), Lin et al. (2012) and Williams (2007), who reported that credit

Table 4. Econometric regressions.

Model 1 Balance sheet variables		Model 2 Income statement and annual report variables		Model 3 External variables		Model 4 Annual effects	
C	0.054*** (0.015)	C	0.007*** (0.001)	C	0.025*** (0.002)	2006	−0.001*** (0.028)
Size	−0.002** (0.001)	Fees	−0.417** (0.176)	Market power	−0.001*** (0.000)	2007	0.001*** (0.000)
Liquidity	−0.009*** (0.003)	Earnings from investment capital and affiliates	−0.087* (0.044)	HICP	−0.024*** (0.006)	2008	−0.000 (0.000)
Associated companies	−0.049*** (0.013)	Administrative expenses	0.743*** (0.108)	Interest rate	−0.059*** (0.016)	2009	0.001*** (0.000)
Investment in fixed income	−0.006*** (0.002)	Default rate	−0.018*** (0.006)	GDP	−0.015*** (0.000)	2010	−0.004*** (0.000)
Investment in variable income	−0.021*** (0.006)	Risk-weighted assets	0.006*** (0.004)	Ownership structure	0.002*** (0.000)	2011	0.001*** (0.000)
Wholesale debt financing	0.007** (0.003)	Profit before tax	0.006* (0.003)			2012	0.002*** (0.000)
Equity	0.021** (0.010)					2013	−0.001*** (0.000)
AR(1), Inertia	0.289*** (0.071)	AR(1), Inertia	0.283*** (0.074)	AR(1), Inertia	0.460*** (0.066)	2014	−0.000 (0.000)
Adjusted R^2	0.803		0.811		0.818	Margin(t-1)	0.402*** (0.000)
Durbin–Watson	1.944		1.989		2.081		−0.28
F-statistic	22.92		20.94		25.78	J-statistic	47.97
Akaike	−9.340		−9.389		−9.422	Instrument rank	52

Note: *, ** and *** denote significance at the 1%, 5% and 10% levels, respectively; robust standard errors appear in brackets.
Source: Compiled by the authors.
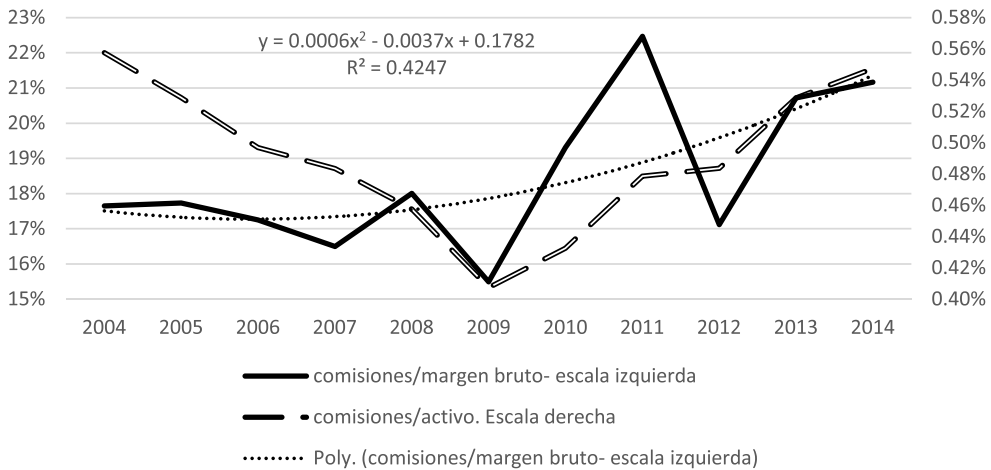
Figure 2. Fees and commissions as a percentage of assets and gross margin.
Source: Compiled by the authors.

institutions with high rates of default should increase their margin to offset the associated fall in revenue. However, this conclusion was not support by our analyses.

The improvement in risk-weighted assets (i.e., a reduction in) reduced the margin. In this case, the hypothesis proposed under the theoretical framework was also corroborated. Credit institutions require lower interest on assets with greater solvency, penalising lower-quality investments.

The control variable was significant and had the expected sign because credit institutions that had a higher ratio of earnings before tax to assets had a higher interest margin.

Finally, we also observed a certain degree of inertia in the interest margin. This was detected after estimating the AR(1) system regression, where the coefficient was 0.28. This value was similar to the result for the regression of balance sheet variables.

4.3. External variables

An increase in market power (Herfindahl–Hirschmann index) reduced the interest margin. This result contradicts those reported by other authors cited in the literature review. However, this finding is reasonable given the nature of the process of mergers and acquisitions in the Spanish financial system. Credit institutions have grown through these mergers, but this growth has taken place in other regional markets where they did not previously operate. Therefore, by increasing their size, these credit institutions have achieved economies of scale and have reduced their interest margins. However, this growth does not indicate a greater market share (greater market concentration) in the home market. Therefore, the interest margin did not increase, which was the outcome predicted by the authors cited in the literature review.

By increasing inflation, the interest margin decreased. This finding thereby implies that the effect is counter-cyclical. This finding is consistent with those of Claeys and Vennet (2008) and Kasman et al. (2010).

The final variable studied in this group was ownership structure (savings banks vs. commercial banks). Private banks had a greater interest margin than public savings banks.

4.4. Annual effects

The crisis of 2007 to 2009 and the injection of public capital in 2011 and 2012 caused an increase in the margin. Chen and Lin (2016) theory of bank bailouts could not be corroborated for the case of Spain.

5. Implications

The new Basil III Accord, which stipulates both short- and long-term minimum liquidity requirements, is deeply detrimental to the earnings of credit institutions because these requirements cause the interest margin to fall and thereby reduce profits and solvency. According to Chen, Tsai, and Jou (2016), however, greater capital banking requirements lead to a higher interest margin. Accordingly, this increase would have a considerable negative effect on the interest margin and profitability.

Investment in associated companies (investment banking) diversifies risk. If funds are well invested and the associated companies perform well, this can offset or outweigh the attendant reduction in the margin, especially given today's small margins. However, if the decision to take control is based on political reasons, as has occurred with Spanish savings banks in recent years (Climent-Serrano & Pavía, 2014a), these investments will impair profitability. This seems to be the point of view of the European Commission because it plans to limit investments made by European credit institutions using their own funds. This measure has already been applied to institutions that have requested public funding from the EU.

The increase in turnover by attracting funding from securitization or mortgage bonds in the wholesale markets has led to an increase in the interest margin. This situation, which, a priori, would seem positive for credit institutions, must be further explained. The increase in financing was largely due to issuing mortgages under weak conditions in terms of repayment guarantees, leading to over lending. This increase in credit contributed to the housing bubble, which subsequently caused the rate of default to rise to over 13% (Climent-Serrano & Pavía, 2014b). Furthermore, subprime mortgages increased uncertainty from 2008 onward, the wholesale markets virtually disappeared, and highly leveraged institutions encountered major liquidity problems. These problems would have been fatal without the intervention of the European Central Bank (E.C.B.), which injected huge amounts of liquidity to European banks.

Earnings from fees and commissions provide the main source of income used by credit institutions to offset the decrease in the interest margin. Customers are renowned for their reluctance to pay bank fees and commissions. However, banks are forced to apply these fees and commissions because numerous long-term loans are indexed to the Euribor, which, as of July 2016, remained negative, meaning that the interest in most cases is less than 1%.

Credit institutions with high labour costs have a high interest margin. This may be for two reasons. First, credit institutions that incur high operating costs transfer these costs to customers through a high interest margin. Second, credit institutions with high labour costs may offer customers a higher quality product at a lower risk to lenders. This is reflected by a higher margin because, as noted by Alhassan and Asare (2016), credit institutions that invest in intellectual capital can achieve a competitive advantage. This would be an interesting topic for further research, especially given the cost reduction policies adopted by Spanish credit institutions.

One variable that has received little attention is risk-weighted assets. This variable is nonetheless important because it indicates the risk taken by credit institutions. A lower value means less risk and therefore a lower margin. Furthermore, since the first version of the Basil Accords, this has been one of the key variables to calculate capital needs. However, the Basil Accords allow the calculation of risk-weighted assets through the internal ratings-based approach (I.R.B.). This benefits credit institutions because, in addition to calculating this value, they can study their customers and obtain information about their solvency. This information, in addition to being used internally, can be sold, providing additional revenue. In this case, it would also be of interest to study the effect of risk-weighted assets on total income. In other words, it would be of interest to study whether a higher margin with poor-quality assets and high risk is more profitable than a lower margin with high-quality assets and low risk.

The current restructuring of the Spanish financial system, backed by the Spanish authorities, has substantially reduced the number of credit institutions (Climent-Serrano & Pavía, 2015). Accordingly, the market power of the remaining credit institutions seems to have increased. However, this market growth has not actually resulted in a greater margin, as was expected; instead, the opposite has occurred. A possible cause is the nature of the mergers and acquisitions that have taken place during this process because, for the first time, these mergers and acquisitions have mostly been across regions (Climent-Serrano, 2013). Therefore, the credit institutions have grown in size and market power without any increase in the regional market share. Unlike Cai et al. (2016), we did not study the market share by province. The same situation that has arisen in Spain following mergers between credit institutions operating in different regions could just as easily apply to the process of mergers between credit institutions from different EU countries. This policy could potentially be implemented under the auspices of the ECB. The outcome would be larger credit institutions without increasing monopolistic power. Therefore, economies of scale could reduce the interest margin.

Savings banks have disappeared from the Spanish financial market. One of the results that partially justifies this situation is that savings banks had lower interest margins than those of commercial banks.

Just as Hännikäinen (2015) reported, we have confirmed that the interest margin has predictive power, predicting monetary policy and economic cycles.

6. Conclusion

In two decades, the interest margin has decreased from 80% of credit institutions' total earnings to less than 50% of revenue. Accordingly, the determinants of the

interest margin must also have changed. It is therefore important to study this issue. We drew upon and enhanced the method described by Ho and Saunders (1981). Four different regression models were estimated to separately study balance sheet variables, income statement and annual report variables, external variables, and the annual effects on the interest margin.

The common denominator in all of these models was a certain inertia of the dependent variable. We therefore estimated three of the models using the AR(1) system and one of the models using the G.M.M. This variable was significant, with an average coefficient of 0.30. We also considered seven variables that had never been studied.

The results with respect to the balance sheet variables indicate that an increase in liquidity, investment in associated companies, investment in fixed income and investment in variable income all reduce the interest margin. In contrast, an increase in equity and wholesale funding should increase the interest margin. With respect to the income statement and annual report variables, the results imply that a decrease in the interest margin is offset by an increase in fees and commissions and in earnings from fixed income, variable income and associated companies. The increase in the rate of default reduces the margin, whereas a decrease in the risk-weighted assets (i.e., an increase in asset quality) also reduces the margin.

In terms of the external variables, the increase in the market power of interest rates, the G.D.P. and the H.I.C.P. reduce the interest margin. Finally, the results show that the period of crisis in 2008 and the injection of public funds in 2001 and 2002 caused an increase in the interest margin.

Finally, the results suggest that a possible cause leading to the disappearance of savings banks is a lower interest margin than that of commercial banks.

There are limitations to enhanced research given that the evolution of the economy is a continuous process. This is why new factors and actors, such as new technology companies like Google, or large companies like Amazon are entering the market. New actors are also increasing competition with less regulation, with companies like TransferWise at much more competitive prices. Even factors that cannot be observed, due to their recent implementation – as the taxes for bailouts (Kogler, 2019). However, the results obtained will provide a great help to the current theoretical framework.

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ORCID

Elisabeth Bustos-Contell iD http://orcid.org/0000-0003-3643-7274
Salvador Climent-Serrano iD http://orcid.org/0000-0002-5945-8900
Gregorio Labatut-Serer iD http://orcid.org/0000-0002-3242-5412

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