BANKING CONSOLIDATION AND MARGINS ON BANK LOAN AND DEPOSIT TRANSACTIONS OF NON-FINANCIAL CORPORATIONS IN SPAIN

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BANKING CONSOLIDATION AND MARGINS ON BANK LOAN AND DEPOSIT TRANSACTIONS OF NON-FINANCIAL CORPORATIONS IN SPAIN

Abstract

This article analyses the effects of the European Central Bank's (ECB) monetary policy and of banking consolidation on the interest rates and margins on monthly new loan and deposit transactions with non-financial corporations (NFCs) in Spain in the period January 2003 to June 2025. The results indicate an increase in market power – as measured by the Lerner index (or relative margin) – in the post-consolidation period, leading to higher (lower) loan (deposit) rates for a given euro interbank offered rate (EURIBOR), although the largest changes in banks' market power over the period are driven by movements in the EURIBOR. The article explains the responsiveness of banks' market power (Lerner index) to changes in the EURIBOR using a theoretical model of bank competition. It also argues that because the EURIBOR is unrelated to bank competition, its demonstrated influence on the Lerner index calls into question the latter's use as a general indicator of market competition.

Keywords: banking consolidation in Spain, market power, monetary policy transmission, NFC bank transactions.

1 Introduction

This article examines developments in interest margins on new bank loan and deposit transactions with non-financial corporations (NFCs) in Spain in the period 2003-25. Next, drawing on the theoretical predictions of a stylised model of banking competition, the article analyses the possible impact of the banking consolidation that took place in Spain – from the equivalent of 20 equal banks before 2010 to eight equal banks from 2020 onwards – on these developments. A significant original aspect of this study is its analysis of the relationship between banking consolidation and banks' profit margins or market power, as predicted by the theoretical model, controlling both for changes in European Central Bank (ECB) monetary policy during the period under review and its transmission to loan and deposit markets via the interbank rate (EURIBOR).

The theoretical framework considers N banks competing – using a Nash-Cournot approach – in loan and deposit markets. The banks have access to an interbank market where they can lend and borrow at competitive interest rates, meaning independent interest rate formation in both the lending and deposit markets. The stylised model also assumes that banks' operating costs are fixed, making the EURIBOR both their marginal cost per euro lent and their marginal return per euro of customer deposits. Under these assumptions, the relative margin (Lerner index) on loans and deposits, calculated using the interbank rate, serves as an indicator of market power in the respective markets. Nash equilibrium modelling distinguishes between predictions for interest rate and margin formation using functions of loan demand and deposit supply that are log-linear and linear with prices, to subsequently test them against the evidence

available.[1] With the theoretical framework established, the last section of the article analyses the potential effects of banking consolidation on margins and interest rates.

The study is limited to monthly new bank loans and deposits with NFCs in Spain, while the respective average interest rates for each month are those published by the Banco de España. The interbank rate is assumed to be equal to the 12-month EURIBOR. Banking consolidation data are drawn from ECB statistics, namely the Herfindahl Hirschman index (HHI) calculated for the domestic banking market of each euro area Member State. One benefit of using interest rates on new transactions is their greater responsiveness to changes in policy interest rates, compared with average rates from past transactions on banks' balance sheets. In addition, focusing on bank transactions of NFCs in Spain ensures greater market homogeneity than aggregating transactions from all institutional sectors of the economy (firms, households and general government). Moreover, taking aggregated data for all monthly bank transactions precludes the inclusion in the statistical tests of variables that control for bank heterogeneity (specialisation, risk exposure, efficiency, etc.), something that is possible with more granular data (De Graeve, De Jonghe and Vander Vennet, 2007; Wang, Macaluso and Hersbein, 2022).

An analysis of average interest rates on Spanish NFCs' bank loan and deposit transactions shows a 6.2% increase in loan rates and a 60% decrease in sight deposit rates in the post-consolidation period compared with the pre-consolidation period under similar monetary conditions (i.e. a similar EURIBOR). No significant differences are identified in time deposits. The figures are obtained as the difference between the relative margins observed on loans and deposits in the post-consolidation period and those for the same period had the estimated margin formation model based on the pre-consolidation period EURIBOR been maintained. The testing methodology used here cannot demonstrate a causal relationship between market consolidation and margins (market power) or loan and deposit rates; therefore, other explanations for the differences observed cannot be ruled out.

Beyond providing an explanation for the formation of bank margins in transactions with NFCs in Spain during a period of banking sector consolidation, the article is also relevant for broader research into assessing firms' market power and how it affects monetary policy transmission.[2] The article shows theoretically that – with loan demand and deposit supply functions linear with interest rates and under the Nash equilibrium model for competition in an oligopoly – the Lerner index (used as an inverse indicator of market competition) depends on both the number

1 The bank and competition model is based on the Monti-Klein model (Freixas and Rochet, 2008, Chapter 3). The stylised model assumes complete and symmetric information in the loan market and ignores bank solvency and deposit guarantee regulations. Carletti, Leonello and Marquez (2024) and Choi and Rocheteau (2023) extend the basic model to factor in these banking market imperfections. Martínez-Miera and Repullo (2021) analyse the implications of market power for banks' risk-taking decisions and the ultimate impact on financial stability.

2 Previous research underscores the slow and often incomplete adjustment of lending and deposit rates to changes in central bank rates (De Bondt, 2005; Drechsler, Savov and Schnabl, 2017; Englisch, Terhalle, Horn, Lister and Hollander, 2024; and Jude and Levieuge, 2024), revealing lags and inefficiencies in the transmission process. Research papers by Hannan and Berger (1991), Neumark and Sharpe (1992) and Drechsler, Savov and Schnabl (2017) on the deposit market, and by Kopecky and Van Hoose (2012) and Scharfstein and Sunderam (2016) on the loan market, find evidence that monetary policy transmission to market rates is weaker in more consolidated banking markets. Lago-González and Salas Fumás (2005) and Van Leuvensteijn, Kok Sørensen, Bikker and Van Rixtel (2013) find similar results using Spanish data. Medrano Adán and Salas Fumás (2025) model the effect of banking consolidation on the transmission of ECB monetary policy to interest rates in Spain, using the same database as this article.

of competitors (the structural competition indicator) and the EURIBOR (marginal cost). Therefore, in theory, relative margins may vary for reasons other than shifts in market competition conditions, including changes in the interbank rate driven by central bank monetary policy. This is precisely what happens in Spain during the period under review: banking consolidation occurs at the same time as changes in monetary conditions (the EURIBOR), which complicates the task of answering the research question regarding the impact of banking sector consolidation on interest rates and margins on Spanish NFCs' loans and deposits. The lessons from this case study can be extrapolated to the extensive research conducted in recent years on measuring firms' market power.[3]

The rest of the article is structured as follows. Section 2 presents the preliminary evidence on banking consolidation and banks' margins on loan and deposit transactions with NFCs in Spain. Section 3 sets out the theoretical framework for interest rate and margin formation. Section 4 presents the results of tests conducted on certain theoretical predictions and Section 5 concludes with a summary of the main findings.

2 Preliminary evidence on consolidation and margins

This section presents descriptive information on developments in banking consolidation in Spain, as well as in bank margins on NFCs' loans and deposits, during the period under review (January 2003 to June 2025).

2.1 Consolidation

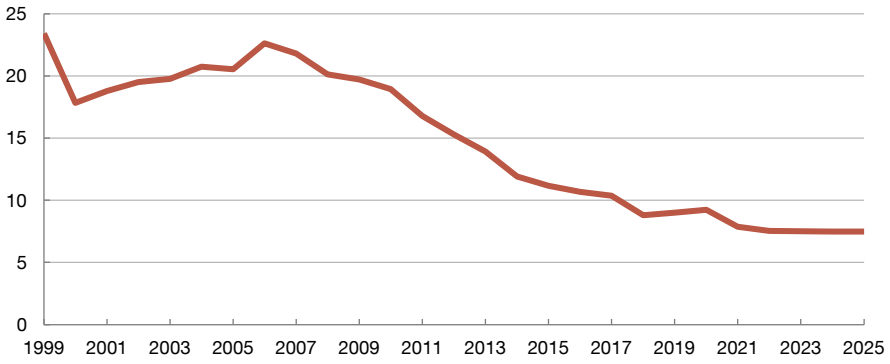
As shown in Chart 1 (based on ECB data for banking market consolidation in euro area countries), the equivalent number of equal banks in Spain, calculated as the inverse of the HHI, held relatively stable at around 20 until the great financial crisis. From 2010 the number begins to gradually decline, stabilising at 7-8 equal banks from 2020 onwards. Although the relevant banking service markets have traditionally been local, with services largely accessed through physical branches, the broad-based trend towards greater consolidation is likely to have affected all markets and customer segments, including NFCs.

2.2 Market power: the relative unit margin or Lerner index

The existence of an interbank market where banks can lend and borrow at competitive rates means that interest rate formation takes place independently in the loan and deposit markets.

3 Representative papers in this literature include Díez, Leigh and Tambunlertchai (2017); Berry, Gaynor and Scott Morton (2019); De Loecker, Eeckhout and Unger (2020); Eeckhout (2021) and Syverson (2024). For estimates of Spanish banks' market power see Oroz and Salas Fumás (2003); Fernández de Guevara and Maudos (2005); Maudos and Fernández de Guevara (2007); and Martín-Oliver, Salas Fumás and Saurina (2006). For estimates of European banks' market power see Fernández de Guevara, Maudos and Pérez (2005) and Carbó, Humphrey, Maudos and Molyneux (2009). Unlike this article, none of these publications analyse the responsiveness of market power indicators to marginal cost, an issue that is particularly relevant in an economic context of declining variable costs and rising fixed costs (De Ridder, 2024).

Chart 1
Equivalent number of equal competitor banks (1999-2025) (a)



SOURCE: Authors' calculations drawing on ECB data.

a Calculated as the inverse of the HHI for the Spanish banking sector as a whole.

With an interbank market, the EURIBOR is both the banks' marginal financial cost of loanable funds and their marginal return on customer deposits. This article assumes that banks regard the operating costs of lending and deposit-taking as fixed, irrespective of transaction volume. Therefore, the marginal cost of loans and the marginal return on deposits coincide with the interbank rate, which in this article is the 12-month EURIBOR.

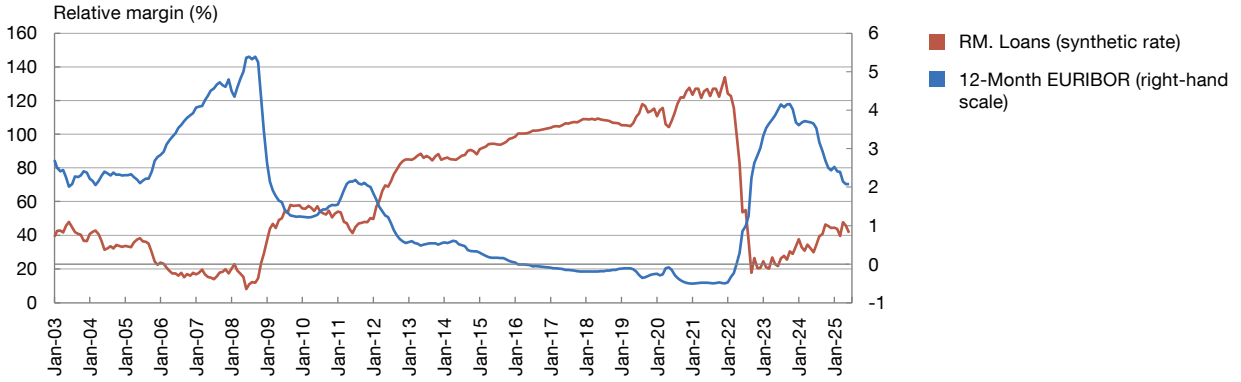
Broadly speaking, firms are said to have market power when their decisions on the volume of production for sale and/or input purchases influence the respective market prices (selling and purchase prices). In perfectly competitive markets, firms are price takers because their production and/or purchasing decisions have no impact on the equilibrium price; therefore, their market power is zero. Being a price taker also means that a firms' profit-maximising production is the quantity at which the selling price equals the marginal cost of production. In imperfectly competitive markets, where firms' individual decisions influence market prices, profit-maximising production choices take that influence into account and market equilibrium prices exceed the marginal cost of production.

The standard indicators of firms' market power are constructed based on the estimated relative difference between price and marginal cost, with the value of zero indicating the absence of market power. Moreover, larger relative differences are associated with less market competition, since the margin increasingly diverges from the zero value that represents perfect competition. In this article, banks' market power in loan and deposit markets is measured by the respective relative margins, calculated as:[4]

4 The approach to calculating banks' market power using the Lerner index varies depending on assumptions regarding the bank, intermediation and production. In the first of these, loans are produced by combining deposits, labour and capital acquired in competitive markets. All the inputs are variables and the type of deposit influences the calculation of the marginal cost of loan production (Carbó, Humphrey, Maudos and Molyneux, 2009). In the production model (as used in this article), the bank uses capital and labour to receive deposits and extend loans. Imperfect competition and bank market power is possible in both the loan and deposit markets.

Chart 2

The EURIBOR and banks' relative margin (RM) in the loan market (monthly new loans to NFCs). January 2003 to June 2025 (a)



SOURCE: Authors' calculations.

a Relative margin calculated as (interest rate on loans - EURIBOR) / interest rate on loans.

$$\text{Lerner index: loans} = \frac{r_P - i_E}{r_P}$$

$$\text{Lerner index: deposits} = \frac{i_E - r_D}{r_D}$$

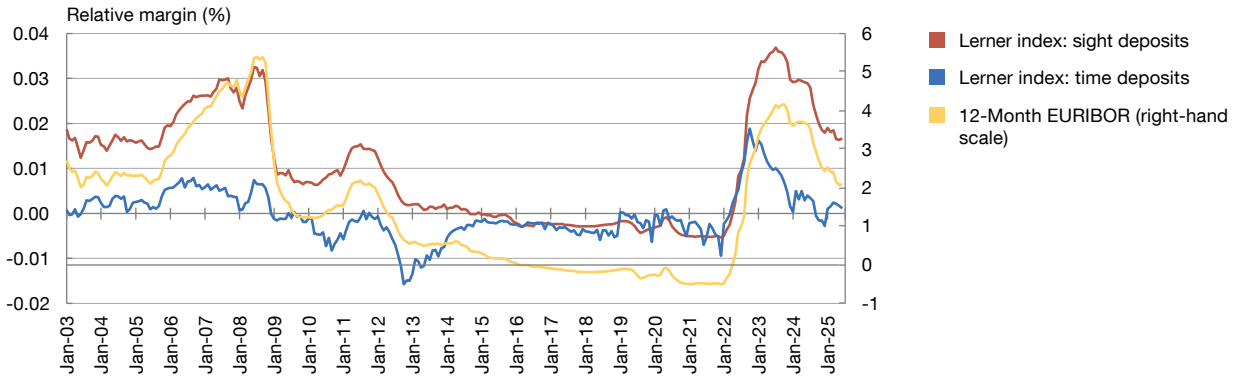
where r_P is the loan rate, i_E is the 12-month EURIBOR (as the benchmark interbank market rate) and r_D is the net deposit rate.[5]

Chart 2 shows the Lerner index calculated as the average (synthetic) lending rate to NFCs (for new loans month-to-month between January 2003 and June 2025) and the 12-month EURIBOR (daily average for the respective month). At the start of the series the Lerner index is 40% (the absolute unit margin represents 40% of the loan interest rate). In the subsequent years the relative margin first declines gradually to a low of 8.1% in July 2008 before rising to a peak of 134% in December 2021. From the summer of 2022 onwards the Lerner index falls rapidly to 20%, before recovering to the values observed at the beginning of the period. Chart 2 also plots the path of the EURIBOR, revealing a clear negative correlation between the interbank rate and the relative margin on loans (market power).

5 The market power indicator used in the most recent research is the ratio between the selling price and the marginal cost of production (see references in note 3). The indicator is related to the Lerner index through the expression $\frac{\text{Interest rate on loans}}{\text{EURIBOR}} = \frac{1}{1-\text{Lerner index: loans}}$. The term $\frac{1}{1-\text{Lerner index: loans}}$ is interpreted as the markup, greater than or equal to 1, that the firm/bank applies to the marginal cost (the EURIBOR) to determine the interest rate that NFCs pay on loans. In the deposit market the equivalent expression is $\frac{\text{Interest rate on deposits}}{\text{EURIBOR}} = \frac{1}{1+\text{Lerner index: deposits}}$. The term $\frac{1}{1+\text{Lerner index: deposits}}$ is now the markdown applied by banks to the EURIBOR to determine the interest rate paid on each euro of the NFCs' deposits.

Chart 3

The EURIBOR and banks' relative margin (Lerner index) in the deposit market (monthly new business with NFCs). January 2003 to June 2025 (a)



SOURCE: Authors' calculations.

a Relative margin (Lerner index) calculated as gross interest rates (1 + EURIBOR) / (1 + interest rate on deposits) -1 = (EURIBOR - interest rate on deposits) / (1 + interest rate on deposits).

In the deposit market, differences in interest rate patterns between NFCs' sight and time deposits indicate that relative margin indicators should be estimated separately for each deposit type. Both the EURIBOR and deposit rates hold close to zero for much of the period under review. Using those values to calculate the relative margin on deposits gives extreme readings that are difficult to explain. To avoid these extreme values, the relative margin on deposits is calculated using gross interest rates, $\left(\frac{1+\text{EURIBOR}}{1+\text{Interest rate on deposits}}-1\right)$. The results are shown in Chart 3.

The relative margins on time deposits stand at values close to zero throughout the period, even when the EURIBOR is moderately high. As Chart 3 shows, there is a clear overlap between developments in the EURIBOR and the Lerner index for deposits, except during the negative EURIBOR period when some divergence occurs. Therefore, the correlation between the EURIBOR and the relative margin on deposits is positive.

Charts 1 and 2 might initially suggest that the banking sector consolidation between 2010 and 2020 drove lasting increases in the relative margin on loans to NFCs. In other words, that consolidation could explain banks' increased market power in the market for loans to NFCs in Spain. However, the increase in the EURIBOR towards the end of the period, once consolidation had already concluded, coincides with a sharp drop in the market power indicator, which cannot be attributed to changes in banking consolidation. In the case of deposits, margins held at their lowest levels during the consolidation period (2010-20). Clearly then, bank consolidation alone cannot explain developments in bank margins; at the very least, EURIBOR dynamics must also be considered. The following sections analyse, first theoretically and then empirically, the interlinkages between margins, consolidation and the EURIBOR that help explain the above evidence.

3 Market power and its determinants

A loan market with N symmetrical banks – where all the banks "produce" loans with a unit marginal cost equal to the EURIBOR and "purchase" deposits to invest in the interbank market at the EURIBOR – is considered as a theoretical reference framework to explain the changes observed in interest rates and margins. Customers in both markets perceive the different banks' products as homogeneous and, therefore, each product (loans or deposits) will be exchanged at the same interest rate for all banks. The interbank market separates interest rate formation in loans and deposits. Table 1 summarises the main results of the Nash equilibrium under two different assumptions relating to the loan demand and deposit supply function: log-linear functions and linear functions of the relationship between quantity and price.[6]

Log-linear functions involve constant price elasticities at any point of the function. In the case of demand and supply functions that are linear with prices, elasticity changes depending on the point of the function at which it is measured. With log-linear functions, equilibrium prices and margins are determined by the constant elasticity and the given number of competitors. This implies proportionality between equilibrium rates and the EURIBOR (marginal cost and return), for a given number of competitors and elasticity. Proportionality between interest rate and marginal cost also means that the Lerner index is constant for a given number of competitors and elasticity, and inversely proportional to the number of competitors and elasticity.

With linear demand and supply functions, the strict proportionality between the equilibrium price and the marginal cost does not hold. In particular, the equilibrium interest rate equals a constant plus the marginal cost (the EURIBOR) multiplied by a factor that depends on the number of competitors, $\frac{N}{N+1}$. At banks, the EURIBOR (or interbank rate) multiplier coincides with the ECB's monetary policy pass-through coefficient.

For log-linear demand, the pass-through coefficient, $\frac{N\varepsilon_P}{N\varepsilon_P - 1}$ for example, depends on the number of competitors and the (constant) price elasticity and increases with each of the parameters (convergence to 1, complete pass-through, for high N values and/or high elasticity values). The pass-through of changes in the EURIBOR to market rates is therefore larger in structurally more competitive markets (more competitors). Once the pass-through has been completed, the change in the market rate will be proportional to the change in the interbank rate. However, for linear functions the pass-through coefficient is also higher in structurally more competitive markets, with a higher N, but the change in the market interest rate as the pass-through is completed will be smaller than that proportional to the change in the EURIBOR, because there is an intercept in the price formation function (proportionality holds only when N is high, the constant tends to 0 and the slope to 1).

6 For the general theory of price formation in oligopolies see Tirole (1988) and Vives (1999). For firms and banking markets see Freixas and Rochet (2008). For further details of the imperfect competition models in the Table 2 results, see Medrano Adán and Salas Fumás (2025).

Table 1

Summary of Nash equilibrium values for variables selected under two assumptions on loan demand and deposit supply functions

	Log-linear demand: loans	Linear demand: loans	Log-linear demand: deposits	Linear demand: deposits
Interest	$r_P^* = \frac{N\varepsilon_P}{N\varepsilon_P - 1} i_E$	$r_P^* = \frac{a + Ni_E}{N+1}$	$r_D^* = \frac{N\varepsilon_D}{N\varepsilon_D + 1} i_E$	$r_D^* = \frac{\alpha + Ni_E}{N+1}$
Absolute margin	$r_P^* - i_E = \frac{i_E}{N\varepsilon_P - 1}$	$r_P^* - i_E = \frac{a - i_E}{N+1}$	$i_E - r_D^* = \frac{-i_E}{N\varepsilon_D + 1}$	$i_E - r_D^* = \frac{i_E - \alpha}{N+1}$
Relative margin (Lerner index)	$\frac{r_P^* - i_E}{r_P^*} = \frac{1}{N\varepsilon_P}$	$\frac{r_P^* - i_E}{r_P^*} = \frac{a - i_E}{a + Ni_E}$	$\frac{i_E - r_D^*}{r_D^*} = \frac{1}{N\varepsilon_D}$	$\frac{i_E - r_D^*}{r_D^*} = \frac{i_E - \alpha}{\alpha + Ni_E}$
Markup and markdown	$\frac{r_P^*}{i_E} = \frac{N\varepsilon_P}{N\varepsilon_P - 1}$	$\frac{r_P^*}{i_E} = \frac{a + Ni_E}{(N+1)i_E}$	$\frac{i_E}{r_D^*} = \frac{N\varepsilon_D + 1}{N\varepsilon_D}$	$\frac{i_E}{r_D^*} = \frac{(N+1)i_E}{\alpha + Ni_E}$

SOURCE: Authors' calculations.
NOTE: * denotes Nash equilibrium values. Demand and supply functions considered: linear loan demand function, $r_P = a - bP$, where P denotes loan volume; linear deposit supply function, $r_D = \alpha + \beta D$, where D denotes deposit volume; log-linear loan demand function, $\ln(r_P) = A - \varepsilon_P \ln(P)$; log-linear deposit supply function, $\ln(r_D) = B - \varepsilon_D \ln(D)$; where a, b, β, A are positive parameters; the α sign is undetermined; ε_P, ε_D are, respectively, the constant price elasticities of log-linear loan demand and deposit supply functions, in absolute terms; and where $a > \alpha$ in order for the result to be economically meaningful.

With a log-linear function, the absolute margin on loans (deposits) is an increasing (decreasing) function of the interbank rate, while with linear functions the sign of the function linking absolute margins to the interbank rate is exactly the opposite. Lastly, as regards the relative margin, with a log-linear function the margin is independent of the interbank rate, while on a linear basis the relative margin depends on the value of the marginal cost (the interbank rate in this case), at which it is measured. In particular, the relative margin on loans (deposits), calculated based on Nash equilibrium interest rates, is a decreasing (increasing) and convex (concave) function of the interbank rate.

The number of competitors on the market also has a role in determining prices and margins in equilibrium. In all cases, a lower number of competitors (lower N) means lower margins (lower loan rates and higher deposit rates). The sign and magnitude of the impact of changes in the number of competitors on interest rates and the equilibrium margin depend on the interbank rate used. The same applies to the sign and impact of changes in the EURIBOR on rates and margins. These interactions between the effects of the EURIBOR and the number of competitors on equilibrium price and margin values make it difficult to respond to the question raised in this article on the impact of bank consolidation on banks' market power because, as noted in the descriptive section above, changes in the EURIBOR occur at the same time as changes in the number of competitors.

4 Explanation of changes in market power

This section examines the correlation between the theoretical predictions in Table 1 and the descriptive data on concentration, the EURIBOR and relative margins in Section 2. First, an exploratory analysis is conducted to see whether the evidence presented is consistent with log-linear or linear demand and supply. Second, a comparison of pre- and post-consolidation

rates and margins is carried out to assess whether the reduction in the number of competitors has an impact on interest rates and margins as predicted by the theoretical model.

4.1 Correlation between relative margins (market power) and the EURIBOR and the number of banks

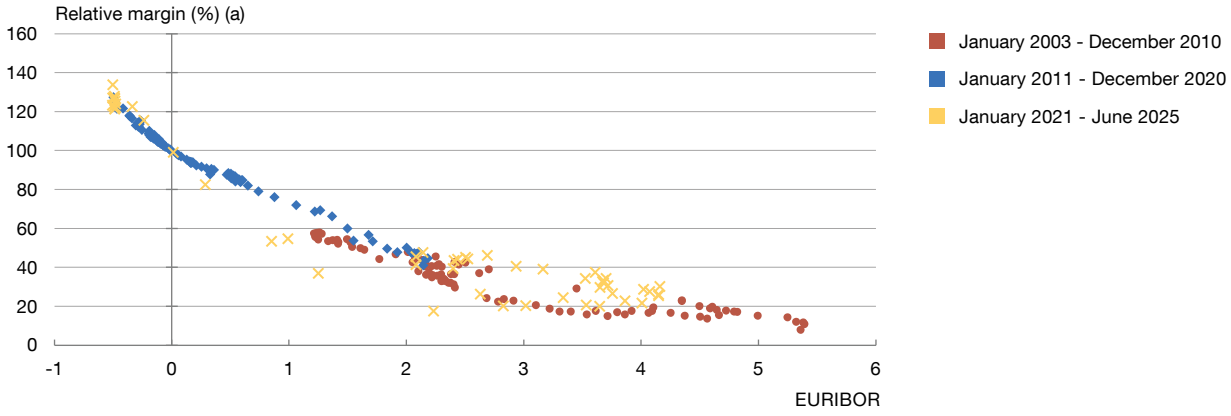
Charts 4 and 5 illustrate the relationship between changes in the EURIBOR and changes in the relative margin for loans and sight deposits. Chart 4 bears out a negative and convex association between the EURIBOR and the relative margin for loans according to Table 1, based on a linear demand function. While Chart 5 bears out a growing and concave functional relationship between the EURIBOR and the relative margin of sight deposits under the same theoretical basis (a linear deposit supply function). With the log-linear demand and supply functions, relative margins calculated based on equilibrium interest rates are independent of the EURIBOR at which they are measured. Accordingly, for the rest of the exposure the linear demand and supply assumption remains applicable.

The dot colours indicate the period: pre-consolidation (red), consolidation (blue) and post-consolidation (yellow). There are differences in the relationship with the EURIBOR over the various time periods, indicating higher margins in the post-consolidation period than in the pre-consolidation period (the details of the comparison are discussed in a later section).

Chart 6 shows a decreasing correlation between the relative loan margin and the number of competitors in the market, which is in line with the theoretical results in Table 1. The chart uses different colours for years 2006 to 2008 (red) and years 2022 to 2024 (yellow) to identify those in which policy rates increased sharply. The relative margins for sub-periods 2006-08 and 2022-24 are lower than those observed in other sub-periods for a similar number of competitors. This is theoretically explained by the negative effect of the EURIBOR increase on margins for a given number of banks. The decrease in relative margins coinciding with the rise in the policy rate was greater in 2022-24 because the increase vis-à-vis the starting levels was higher than in the period 2006-08 (in 2021 the EURIBOR was in negative territory). Also, the average value of the relative margin in the years 2022-24 (43%) was significantly higher than in the period 2006-08 (20%), which could be explained by the lower number of competing banks and the lower average EURIBOR in the post-consolidation period.

The blue dots in Chart 6 denote periods in which changes in the number of competitors and changes in the EURIBOR coincide (Charts 1 and 2). In the Annex a theoretical relationship is established between developments in the EURIBOR and banking consolidation in Spain, based on equilibrium in the number of competitors in the market under free entry and fixed operating costs for the bank. According to the results in the Annex, the total gross margin on loans per bank decreases in line with the EURIBOR, while the total gross margin on deposits increases in line with the EURIBOR. For a given fixed cost of transactions, the decline in the EURIBOR, which started in 2010 and remained at values close to 0 for several years, may contribute to market concentration if the decline in the total gross margin on liabilities envisaged

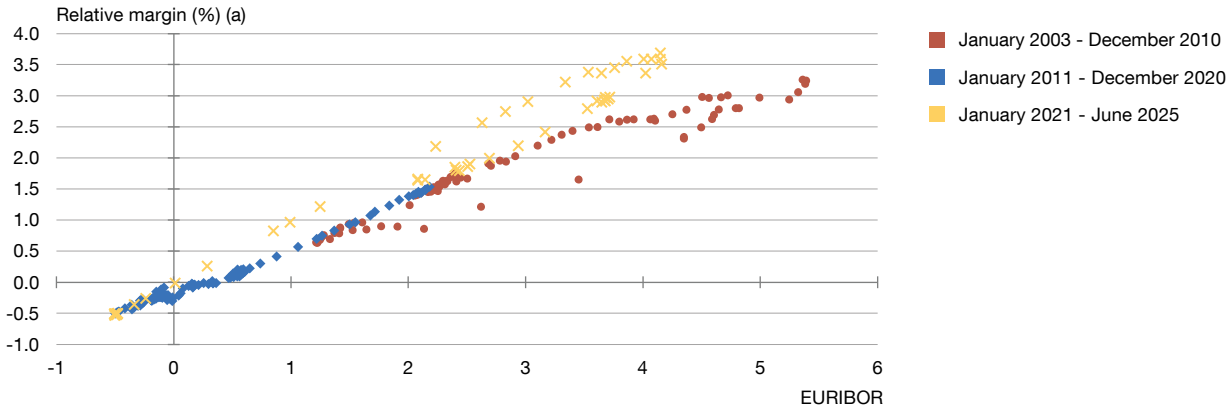
Chart 4
Correlation between the EURIBOR and the relative margin (Lerner index) on loans



SOURCE: Authors' calculations.

a Lerner index calculated as EURIBOR / (Interest rate on loans) –1 = (Interest rate on loans – EURIBOR) / (1 + Interest rate on loans).

Chart 5
Correlation between the EURIBOR and the relative margin (Lerner index) on sight deposits



SOURCE: Authors' calculations.

a Lerner index calculated as gross interest rates: (1 + EURIBOR) / (1 + Interest rate on deposits) – 1 = (EURIBOR – Interest rate on deposits) / (1 + Interest rate on deposits).

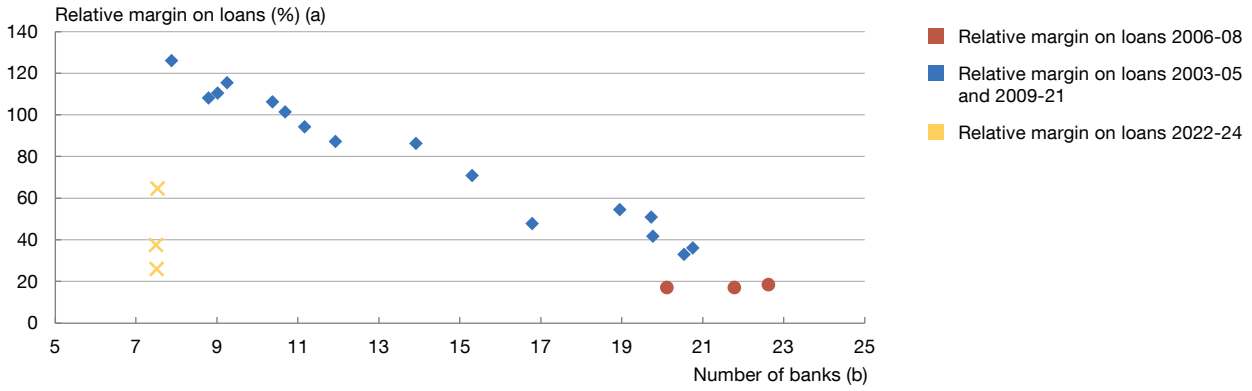
in the theory is indeed greater than the (also theoretical) increase in the total gross margin on assets. It is therefore possible that the effect on interest rates and profit margins of the prolonged decline in the EURIBOR has had a direct and an indirect component, the latter induced through the impact of EURIBOR developments on sector concentration.

4.2 Comparison of average interest rates and margins pre- and post-consolidation

In principle, under similar EURIBOR monetary conditions, the relative margin should be expected to be higher in the post-consolidation period than in the pre-consolidation period.

Chart 6

Relationship between the relative margin on loans and the number of banks



SOURCE: Authors' calculations.

a Lerner index calculated as EURIBOR/(Interest rate on loans) - 1.
b Equivalent number of equal competitor banks (N), calculated as the inverse of the HHI.

However, the theory says that the effect of the EURIBOR on the Lerner index is not independent of the number of competitors in the market and, moreover, the impact of N on the effect of changes in the EURIBOR on the relative margin has an undetermined sign (depending on the EURIBOR value at which the effects are calculated). Therefore, the answer to the question of whether the indicator of market power increases with consolidation is answered through evidence.[7]

Table 2 shows the average values for the main monetary variables (ECB policy interest rates, the EURIBOR), interest rates and loan and deposit margins, and the equivalent number of equal competitors, for the entire period and for three sub-periods: from January 2003 to June 2008, from July 2008 to June 2022 and from July 2022 to June 2025. Cut-off points for the sub-periods have been selected such that for the first and third sub-periods the average EURIBOR is similar (around 3%) and the number of banks is stable (around 21 in the first sub-period and around 7.5 in the third). The intermediate period therefore coincides with the sector's gradual consolidation from 21 to 7.5 equivalent equal banks and the ECB's monetary expansion (near-zero rates). A comparison of interest rates and margins between the first and the last period captures the effect of the sector's increasing concentration while similar monetary conditions are maintained. The intermediate period illustrates the combined effects of gradual consolidation and the reduction of policy rates.

The results of the comparison of pre- and post-consolidation interest rates and margins show higher (lower) average values of interest rates on loans (deposits) in the post-consolidation

7 Another possibility is to respond to the question, for example, by estimating the formation equation for equilibrium interest rates. Based on Table 2, $\frac{\Delta r_P^*}{\Delta i_E} = \frac{N}{N+1}$. Therefore, $\frac{\Delta}{\Delta N}\left(\frac{\Delta r_P^*}{\Delta i_E}\right) = \frac{\Delta}{\Delta N}\left(\frac{N}{N+1}\right) > 0$. In other words, the impact of the change in the equilibrium interest rate on changes in the EURIBOR is greater in markets with more competitors. Medrano Adán and Salas Fumás (2025) use this test to answer the question posed.

Table 2

Average values of monetary variables, observed interest rates, absolute and relative margins and average number of competitors

Period	Total period: January 2003 - June 2025	Sub-period 1: January 2003 - June 2008	Sub-period 2: July 2008 - June 2022	Sub-period 3: July 2022 - June 2025
Interest rate on deposit facilities	0.79	1.71	-0.03	2.90
Interest rate on loan facilities	1.97	3.71	0.95	3.56
12-month EURIBOR	1.55	3.13	0.60	3.12
Interest rate on loans (composite)	3.49	4.27	2.93	4.65
Interest rate on sight deposits	0.54	1.05	0.36	0.47
Interest rate on time deposits	1.58	2.76	0.92	2.46
Interest rate on deposits (composite)	0.91	1.71	0.62	0.85
Absolute margin on time deposits	-0.03	0.37	-0.33	0.66
Absolute margin on sight deposits	1.01	2.08	0.23	2.65
Absolute margin on deposits	0.64	1.42	-0.02	2.27
Absolute margin on loans	1.93	1.14	2.33	1.53
Total absolute margin	2.57	2.56	2.31	3.80
Relative margin on time deposits*	-0.028	0.355	-0.322	0.643
Relative margin on sight deposits*	0.998	2.060	0.230	2.638
Relative margin on deposits*	0.627	1.396	-0.023	2.252
Relative margin on loans	65.4	28.1	87.0	33.3
Number of equal banks	14.0	21.0	12.7	7.5

SOURCE: Authors' calculations drawing on the Banco de España's statistical data.

years. Something similar is true for the average values of the absolute and relative margins on loans and deposits.

Although this paper places emphasis on explaining relative margins (market power), it is important to understand the relationship between changes in market power and changes in market interest rates. Based on the Lerner index for loans, $L = \frac{r-i}{r}$, $r = \frac{i}{1-L}$ is obtained by taking the logarithms and differentiating, $\frac{\Delta r}{r} \approx \frac{\Delta i}{i} + \frac{1}{1-L}\Delta L = \frac{\Delta i}{i} + \frac{r}{i}\Delta L$ (given that $1 - L = i/r$). Since the $\frac{r}{i}$ markup is greater than or equal to 1, the absolute change in the relative margin is a lower bound than the relative change in the interest rate on loans. According to the data in Table 2, the average EURIBOR is virtually the same during the pre- and post-consolidation periods. The absolute change in the relative margin during the post- and pre-consolidation periods is $\Delta L = 33.3 - 28.1 = 5.2$; therefore, the minimum bound of the relative change in the interest rate on loans ($\Delta r/r$) is 5.2%. The markup estimated based on the average interest rate on loans and the EURIBOR in the pre-consolidation period is $(r/i) = 4.27 / 3.13 = 1.36$. Accordingly, an increase in the interest rate on loans in the post-consolidation period of $(\Delta r/r) = 1.36 \times 5.2\% = 7.1\%$ is estimated. The difference in average relative margins between post- and pre-consolidation predicts an average interest rate of $1.071 \times 4.27\% = 4.57\%$ in the post-consolidation period, compared with the observed 4.65% (Table 2).

Table 3
Estimation of the empirical model for determinants of the relative margin-Lerner index

	Lerner index: loans	Lerner index: sight deposits (based on gross interest rates)
Constant (ϕ_0)	79.138	0.028
p-value	0.000	0.860
EURIBOR, $i_{E,t}$ (ϕ_1)	-19.812	0.574
p-value	0.0001	0.000
EURIBOR squared, $(i_{E,t})^2$ (ϕ_2)	1.216	0.020
p-value	0.065	0.016
$Z_{2011\text{-}2020}$ (ϕ_3)	24.564	-0.300
p-value	0.0053	0.289
$Z_{2021\text{-}2025}$ (ϕ_4)	22.260	-0.249
p-value	0.012	0.408
$i_{E,t} \times Z_{2011\text{-}2020}$ (ϕ_5)	-24.754	0.315
p-value	0.0003	0.187
$i_{E,t} \times Z_{2021\text{-}2025}$ (ϕ_6)	-25.085	0.425
p-value	0.0000	0.0001
$(i_{E,t})^2 \times Z_{2011\text{-}2020}$ (ϕ_7)	6.759	-0.032
p-value	0.0017	0.733
$(i_{E,t})^2 \times Z_{2021\text{-}2025}$ (ϕ_8)	5.400	-0.032
p-value	0.0000	0.057
ρ	0.888	0.977
R squared, R^2	0.996	0.999
Durbin-Watson	2.362	1.968

SOURCE: Authors' calculations.
NOTE: Lerner index of sight deposits calculated on the basis of gross interest rates, Lerner index: deposits $= \frac{(1+i_E)-(r+1_D)}{(1+r_D)} = \frac{i_E - r_D}{(1+r_D)}$.

In the case of deposits, the relative margin has been calculated on the basis of gross interest rates, $L_D = \left(\frac{1+i}{1+r_D} - 1\right) = \frac{I}{R_D} - 1$, where R_D and I denote the gross interest rates on sight deposits and the EURIBOR, respectively, $R_D = 1+r_D$, $I = 1+i$. Differentiating, it holds that $\frac{\Delta R_D}{R_D} = -\frac{R_D}{I}\Delta L_D + \frac{\Delta I}{I}$. Based on Table 3 data, the absolute change in the relative margin (post-consolidation minus pre-consolidation) is $\Delta L_D = 2.638 - 2.060 = 0.577$. For a markdown (in gross rates) in the pre-consolidation period of $\frac{R_D}{I} = \frac{1+r_D}{1+i}$ = (101.5 / 103.13) = 0.98, and given $\Delta I/I$ = -0.01146, the estimated relative change in the (gross) interest rate on deposits is -0.577 × 0.98 = -0.5769, compared with the observed value $\Delta R_D / R_D = 100 \times (1.0047 / 1.0105 - 1) - 100$ = -0.5717. The estimated value $\Delta R_D / R_D$ = -0.5769 would imply an (average) interest rate on deposits in the post-consolidation period of 0.4627% (compared with the observed 0.47%) and a relative change compared with the pre-consolidation rate of 0.4627 / 1.0456 − 1 = -55.75%.

The impact of consolidation on market interest rates can also be assessed directly from the equilibrium interest rate formation equation in Table 1. In the pre-consolidation period (N = 21),

the pass-through coefficient is $\frac{N}{N+1}=0.955$, close to 1, $\frac{a}{N+1}\approx r_P^* - \frac{21}{22}i_E = 4.27-(21/22)\times 3.13 = 1.283$ and $a=(N+1)r_P^* - Ni_E = 22\times 4.27 - 21\times 3.13 = 28.22$. If N declines from 21 to 7.5, the interest rate predicted, assuming that the parameter does not change, is $(28.22+7.5\times 3.13)/8.5 = 6.08$. For EURIBOR around 3%, with the same parameters of the loan demand function as in the pre-consolidation period, the reduction in the number of competitors from 21 to 7-8 is estimated to increase the interest rate on loans by 33% (from 4.27 to 6.08). The estimated interest is higher than the observed average interest on loans after consolidation of 4.65 in Table 2, although the purely approximate nature of the calculations should be taken into account. In any event, note that with a log-linear demand function and constant elasticity, reducing the number of competitors to one-third directly multiplies by three the relative margin (Table 1). Therefore, given the relationship between the change in the relative margin and the change in the interest rate, the equilibrium interest rate on loans would change by at least the same proportion.[8]

The average value of the variables in Table 2 in the intermediate period (from July 2008 to June 2022, when banking consolidation tool place and the EURIBOR declined) is consistent with changes in the EURIBOR having a stronger influence on developments in interest rates and margins than changes in the number of competitors. Lending and deposit rates are below the values in the pre- and post-consolidation periods, in line with a lower average EURIBOR value (0.6% compared with 3%). Moreover, as expected based on the theory (Table 1), average, absolute and relative loan margins are higher when interest rates are lower, while the opposite is true for deposit margins.

4.3 Structural changes in the models

The relationship between the EURIBOR and the number of competitors as determinants of the relative margin suggests that the functional relationship between the margin and the EURIBOR varies structurally as the number of competitors in the market rises or falls. To account for this possibility when comparing pre- and post-consolidation average margins, the following econometric model is formulated for subsequent estimation:

$$L_t = \phi_0 + \phi_1 i_{Et} + \phi_2 i_{Et}^2 + \phi_3 Z_{2011-2020} + \phi_4 Z_{2021-2025} + \phi_5 i_{Et} Z_{2011-2020} + \phi_6 i_{Et} Z_{2021-2025} + \phi_7 i_{Et}^2 Z_{2011-2020} + \\ + \phi_8 i_{Et}^2 Z_{2021-2025} + u_t,$$

$$u_t = \rho u_{t-1} + \varepsilon_t.$$

8 In the case of deposits, a major structural change in the supply function is necessary in order to reconcile the average values in Table 3 with the theoretical predictions. Another significant factor not considered in the above comparative statics is the speed of the pass-through of the EURIBOR to market rates. For instance, in April 2022 when the EURIBOR turned positive (0.013%) after a long period with negative values, the rate on sight deposits was 0.029% and that on time deposits was -0.2%. In December 2022, with the EURIBOR at 3%, these values were 0.11% and 1.6%, respectively. The maximum sight deposit rate was reached 12 months after the EURIBOR peak.

where L_t is the Lerner index for month t; $i_{E,t}$ is the interbank interest rate for month t; $Z_{2011-2020,t}$ is a binary variable equal to 1 for periods between January 2011 and December 2020 and 0 otherwise; and $Z_{2021-2025,t}$ is likewise a binary variable equal to 1 from January 2021 to June 2025. The sub-periods were selected based on times when significant changes took place in the number of competitors (Chart 1). The error term u_t captures the random disturbance that is modelled to account for possible autocorrelation in the estimation residuals, $u_t = \rho u_{t-1} + \varepsilon_t$.

The parameters $\phi_l, l = 1-8$, have different expected signs for loan and deposit margins (a decreasing and convex function of the Lerner index with respect to the EURIBOR for loans, and an increasing and concave function for deposits). The estimated values of ϕ_0, ϕ_1, ϕ_2 correspond to the pre-consolidation model, while the estimated values of $\phi_0 + \phi_4, \phi_1 + \phi_6, \phi_2 + \phi_8$ correspond to the post-consolidation model. The remainder correspond to the intermediate period during which the consolidation takes place.

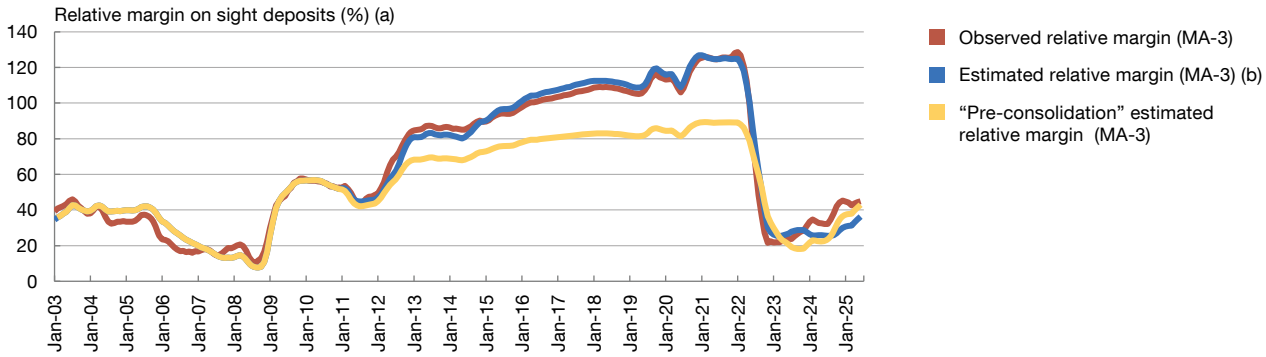
Table 3 shows the results of the econometric model's estimation for the Lerner index of (gross) loans and sight deposits with the error term modelled as an autoregressive (1) process. In general, the statistical significance of the estimated coefficients for the variables defined in multiplicative terms, in both loan and sight deposit margins, confirms the structural change in the relationship between the relative margin and the EURIBOR. The theoretical prediction regarding the function's form (decreasing and convex for loans and increasing and concave for deposits) is also confirmed.

If the estimated coefficients for the multiplicative variables were not significantly different from zero, the effect of the number of competitors on relative margins would be determined directly by the estimated coefficient for the respective binary variable, Z. However, when the coefficients for the multiplicative variables are not zero, measuring the effect of the number of competitors on relative margins requires accounting for the change in the slopes of the EURIBOR variable's effect owing to the variance in the number of competitors. With these considerations, the comparison between pre- and post-consolidation is replaced by a comparison between the relative margin values observed and those predicted by the model estimated in the pre-consolidation period. Charts 7 and 8 display the moving averages of order 3 of the values observed, those predicted by the models estimated in Table 3 and those predicted for the entire period on the basis of the model estimated in the pre-consolidation period.

Although there are notable differences between the observed values and those predicted by the pre-consolidation model in different sub-periods, it is particularly interesting to compare them in the post-consolidation period from January 2023 to June 2025. After performing the relevant calculations, an average difference of 6.2 percentage points (pp) is estimated for the relative margin on loans and -60 pp for sight deposits. These values are consistent with those estimated directly from the differences between the pre- and post-consolidation average values in Table 3. The charts also demonstrate that the differences between the observed and estimated relative margins change within the sub-period with EURIBOR variations, as predicted by the theoretical results.

Chart 7

Observed and predicted relative margin on loans

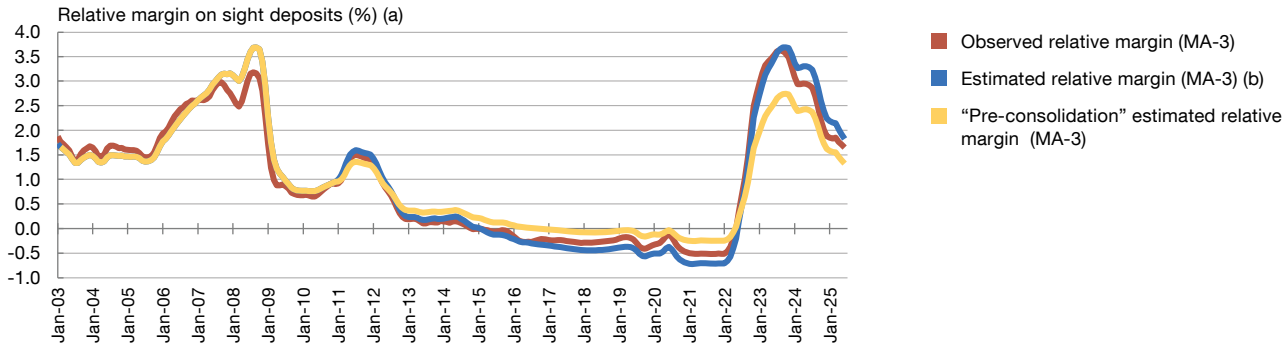


SOURCE: Authors' calculations.

a Relative margin (Lerner index) calculated as (Interest rate on loans - EURIBOR) / (Interest rate on loans).
b The "estimated relative margin" on loans has been calculated using the estimated coefficients shown in Table 3. Furthermore, the predicted values (of the "pre-consolidation" estimated relative margin) have been calculated that would be found for the entire period (2003-25) based on the estimated coefficients in the pre-consolidation period Φ_0, Φ_1, Φ_2. The moving averages of order three (MA-3) are shown.

Chart 8

Observed and estimated relative margin on sight deposits



SOURCE: Authors' calculations.

a Relative margin (Lerner index) calculated as gross interest rates, (1 + EURIBOR) / (1 + Interest rate on deposits) –1.
b The "estimated relative margin" on sight deposits has been calculated on the basis of the estimated coefficients shown in Table 3. In addition, the predicted values (of the "pre-consolidation" estimated relative margin) have been calculated that would have been found for the entire period (2003-25) based on the estimated coefficients in the pre-consolidation period, Φ_0, Φ_1, Φ_2. The moving averages of order three (MA-3) are shown.

5 Conclusion

This paper documents changes in interest rates and margins on Spanish banks' loan and deposit transactions with NFCs in terms of new transactions month by month between January 2003 and June 2025. This period coincides with significant fluctuations in ECB policy interest rates, along with the consolidation of the Spanish banking sector, which saw the equivalent number of equal competitor banks in the domestic market as a whole drop from 20 to eight. This raises the question of the influence of changes in monetary conditions and competition on market power and on the interest rates on loans and deposits.

The analyses combine a theoretical framework for equilibrium price formation in imperfectly competitive markets with observation and statistical treatment of the data. The results highlight the complexity of separating the effects of monetary conditions and competition on developments in banks' market power in Spain in the period under review. Lastly, it is estimated that, for the EURIBOR monthly values between January 2023 and June 2025, using the price formation model estimated for the period 2003-08, loan interest rates (sight deposits) would have been on average 6.2% (60%) higher (lower) than those observed. This is a preliminary estimate of the effect of banking sector consolidation on the interest rates on transactions with NFCs in Spain, although it cannot be ruled out that other changes in the sector and its environment have contributed to these differences in this period (for example, different liquidity conditions for firms and banks and barriers to negative rates on sight deposits).

A second noteworthy result concerns the conditions under which the Lerner index, or other equivalent measures of market power, is a reliable indicator of the degree of competition in the market. With linear demand functions, for instance, the Lerner index, calculated on the basis of Nash equilibrium prices in an oligopoly, varies according to the level of marginal cost at which it is assessed. As a result, changes in marginal cost over time alter the value of the relative margin, even if market competition conditions remain unchanged. In the case of the banking markets, where the interbank rate accounts for a significant share of the marginal cost of loans and the marginal return on deposits, the indicator of banks' market power will be sensitive to the ECB's monetary policy, given the influence the latter has on the interbank rate. The evidence presented in this study is consistent with loan demand and deposit supply functions that are linear with interest rates, which makes it difficult to identify structural competition trends in the sector based solely on the Lerner indices calculated. The caution required when interpreting developments in the relative margin as an indicator of trends in competition in the market is also needed for any activity where marginal costs may vary over time.

The data on interest rates and margins have been assessed based on theoretical predictions from a stylised model of banking competition that does not take into account some real-life aspects of granting loans and taking deposits, such as incorporating credit risk when setting interest rates on loans, solvency and liquidity regulation, and NFCs' potential access to alternative sources of financing and investment. Moreover, the aggregated data (sector averages) for loan and deposit interest rates used in the analysis do not allow for controlling heterogeneity across banks and markets, nor for any relaxation of the assumption of fixed costs for labour and capital resources. All these are significant limitations and point the way for further research.

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Based on the Nash equilibrium results in the market, including those in Table 1, the gross profit of a bank is equal to the sum of the gross profit in the loan market and in the deposit market, as follows:

$$\text{Banks' gross profit on loans}_j^* = \left(r_P^* - i_E\right)P_j^* = \frac{1}{b}\left(\frac{a - i_E}{N+1}\right)^2$$

$$\text{Banks' gross profit on deposits}_j^* = \left(i_E - r_D^*\right)D_j^* = \frac{1}{\beta}\left(\frac{i_E - \alpha}{N+1}\right)^2$$

The asterisk * denotes the value at Nash equilibrium and $P_j^*\left(D_j^*\right)$ the loans (deposits) of bank j at the (symmetric) Nash equilibrium.

$$\text{Total profit} = \frac{1}{b}\left(\frac{a - i_E}{N+1}\right)^2 + \frac{1}{\beta}\left(\frac{i_E - \alpha}{N+1}\right)^2 = \left(\frac{1}{N+1}\right)^2\left(\frac{\left(a - i_E\right)^2}{b} + \frac{\left(i_E - \alpha\right)^2}{\beta}\right)$$

For a bank to remain viable, gross profit must be greater than or equal to the fixed operating cost, represented by F:

$$\left(\frac{1}{N+1}\right)^2\left(\frac{\left(a - i_E\right)^2}{b} + \frac{\left(i_E - \alpha\right)^2}{\beta}\right) \geq F$$

This means that the maximum number of competitors in the market for banks to remain economically viable is:

$$N+1 = \sqrt{\frac{\left(\frac{\left(a - i_E\right)^2}{b} + \frac{\left(i_E - \alpha\right)^2}{\beta}\right)}{F}}.$$

With free entry and exit of competitors, the equilibrium number of banks will adjust to satisfy this condition. The equilibrium number of banks depends on the interbank rate, although whether the effect is positive or negative is not known a priori. An increase in interbank rates leads to lower gross profits in the loan market, which depresses the equilibrium number of competitors. However, a higher EURIBOR contributes to increased gross profits in the deposit market, which lifts the equilibrium number of competitors. It is a notable theoretical finding that ECB monetary policy can influence the number of competing banks in the market, although whether positively or negatively is dependent on the characteristics (supply and demand functions) of the loan and deposit markets. The evidence presented in the main text

shows that banking consolidation since 2010 coincides with a period of particularly low ECB policy rates and relatively low banking profits in Spain. The relatively low profits across the banking sector in this period suggest that the expected positive effect of low rates on gross profits in the loan market may have been outweighed, in absolute terms, by lower total gross margins in the deposit market. Given fixed costs per bank, the decline in total gross profits from both loans and deposits likely exerted pressure in favour of consolidation and concentration in the sector.

With the rise in policy rates in 2022 and subsequent developments in these rates and the EURIBOR up to mid-2025 (the latest available data), the extraordinarily loose monetary conditions of the 2012-22 decade may be coming to an end. In the near future, more "normal" EURIBOR values, of around 2%, could be expected. Taking this EURIBOR as a reference, the current equivalent number of equal banks (sector concentration) may be below the equilibrium number. In other words, with the present number of banks and less accommodative monetary conditions, the economic profits of banks could once again become sustainably positive, which would act as a draw for potential entrants to the market.

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