

WORKING PAPER

The impact of European banking consolidation on credit prices

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Abstract

The crisis has made obvious the fragility of some aspects of EMU, like financial fragmentation and the need of banking consolidation. Banks have merged due to the vulnerability of some players or in order to improve the profitability/efficiency of the sector. There is ample economic literature on the differences between banking concentration and competition, which proves that additional banking consolidation does not necessarily lead to reduced competition. According to our analysis, except in the case of credit to non-financial firms in Portugal, there is no evidence of concentration having affected competition, as it is not one of the determinants of credit interest rates.

Key words: Credit, SMEs, interest rate, banking union, monetary policy, concentration

JEL classification: E42, E43, E44, E51, E52, F36

1. Financial fragmentation and bank consolidation

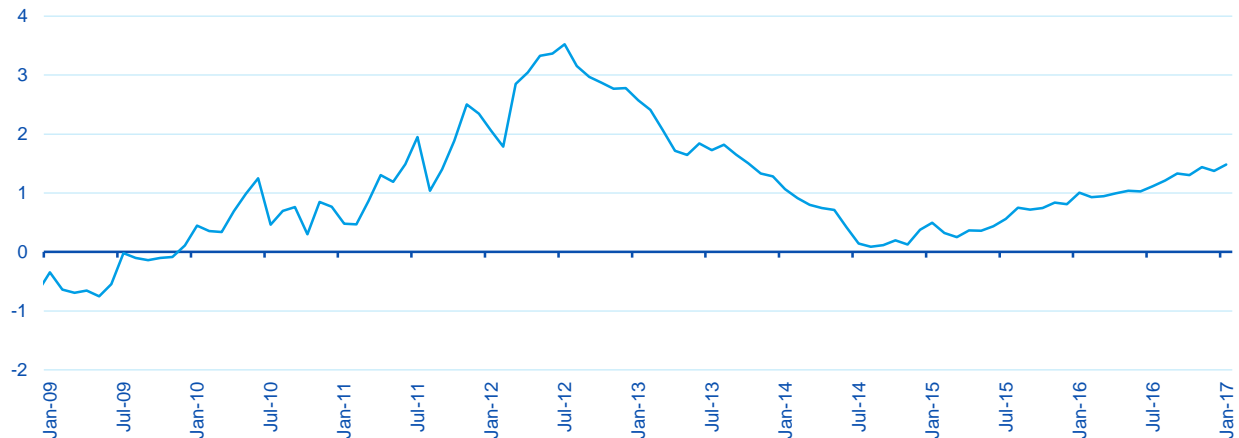
The recent international financial crisis has made obvious important vulnerabilities of the global economy, and in particular of the European Monetary Union (EMU). First, the financial fragmentation of European markets materialized in that when the crisis started markets started to work as a plethora of national markets rather than like a banking union. Second, the crisis has forced banks to merge, due to the vulnerability of some players or in order to exploit the synergies and improve the efficiency of the sector. In this paper, we try to analyze the implications of these two trends in banking competition, using the formation of credit interest rates as a proxy of it. In fact, we try to answer the question: Has concentration affected competition? or in particular, is concentration one of the determinants of credit interest rates?

Regarding the **first point, financial fragmentation**, the crisis triggered an increase of uncertainty on the real situation of the economies and financial entities. There were doubts on what agents were the holders of the US toxic assets, who was more exposed to volatile markets or what banks were hiding problematic assets on their balance sheets. In that framework, international wholesale market transaction diminished drastically, interbank market activity halted (even among banks in core markets) and the use of foreign collateral went down (for example in the Eurosystem operations). In this framework, a sovereign-banking risk loop emerged, as financial conditions for banks depended on their country of origin and sovereign funding conditions depended on whether the market thought that public funds could support its banks (as in Ireland). Banks in peripheral countries (Portugal, Italy, Ireland, Greece and Spain) were more severely penalized.

These trends can be summarized in BBVA Research Financial Fragmentation Index (Figure 1), which uses information on sovereign debt spread, private sector credit interest rates, ECB liquidity and Target-2 amounts.

Figure 1

Composite measure of EZ financial fragmentation



Source: BBVA Research

What factor helped reducing fragmentation since 2012? The willingness of the ECB to do ‘whatever it takes’ to preserve the euro and the Banking Union. Having a single rulebook, a single supervisory mechanism and a single resolution mechanism has helped increasing confidence in the resilience of European financial systems, fostering cross-border operations in the EU. The Banking Union is far from completed, but at the end of this process funding conditions should depend on the credit quality of the debtor, and not on its country of origin.

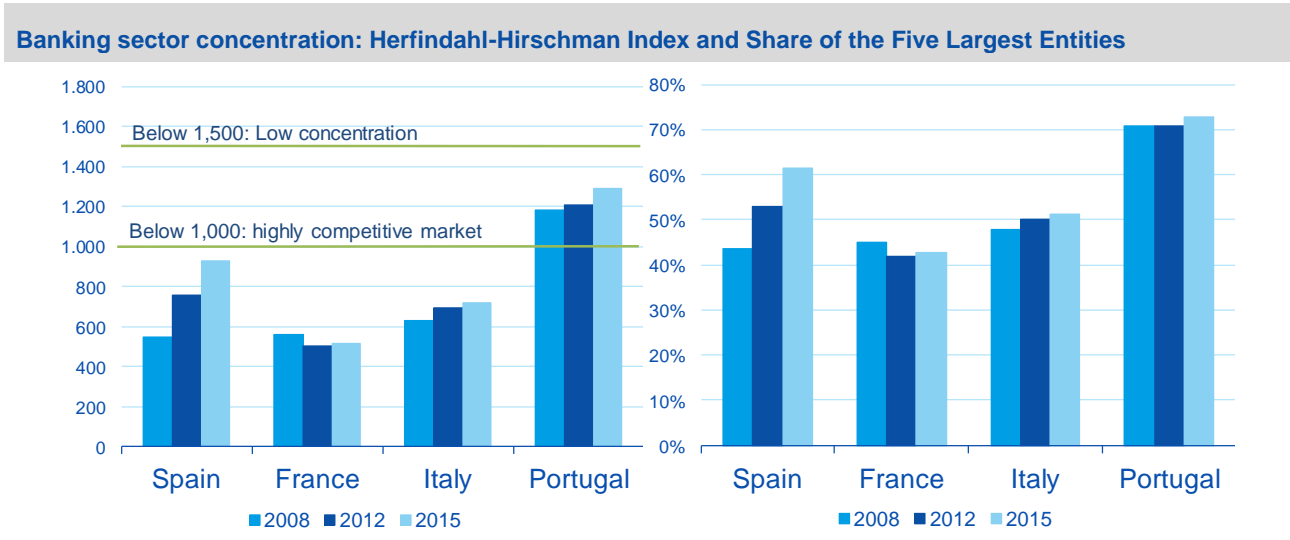
Since mid-2014 the increase in ECB liquidity caused by the Quantitative Easing measures has implied a surge in financial fragmentation and delayed the recovery of markets such as the interbank one.

The equilibrium level of this index is unclear, but it should be above the pre-crisis one (as risks were undervalued and liquidity seemed unlimited). The current level, where Spanish entities absorb around 60% of net ECB liquidity (vs. a capital key around 13%), does not seem to be equilibrium.

In this paper, we will analyze the influence of the sovereign risk of each country in the formation of the prices of its credit, to understand whether fragmentation is affecting competition.

The second trend is banking consolidation. As a result of the crisis, several banks experienced difficulties and had to be absorbed by other players or disappeared. In other cases, low profitability and suboptimal efficiency pushed banks to search for synergies via mergers.

Figure 2



Source: BBVA Research based on Orbis Bank Focus

The key question is whether concentration has reached a level as high as to affect credit price formation. According to economic literature an index below 1000 signals a highly competitive market, so it should not affect the way that banks operate. This level has only been reached in the case of Portugal. In order to check this hypothesis, a concentration measure will be introduced as one of the determinants of credit interest rates, to see whether it turns to be significant and has a positive coefficient.

2. The relationship between concentration and competition

The theoretical impact of increased concentration on market competition has been extensively studied. Firstly, the Structure-Conduct-Performance Paradigm and the Efficiency Hypothesis analyze whether a highly concentrated industry generates collusive behavior between the main entities in the market, which would lead to higher results for all of them, or whether the better results and increased market share captured by the main player is the result of their higher efficiency. However, these theories do not fully explain the industry's competition level based on its structure.

Other approach is based on the Panzar-Rosse model, which is a formal attempt to measure an industry's competition level and, thus, determine its competitive structure by calculating an indicator (the H-statistic) that provides a continuous measure of the degree of competition in the market.

The first empirical studies based on this model showed that banking systems typically have a monopolistic competition structure, which suggested that a detailed analysis of the factors that result in the degree of (imperfect) competition in the market is key. In this vein, a study by Bikker, Spierdijk and Finnie (2006) divided banks in 101 countries by size using deciles, not just separating between "large" and "small" entities, and analyzing separately developed and emerging countries, concluded that the degree of competition is lower among the largest entities (10th decile) in developed countries, suggesting that bank consolidation among large entities results in dampened competition among these entities. This conclusion cannot be applied to groups of smaller banks and banking systems in emerging countries.

Subsequently, the same authors published another study in 2007 based on data from 76 banking systems in 1995-2004 in which some determinants of competition are analyzed. These factors are divided in five groups: 1) market structure, i.e. industry concentration; 2) market contestability, i.e., barriers to entry and exit; 3) financial industry players, i.e., presence of active capital markets and insurance companies; 4) institutional variables; i.e. property rights, regulatory and supervisory bodies etc.; 5) macroeconomic variables. Among other conclusions, this study provided no support to the hypothesis that higher concentration leads to lower competition in the market, and that other factors such as the market's contestability and the country's institutional framework are more directly related to the level of competition in the banking system. Furthermore, collusion between the entities is higher during boom phases of the business cycle and tends to decline during recessions.

Similar results are obtained in other studies. Beck et al (2004) find that in concentrated markets, banks of all sizes face higher financing obstacles. However, this effect declines as banks get larger, and becomes insignificant in countries with high levels of GDP per capita, well-developed institutions, an efficient property rights, and a high share of foreign banks. Public bank ownership, a high degree of government interference in the banking system, and restrictions on banks' activities, on the other hand, exacerbate the impact of bank

concentration on financing obstacles. Removing activity restrictions in a concentrated banking system alleviates the negative impact of bank concentration on access to finance. Also Beck et al (2006) in another paper finds the degree of concentration is not necessarily related to the degree of competition, but the more efficient banks are, the higher its competitiveness.

Other authors like Berger, Demirgüç-Kunt, Levine and Haubrich (2003) also find that the relationship between bank concentration and competition is not straightforward and that the main determinant of competition is not the level of concentration in the market. Also, Sandrine Corvoissier and Reint Gropp (2001) find that market contestability may be the main force behind the level of competition in European banking sectors. These authors also find that concentration may have some impact on certain, but not all, banking products, and that concentration should be analyzed on a regional/provincial basis.

Focusing on eight Latin American banking systems, Levy Yeyati and Micco (2004) find that the increased level of concentration in these markets did not reduce competition, but the entry of foreign entities appears to have led to less competitive banking sectors. Moreover, banking sector fragility appears to be positively related to (lower) competition. These authors find that market contestability, among other factors not directly related to industry concentration, is critical in deciding the level of competition. Furthermore, Abbasoglu, Aysan and Güneş (2007) conclude that no relationship seems to exist between concentration and competition in the Turkish banking system, nor between efficiency and profitability.

Angelini and Cetorelli (2003) analyze the evolution of competitive conditions in the Italian banking industry during the period 1984-1997. This paper analyzed the long-run impact of consolidation on competition and found no evidence that banks involved in mergers and acquisitions gained market power. The overall results are consistent with the hypothesis that the deregulation process significantly contributed to improving bank competition and that it may also have been an important determinant of the consolidation process recorded by the Italian credit system during the 1990s.

On the other hand, Beck, Demirgüç-Kunt and Levine (2004) study the impact of bank concentration, bank regulations, and national institutions on the likelihood of a country suffering a systemic banking crisis. Using data from 69 countries from 1980 to 1997, the analysis concluded that crises are less likely in economies with more concentrated banking systems. Furthermore, the data indicate that regulatory policies and institutions that thwart competition are also associated with greater banking system fragility.

Also, an older paper by Short (1979) concludes that there may be a small direct relationship between (higher) concentration and (lower) competition. This author examines the relationship between the profit rates of 60 banks of 12 developed countries and concentration in their 'home' banking markets. Evidence supports the view that greater concentration leads to higher profit rates. However relatively large changes in concentration are necessary to change profit rates by one percentage point.

Finally, Nilsen et al (2016) studied the effects of competition on the risk exposure of banks' loan portfolios. From a theoretical point of view these authors try to confirm that poor competition levels may give banks incentives to increase their risk-taking by accepting more borrowers. Using data from 20 Norwegian banks

over the last 20 years, results show a U-shaped relationship between concentration and non-performing loan rates (decreasing and then increasing). Similar results are found when interest margin is used as a measure of the level of competition.

All in all, the relationship between industry concentration and competition is not straightforward and in most cases the main factors that appear to affect competition have little or nothing to do with concentration. Most likely, the main conclusion that can be drawn from this review of literature is that the level of concentration is indeed a variable that must be taken into account in order to explain the degree of competition in a banking sector, but that other variables have also a (more) direct impact on the industry's competition level, such as market contestability, the business cycle, the strength of the institutional and regulatory framework and the historical inheritance of the country.

3. How can concentration be measured?

There is a large number of concentration indicators. In this paper we use five of them whose calculation and basic definition can be found in the appendix. All indicators provide similar information: Portugal has the highest concentration level, even before the crisis, and concentration has increased in peripheral countries but decreased in France.

Table 1

Concentration measures								
	Spain		France		Italy		Portugal	
	2008	2015	2008	2015	2008	2015	2008	2015
Share of 5 largest	43.5%	61.5%	45.1%	42.7%	47.9%	51.2%	70.8%	72.7%
Herfindahl-Hirschman Index	548.8	927.2	560.6	514.3	630.3	718.8	1,181.9	1,287.6
Rosenbluth, Hall & Tideman Index	0.015	0.032	0.007	0.008	0.010	0.013	0.004	0.004
Linda Index	0.016	0.050	0.008	0.009	0.015	0.021	0.005	0.002
Horvath Index	0.230	0.331	0.216	0.204	0.269	0.299	0.427	0.471

Source: * ECB (Herfindahl and Market Share 5) and BBVA Research based on Orbis Bank Focus.

Having said this, it is worth noting that concentration at the regional level can vary from national averages. However, available data does not allow us to calculate it in the studied areas. One alternative in the case of Spain is to use available information on bank branches per region (province) to calculate concentration indexes.

According to this analysis, since 2008 there has been a decrease in the number of branches in Spain, bringing the number of branches per inhabitant to a level similar to the European average and increasing concentration. This trend was motivated by banks' need to reduce costs and by the merger of several entities. However, this trend has not been homogeneous among provinces, as branch reductions have been more limited in areas with lower density of population so as to ensure the provision of services. Data also point to an increase in the market share of the first bank per province, probably because banks are retracting towards their origin areas. In the future, digital banking may reduce the need of having a dense banking network.

Figure 3

Market share of the first bank per province (CR1, in 2008 and 2015)



Source: BBVA Research based on CECA, AEB and UNNAC.

4. The determinants of credit interest rates

In theory, a variety of concepts are involved in the formation of lending rates by the credit institutions that operate in the Economic and Monetary Union: a) the risk-free interest rate, associated with the official cost of money imposed by the monetary authority; b) the funding cost, associated with the marginal cost of the main source of funding and with the sovereign risk; c) the credit risk cost; d) the operational cost; e) fees and commissions; and f) the margin.

As series synthesizing all these factors are not available, we have estimated models using similar variables. We are therefore going to analyze the relationship between the interest rates¹ of new credit operations to SMEs (using credit below 1 million euros as a proxy) and corporates loan portfolios (using credit above 1 million euros) for the main EMU peripheral countries (Spain, Italy and Portugal) and one core country (France) using the official ECB rate (oir_t), the spread between the Euribor and the official rate ($spr_{12m} = euribor_{12m} - oir_t$), the spread between the interest rate on government debt in the theoretical monetary union and the Euribor ($spr_{emu} = \text{interest rate on government debt in the theoretical monetary union} - Euribor_{12m}$), the spread between the debt of the theoretical monetary union and the sovereign debt of each country ($spr_{sov} = \text{interest rate on the debt of the theoretical monetary union} - \text{interest rate on the country's sovereign debt}$) and firms default rate (dr)², using error correction models (ECM) for monthly data since 2003 with the following long-term structure:

Loan portfolio interest rate_t = Constant_t + $\beta_1 oir_t$ + $\beta_2 spr_{12m,t}$ + $\beta_3 spr_{emu,t}$ + $\beta_4 spr_{sov,t}$ + $\beta_5 dr_t$ [1]
where,

- β_1 is the sensitivity to official ECB monetary policy interest rates,
- β_2 the sensitivity to marginal cost of interbank finance,
- β_3 the sensitivity to a benchmark of the theoretical longest term common finance of a hypothetical perfect monetary union,
- β_4 the sensitivity of specific long-term finance in each country,
- β_5 the sensitivity to credit risk, using the default rate (dr) of the relevant portfolio as a proxy. As there are no statistics of SMEs and corporates default rates, total firms default rate is used in both cases. In principle, it makes sense that a higher credit risk (caused by a worse economic situation) increases the cost of credit.

where the constant will try to reflect the rest of the factors, like the commercial policy aspects and credit and operational risk costs. This implies the assumption that these factors will remain stable in the long term.

1: See "Determinantes de los tipos de interés de las carteras de crédito en la Eurozona" Doc. Trabajo 16/11 junio 2016. José Félix Izquierdo. <https://www.bbvaesearch.com/publicaciones/determinantes-de-los-tipos-de-interes-de-las-carteras-de-credito-en-la-eurozona/>

2: Liquidity restrictions variables have not been included, as the ECB full allotment was available in the period analyzed. No deleveraging factors have been introduced either, as the lower supply of new credit is not necessarily shown in their prices.

However, there have been changes in this term since 2003, above all in the wake of the financial crisis that began in the summer of 2007, but they have not been taken into account for simplicity.

We have also incorporated variables in the short-term component of the equation that include some specific characteristics of each portfolio, such as seasonality.

Therefore, we include both common determinants to all the countries (official rate, Euribor, and theoretical EMU long rate) and specific factors related to each country (sovereign spread and credit risk)

Other factor that may have an impact is regulatory pressure. Requisites became stricter as a result of the crisis, so banks are making an effort to fulfill the new requirements that may be partially transferred to clients. However, difficulties to find a proxy for regulatory pressure make estimates non-satisfactory.

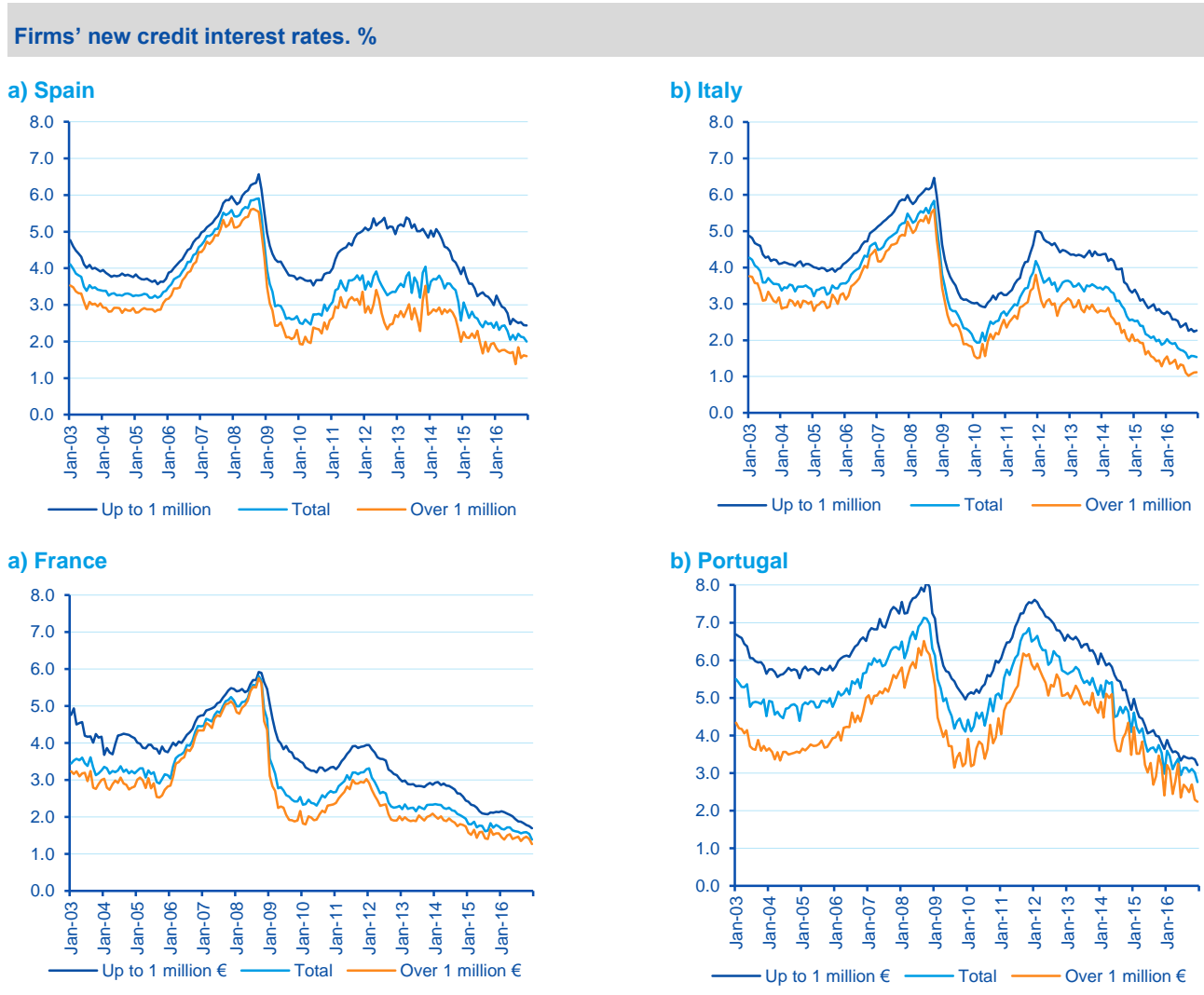
In the next chapter we show the results of estimating this equation, and on chapter 6 the results introducing another variable related to concentration (+ $\beta_6 concentration_t$) are summarized.

5. The determinants of firms' credit interest rates

The reduction of the fragmentation index (and in particular of country risk) has been translated into lower credit prices in all the portfolios, although in a delayed, partial and heterogeneous way. While financial fragmentation started decreasing by mid-2012, firms' credit interest rates in peripheral countries only started reducing by mid-2014, in line with the ECB quantitative easing program and TLTRO liquidity auctions. Portugal is a special case, as the government asked for an international rescue in May 2011 and the maximum interest rates were registered by end-2011 or the beginning of 2012, and as interest rates have been higher than in the rest of the analyzed countries by more than 100 basis points throughout 2003-2016.

The evolution of firms' new credit interest rates are shown in the following figure. Credit up to 1 million euros is used as a proxy of SME loans and the flow above that amount is taken as a proxy of the operations of corporates.

Figure 4



Source: ECB

Divergences between countries are related to national factors that outweigh international trends. There are still differences between SME credit prices in peripheral and core countries, and smaller differences in the case of corporates (which have alternative funding sources to bank credit and operate internationally).

The equation described in the previous section has been estimated. A sign '--' indicates that the variable is not different from 0 with at 5% confidence, so it has been excluded from the equation.

Table 2

Determinants of interest rates on new bank lending to non-financial corporations

Long term multipliers	Spain				Italy				France				Portugal			
	Up to 1 mn EUR	Lag	Above 1 mn EUR	Lag	Up to 1 mn EUR	Lag	Above 1 mn EUR	Lag	Up to 1 mn EUR	Lag	Above 1 mn EUR	Lag	Up to 1 mn EUR	Lag	Above 1 mn EUR	Lag
Constant	--	--	--	--	--	--	--	--	0,77	--	0,46	--	2,63	--	1,79	--
ECB official rate	1,36	0	1,20	0	1,18	0	1,09	0	1,02	0	1,15	0	0,98	1	0,79	0
Euribor 12m Spread	0,74	0	0,65	0	--	--	--	--	1,23	0	0,79	0	1,37	0	0,85	0
EMU Spread	0,40	2	0,14	1	0,14	1	--	--	0,55	1	0,25	3	0,46	4	--	--
Sovereign Spread	0,65	2	0,11	1	0,87	1	0,51	1	0,25	1	--	--	0,23	1	0,13	1
Firms' default rate	0,13	3	0,08	4	0,24	2	0,14	1	--	--	--	--	0,05	2	0,20	0

Sample: January 2003 to December 2015, as there is no available information on concentration in 2016.

Source: BBVA Research based on ECB, BoF, BoI, BoP, BoS and Bloomberg

The constant is not significative in Spain or Italy, but it is in France and Portugal. This could mean that in France and Portugal factors such a higher margin are transferred to clients, or that in Spain and Italy this effect is included in the coefficient of the ECB official rate, which is very high.

The sensitivity of credit rates to common factors is heterogeneous among countries, but there are no differences between core and peripheral countries.

It is worth mentioning the dispersion of the sensitivities of corporate credit rates to sovereign risk on the periphery, as Spain and Portugal show similar low multipliers and Italy shows a coefficient five times bigger. A similar pattern is observed regarding SME credit, with a multiplier of 0.9 in Italy, 0.7 in Spain and 0.25 in France and Portugal. Therefore, Italian corporates and SMEs seem to be severely penalized.

As expected, credit risk has an important effect in Spain, Italy and Portugal, but not in France. In fact, the effect is bigger in the case of corporates than in that of SMEs in Spain and Italy. Every percentage point of higher firms default rate is translated in an increase of 24, 13 and 5 basis points in Italy, Spain and Portugal, respectively. It is also relevant that the default rate affects credit rates with a lag of up to two months in Italy and Portugal, and a lag of 3-4 months in Spain, so in the latter banks take more time to reflect the improves of credit risk into credit prices.

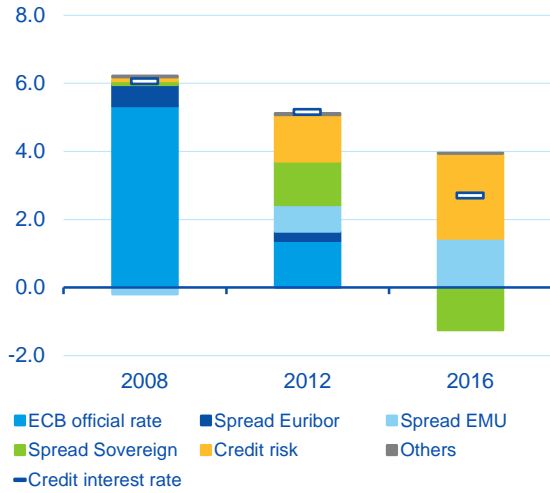
In a nutshell, the transmission of monetary policy is heterogeneous, and in peripheral countries credit risk has played an important role in credit rates formation.

The following figures show the credit interest rate up to € 1 million annual average for 2008, 2012 and 2016 and the contributions of each of the determinants in each country.

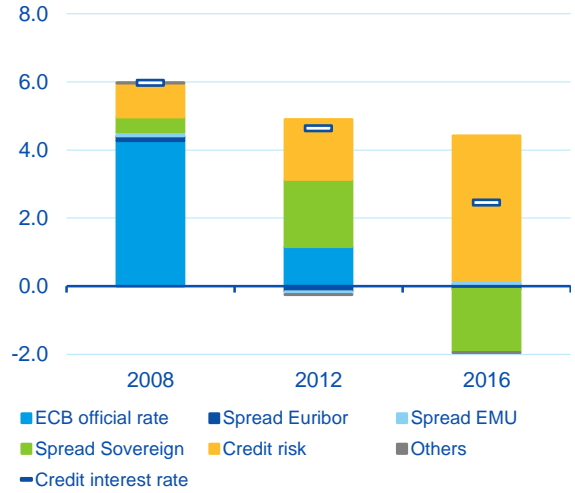
Figure 5

Firms' new credit interest rates. Up to 1 million €. Contributions of determinants. %

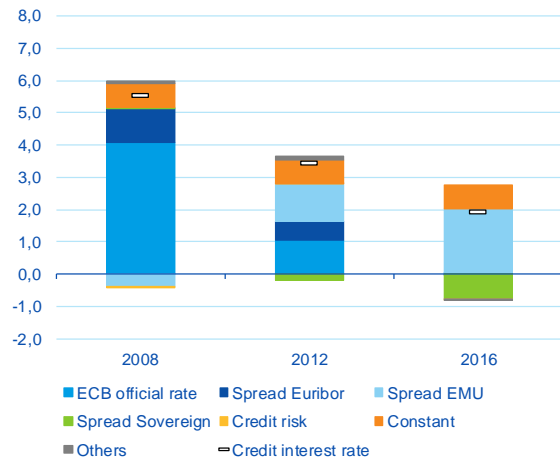
a) Spain



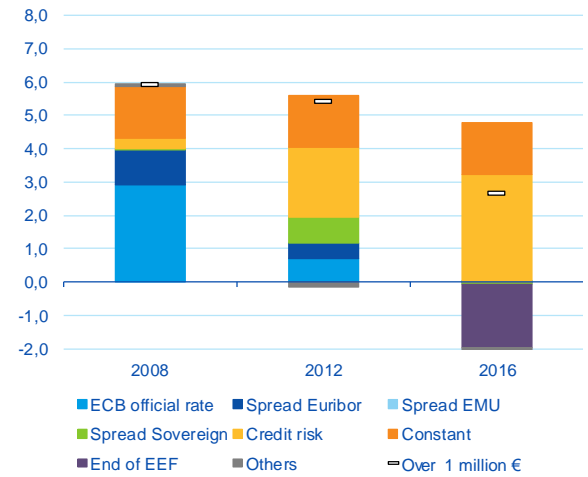
b) Italy



a) France



b) Portugal



End of EEF: End of program Extended Fund Facility by IMF, EC and ECB, in May 2014.
Source: BBVA Research

6. The impact of concentration on credit rates

In this section, the ECM models are estimated again, but this time including concentration³ as another determinant of firms' new credit interest rates⁴. A positive coefficient would indicate that concentration as high as to affect the way in which credit prices are formed, and therefore it is altering competition.

The exercise has been repeated using differing measures of concentration, but results did not vary in a significant way, as show in Table 2. Concentration was not significant for the formation of corporate or SME credit rates in Spain. In the case of SME credit in France and Italy, concentration seems to have an influence as the coefficient is significative, but its sign makes no sense as it is negative (more concentration leads to lower interest rates), so these results have been discharged.

The only case at which concentration has the expected sign (positive) and it is significative is Portugal, both in the case of SMEs and corporate credit and using different measures of concentration (Herfindahl index or market share of the five biggest entities provided by ECB, although the fit is better using in the first case). Therefore, the high banking concentration is having a negative influence on the formation of credit prices, as they are higher than what they would be with lower indexes.

Table 3

Estimated banking concentration multiplier on firms interest rates: sign and significativeness				
Firms interest rate	Spain	France	Italy	Portugal
Herfindahl Index				
Up to 1 mn EUR	- Not Signif	- Signif	- Signif	+ Signif
Above 1 mn EUR	- Not Signif	- Not Signif	- Not Signif	+ Signif
Market share of 5 banks				
Up to 1 mn EUR	- Not Signif	- Signif	- Signif	+ Signif
Above 1 mn EUR	- Not Signif	- Not Signif	- Not Signif	+ Signif

Source: BBVA Research based on ECB, BoF, BoI, BoP, BoS and Bloomberg

We used the concentration indicators presented in Table 1 constructed by BBVA Research to test the robustness of the results showed in Table 3. The Table 3 shows that the main results obtained in Table 2 are maintained for Spain, France and Italy. In the case of France for Rosenbluth, Hall and Tideman Index we get the correct sign but it is not significant. These results show that despite the consolidation and restructuring processes that resulted in higher concentration in Spain, France and Italy, there is no evidence of that having an influence in competition, except in Portugal.

3: To ensure the homogeneity of the concentration indicators we have taken the only two built by the ECB: Herfindalh and Market share of five mains banks. The concentration indices have been interpolated monthly.

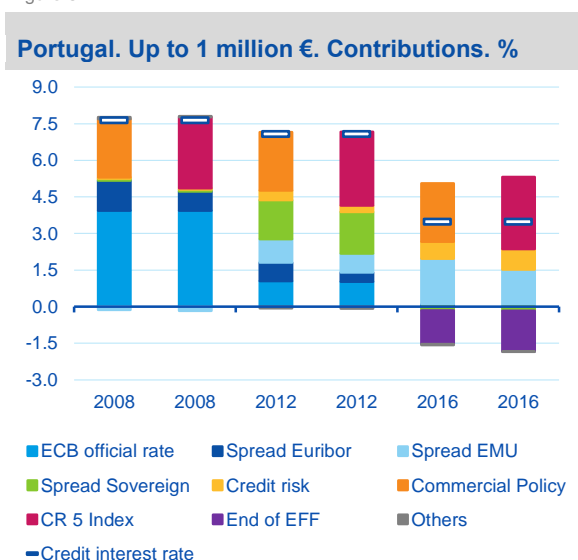
Table 4

Estimated banking concentration multiplier on firms interest rates: sign and significativeness				
Firms interest rate	Spain	France	Italy	Portugal
Horvath Index				
Up to 1 mn EUR	- Not Signif	- Signif	- Signif	+ Signif
Above 1 mn EUR	- Not Signif	- Not Signif	- Not Signif	+ Signif
Linda Index, m=5				
Up to 1 mn EUR	- Not Signif	- Signif	- Not Signif	- Not Signif
Above 1 mn EUR	- Not Signif	- Not Signif	- Not Signif	- Signif
Rosenbluth,Hall, Tideman				
Up to 1 mn EUR	- Not Signif	- Signif	- Not Signif	+ Signif
Above 1 mn EUR	- Not Signif	+ Not Signif	- Not Signif	+ Signif

Source: BBVA Research based on ECB, BoF, BoI, BoP, BoS and Bloomberg

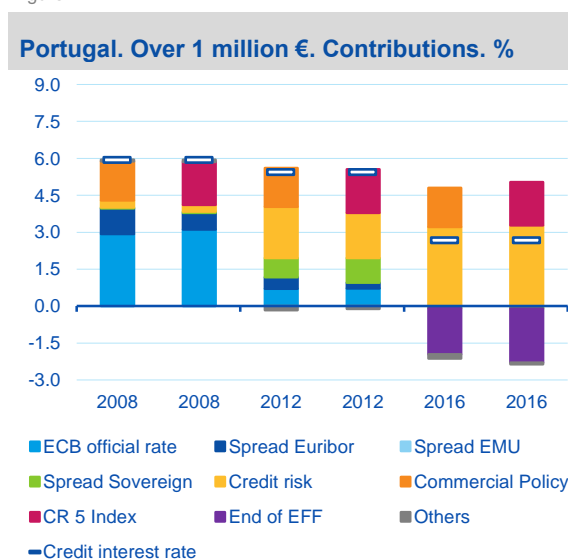
The figures below show the contributions to Portugal's interest rates by comparing the results in Table 1 and Table 2 for the years 2008, 2012 and 2016. For both portfolios, up to 1 million € and over 1 million €, the inclusion of the concentration indicator (CR5 or HHI) replaces the constant term and reduces the sensitivity to Euribor and sovereign risk. The result could be misleading if the replacement of the constant is due to the fact that concentration indices have had little variation around the mean, but this has also happened in France and there has been no replacement. In addition, Portugal has had interest rates significantly higher than those of other countries, and this excess is positively related to the high and persistent concentration indices even before 2003.

Figure 6



End of EFF: End of program Extended Fund Facility by IMF, EC and ECB, in May 2014.
Source: BBVA Research

Figure 7



End of EFF: End of program Extended Fund Facility by IMF, EC and ECB, in May 2014.
Source: BBVA Research

Another test of robustness would be to see the effects of the concentration on the interest rates of other portfolios, for example, mortgages. For this purpose, we used the same structure of variables as the one shown in Table 1, substituting firms' default rate for mortgages' default rate⁵. The Table 4 confirms the results obtained in Tables 2 and 3 for Spain, France and Italy: concentration does not seem to be affecting the formation of credit interest rates. The results obtained for Portugal indicate that concentration does not affect the formation of mortgage interest rates, unlike the results for firms' interest rates.

Table 5

Estimated banking concentration multiplier on mortgage interest rates: sign and significativeness				
Mortgage interest rate	Spain	France	Italy	Portugal
Horvath Index	- Not Signif	- Not Signif	- Not Signif	- Not Signif
Linda Index, m=5	- Not Signif	- Not Signif	- Not Signif	- Not Signif
Rosenbluth,Hall, Tideman	- Not Signif	- Not Signif	- Not Signif	- Not Signif
Up to 1 mn EUR	+ Not Signif	- Not Signif	- Not Signif	- Signif
Above 1 mn EUR	+ Not Signif	- Not Signif	- Not Signif	- Signif

Source: BBVA Research based on ECB, BoF, Bol, BoP, BoS and Bloomberg

5: For more details see the chapter 4 and the annex II of the working paper: "Determinantes de los tipos de interés de las carteras de crédito en la Eurozona" Doc. Trabajo 16/11 junio 2016. José Félix Izquierdo.
<https://www.bbvarsearch.com/publicaciones/determinantes-de-los-tipos-de-interes-de-las-carteras-de-credito-en-la-eurozona/>

7. Conclusions

In this paper we have analyzed the importance of different factors for the formation of new credit prices, focusing on the effects of banking concentration. The exercise has been performed in four European countries: Spain, France, Italy and Portugal.

Regarding consolidation, some analysts claim that the decrease in the number of banks triggered by the crisis could result in oligopolies and therefore in higher credit prices. According to the economic literature, the relationship between industry concentration and competition is not straightforward. The level of concentration is a variable that must be taken into account in order to explain the degree of competition in a banking sector, but other variables have also a direct impact on the industry's competition level, such as market contestability, the business cycle, the strength of the institutional and regulatory framework and the historical inheritance of the country.

We have calculated five different indexes of concentration for Spain, France, Italy and Portugal. They show that the crisis has triggered a moderated and heterogeneous increase of banking consolidation in Europe, but the end-levels are not excessive in most countries.

According to our estimates, concentration has been high in Portugal for a protracted period, and that explains to a significant degree firms' new credit interest rates (but not on mortgage interest rates). In Spain and Italy credit prices can be explained via market variables, while in France there is a constant term which is not related to banking concentration.

In any case, in a more integrated European market concentration would be lower, and a group of banks would find it more difficult to influence prices.

Appendix: concentration indicators

Indicator	Calculation	Interpretation
Share of the "k" largest entities	$Ck = \sum_{i=1}^k S_i$ <p>S_i is the i-th entity's market share</p> <p>k is the number of largest entities included in the index</p>	<p>It is one of the most widely used concentration indices</p> <p>This indicator provides the aggregate market share of the market's k largest entities in a simple way.</p> <p>The k largest entities are equally weighted but the indicator does not take into account the $n-k$ remaining entities.</p> <p>The choice of k is arbitrary. There is no widely accepted rule in this respect</p>
Herfindahl-Hirschman Index	$HHI = \sum_{i=1}^N S_i^2$ <p>S_i is the i-th entity's market share</p> <p>N is the total number of entities in the market</p>	<p>The most widely used concentration indicator. It is often used as benchmark for other concentration indicators</p> <p>As the sum of the squared market shares of all entities the indicator uses information of the whole market. In this respect, HHI overweights the largest entities</p> <p>HHI may take a maximum level of 10,000 in a monopoly. According to the US Department of Justice and The Federal Trade Commission, market concentration as measured by the HHI index may vary according to the following levels:</p> <ul style="list-style-type: none"> - Below 1,000: Highly competitive market - Between 1,000 and 1,500: Low concentration - Between 1,500 and 2,500: Concentrated market - Above 2,500: High concentration
Rosenbluth, Hall and Tideman Index	$RHT = \frac{1}{(2 * \sum_{i=1}^N i S_i) - 1}$ <p>S_i is the market share of the i-th entity in the market, ranked from largest to smallest.</p> <p>N is the total number of entities in the market</p> <p>The RHT Index can also be derived from the Gini Index (G):</p> $RHT = \frac{1}{N(1 - G)}$	<p>Much like HHI, the RHT Index considers all entities in the market, which are accounted for according to their market sizes ranked from smallest to largest.</p> <p>Unlike HHI, the RHT overweights the smallest entities in the market.</p> <p>The lowest possible value of the RHT Index is $1/N$ (close to 0 if the number of entities in the industry is high) which signals very low concentration. The highest value of the Index is 1 (monopoly).</p>
Remo Linda Index	$L = \frac{1}{N(N-1)} \sum_{m=1}^{N-1} \frac{\overline{X}_m}{\overline{X}_{N-m}}$ <p>N is the total number of entities in the market</p> <p>\overline{X}_m is the average market share of the "m" largest entities in the industry</p> <p>\overline{X}_{N-m} is the average market share of the "N-m" remaining entities in the industry.</p>	<p>L is designed to identify the presence of monopolies or groups of dominant entities.</p> <p>This index separates the industry into 2 groups (the largest entities and the rest) and measures the magnitude of the difference between the average market shares of both groups.</p> <ul style="list-style-type: none"> - L below 0.20: non-concentrated industry - L between 0.20 and 0.50: moderately concentrated industry - L between 0.50 and 1: Unbalanced industry that may dampen competition - L greater than 1: Highly concentrated industry with dominant entities
Index of comprehensive concentration by Horvath	$CCI = S_1 + \sum_{i=2}^N S_i^2(2 - S_i)$ <p>N is the total number of entities in the market</p> <p>S_1 is the market share of the largest entity in the industry</p> <p>S_i is the i-th entity's market share.</p>	<p>CCI measures the industry's entities dispersion in size. It provides an absolute measurement of that dispersion</p> <p>It is calculated as the sum of the largest entity's market share and the summation of the squared market shares of the remaining entities weighted by a multiplier that reflects the relative size of the rest of the market.</p> <p>CCI will be 1 in case of monopoly. Otherwise, CCI will have a value that is greater than the leader's market share. An increasing CCI indicates a situation where the largest entities dominate the smaller ones.</p>

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