BANKING CONCENTRATION AND COMPETITION IN SPAIN: THE IMPACT OF THE CRISIS AND RESTRUCTURING (*)

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(*) The authors are grateful for the comments and suggestions made by an anonymous referee and for the financial support of the Ministry of Economic Affairs, Industry and Competitiveness (research project ECO2017-84858-R). Paula Cruz-García is also grateful for financial support from the Ministry of Education, Science and Sport (FPU2014/00936).

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Abstract

The aim of this article is to analyse recent developments in banking concentration and competition in Spain, focusing on the impact of the recent restructuring and consolidation of the industry, and providing information at provincial level. The competition indicators constructed show that, in principle, competition has suffered as a result of the restructuring since 2008, although the indicator that takes into account risk shows that it is currently at levels similar to those existing before the crisis. In the case of market concentration, the picture at national level is an aggregation of very varied situations at the provincial level, with very high levels in some cases. Accordingly, from the standpoint of competition, it is important to analyse competitive rivalry not only at the national level but also in markets covering a more limited geographical area.

1 Introduction

The Spanish banking industry has undergone far-reaching changes in recent years, to correct the imbalances that built up during the expansionary period, up to 2008. The main way in which the Spanish banking industry has been restructured is through mergers and acquisitions, which have led to a significant increase in market concentration. As seen in Chart 1, the number of credit institutions fell by 43% between 2008 and 2016, which reduced the number of competitors by 155, to 207. This is much greater than the (weighted) average decline that took place in the twelve euro area countries shown in the chart (25%).

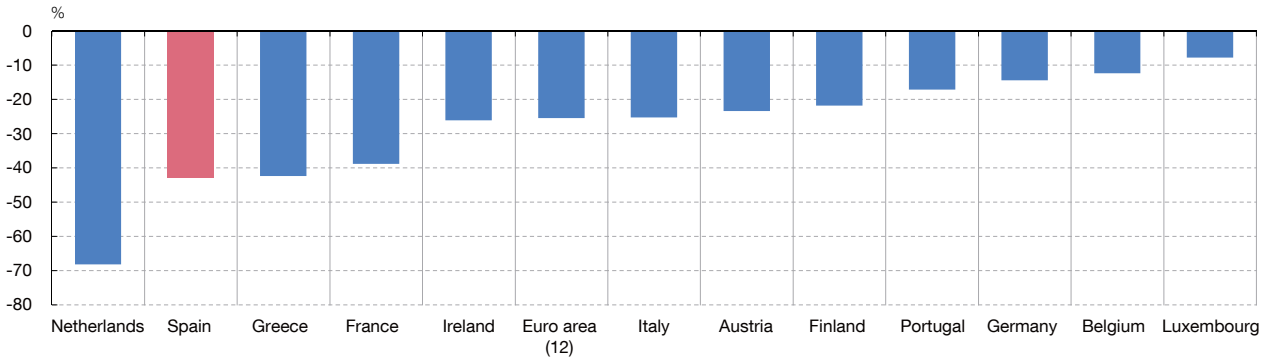
Hand in hand with the reduction in the number of banks has gone a rise in market concentration. While in 2008 the five largest banks (CR5) accounted for 42% of the market, in terms of total assets, in 2016 their joint share was 61.8%, an increase of 46% (see Chart 2). Taking all competitors into account, the Herfindahl index rose from 497 to 937, or by 89%. In both cases, the increases were well above the weighted average for the twelve euro area countries considered (5.1% in the market share of the 5 largest banks and 9.9% in the Herfindahl index).

If we look at the latest figures available for international comparison of banking market concentration, relating to 2016, there is potential cause for concern; following strong growth in recent years, the level of concentration in Spain in 2016 was significantly above the (weighted) average for the euro area (28% higher in terms of the Herfindahl index and 27% in the case of the CR5), which raises the question of the effects this may have on the level of competition. The current level of concentration is, however, below the thresholds above which a market is considered excessively concentrated. The ECB (and also, since 1992, the US Department of Justice and Federal Trade Commission guidelines) considers that a market is excessively concentrated when the value of the Herfindahl index is 1,800 or above, which is much higher than the latest figure published by the ECB (937) for 2016.

The conclusions of a market concentration analysis may vary according to the geographical area selected. The concentration indices published by the ECB refer to the national market. However in more limited areas (such as regions or provinces), in which several banks compete, the concentration indices will naturally be different. Hence, it is worth analysing sub-national geographical areas to assess the degree of concentration in them and its possible effects on competition.

Analysing the regional dimension of competition is nothing new and is of interest to the authorities, in particular the National Competition Commission (CNC by its Spanish initials). Although the now defunct Court for the Defence of Competition established that there

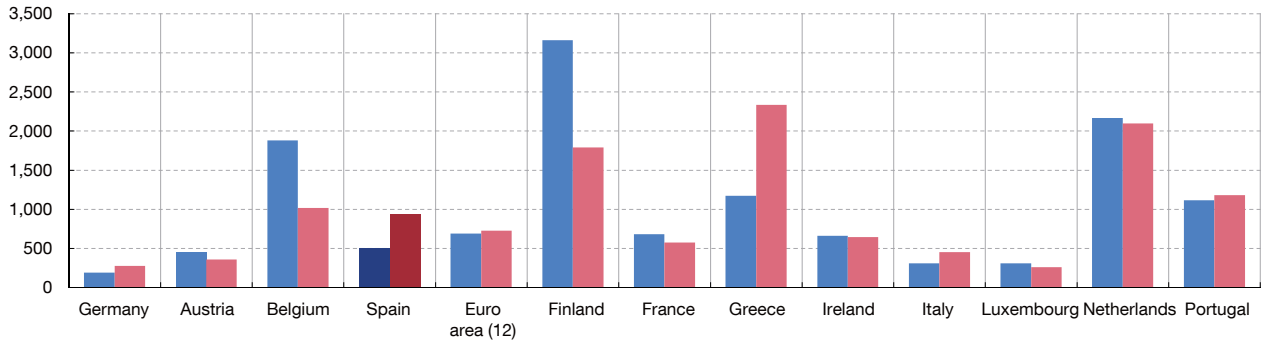
NUMBER OF CREDIT INSTITUTIONS. CHANGE OVER PERIOD 2008-2016 CHART 1



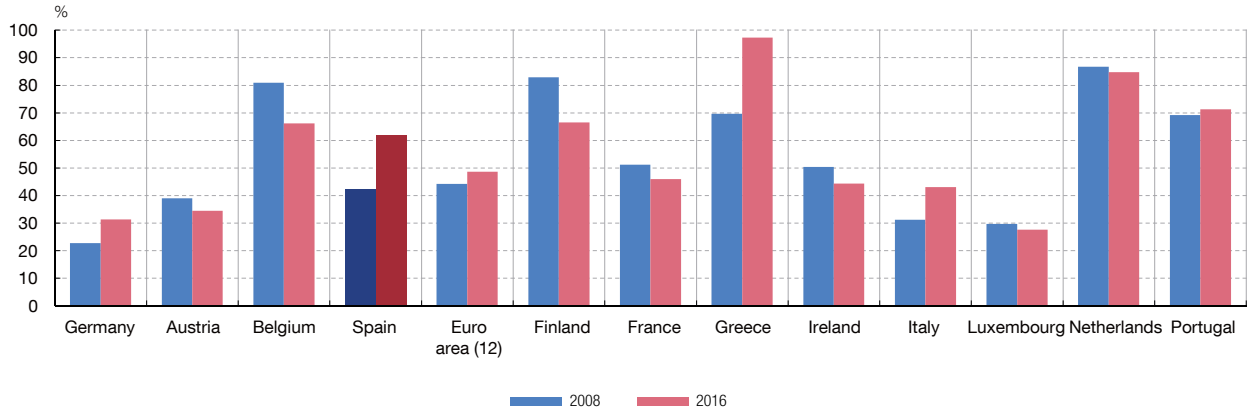
SOURCE: European Central Bank, *Structural financial indicators*.

EURO AREA BANKING MARKET CONCENTRATION (IN TERMS OF TOTAL ASSETS) (a) CHART 2

1 HERFINDAHL INDEX



2 CR5. PERCENTAGE



SOURCE: European Central Bank (2018).

a Euro area (12) is the average weighted by total assets.

were a number of reasons for considering local markets (regional or provincial), the CNC, according to its reports, considers that the relevant market is the national one, at least in the case of banks catering for small savers and SMEs. However, when the market share of the bank resulting from a merger or acquisition exceeds 30%[1] in a particular region or

1 See Article 8 of Law 15/2007 of 3 July 2007 on the Defence of Competition.

province, the CNC analyses the impact of the operation at these local levels, despite its opinion that the national market is the relevant one. In the case of investment banking (except for certain product segments) and corporate banking, the relevant market is supra-national, while in the case of insurance and pension fund activity, the market considered is the national one.

Having analysed geographical markets in which the market share of the resulting bank exceeds 30%, the CNC analyses the increase in such share resulting from the consolidation, and issues a favourable report if the change is small. In some cases its report is even favourable when levels of concentration are high if significant competitors exist.

At regional level, there is, unfortunately, no public information available on proxy variables for banking business for individual banks, so it is not possible to calculate concentration indices based on variables such as assets, loans or deposits. We therefore use the number of branches as an indicator of activity, as this is the only public information available on individual banks at the province level, and we construct concentration indices by province based on the distribution of the branch network of deposit-taking institutions (commercial banks, savings banks and credit cooperatives).

Although we analyse concentration developments in provincial markets, we are aware of the limitations of concentration indices as indicators of competition, despite their use by the defence of competition authorities. As a result, this paper estimates competition indicators, the Lerner index being the only one that can be constructed at the individual bank level. Given that we have data on the distribution of branches by province for each deposit-taking institution, we are able to construct an average Lerner index for each province, using the indices of the deposit-taking institutions that compete in that province weighted by the number of branches. The market concentration in each province can thus be compared with the Lerner index. It is important to point out that the indicator constructed is not strictly an indicator of the competition in each province, given that the Lerner index of each bank is estimated at national level. Therefore, the provincial indicator constructed as a weighted average of the Lerner indices of the banks that have branches in that province indicates the presence of banks that are more or less competitive at national level in the province analysed, but not the exact level of competition in that province.

In this context, the purpose of this paper is to analyse recent developments in competition in the Spanish banking industry (over the period 2005-2016), with the emphasis on the impact of the crisis and the resulting restructuring. Three indicators of competition are used for this purpose (the H-statistic, the Boone indicator and the Lerner index). Given the importance of market concentration and the number of competitors for competition, these variables are also analysed.

With these objectives, the paper is structured as follows. Section 2 briefly summarises the different approaches used to measure banking competition and the related indicators. Section 3 analyses the developments in competition in the Spanish banking industry at the national level, estimating the three indicators. Section 4 focuses on the provincial dimension of competition, constructing concentration and market power indices for each of the 52 Spanish provinces. Finally, Section 5 sets out the conclusions.

2 Review of the literature on the measurement of banking competition

There are, in general, two approaches to analysing banking competition: a) a structural approximation, based on the structure-conduct-result framework [which originated in Bain (1951)], that uses concentration indices as indicators of competition; and b) the approach of

the so-called new empirical industrial organisation literature, which estimates indicators of competition on the basis of bank behaviour models. The former uses concentration indices such as the market share of a certain number of banks (CR) or the Herfindahl index. The latter uses indicators such as the Panzar-Rosse test (H-statistic), the Lerner index, the Boone competition indicator or the Bresnahan conduct index or parameter (conjectured changes).

The idea underlying the first approach is that the fewer the banks and the larger they are, the easier it is to behave in a non-competitive (collusive) way and thus to obtain monopolistic or oligopolistic rents. Consequently, market share or concentration indices are used as indicators of competition. This is the rationale followed by certain defence of competition authorities when they base their decisions on analysis of the change in concentration following a merger.[2] However, using concentration as an indicator of competition has its limitations. As discussed by Shaffer and Spierdijk (2017), it does not take into account the key issue of causation, since a large market share may be a consequence of the existence of barriers to entry (and therefore an absence of competition) but also of the fact that the firm produces high-quality products at lower prices than its competitors, to the benefit of the consumer. Although concentration indices are used as indicators of competition in the guidelines of competition authorities when assessing mergers, both from a theoretical point of view and empirically, many studies show their limitations.[3]

The new empirical industrial organisation theory, in comparison with the first approach, considers additional theoretical elements, taking as its starting point a profit maximisation problem. There are three indicators frequently used by this approach to measuring competition: a) the Lerner index of market power; b) the Boone indicator; and c) the H-statistic or Panzar-Rosse test.

The Lerner index is derived from a classical banking competition model such as the Monti-Klein one,[4] although there are other versions of theoretical models. This index measures the ability of firms to set prices above marginal cost. Thus, with perfect competition the value of the index is zero (price = marginal cost). An increase in the index implies a loss of consumer welfare. The advantages of this indicator of competition are that it offers a value at firm level and it is relatively simple to approximate if information is available on costs, at least in comparison with the econometric problems involved in identifying other indicators of competition, such as the Bresnahan conduct parameter. The Lerner index has been used in many studies, including notably those of Angelini and Cetorelli (2003), Maudos and Fernández de Guevara (2004 and 2007), Fernández de Guevara *et al.* (2005), Fernández de Guevara and Maudos (2017), Carbó and Rodríguez (2007) and Koetter *et al.* (2012).

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2 For example, according to the US Department of Justice and Federal Trade Commission (2010), the change in the Herfindahl index is evaluated and if the post-merger increase exceeds 200 points a deeper analysis is required given the greater risk of market power. According to these guidelines, if the value of the index is above 2,500 the market is considered highly concentrated while a value in the range 1,500-2,500 indicates moderate concentration.

3 Demsetz (1973) showed many years ago the limitations of concentration as an indicator of competition. When efficient firms gain market share concentration increases but this does not necessarily mean there is less competition (this is the so-called efficient structure hypothesis, which calls for the inclusion of efficiency as an explanatory variable of profitability, as well as market concentration). The recent work of Bos *et al.* (2017) shows the limitations of using the Herfindahl index as an indicator of competition and proposes a new measure known as "critical mass".

4 See Freixas and Rochet (2008).

Boone (2008) developed an indicator of competition based on the idea that more efficient firms earn higher profits through larger market shares. It is calculated by regressing the market share or profitability of each bank on its marginal costs, the value of the Boone indicator being the parameter, resulting from the estimation, which accompanies the marginal costs. Thus, the higher the absolute value of the parameter the greater the competition. This measure has been used by various authors, such as van Leuvensteijn *et al.* (2011), Delis (2012) and Fernández de Guevara and Maudos (2017).

In the contestable market theory, developed by Baumol (1982) and Baumol *et al.* (1983), is to be found the third of the indicators most frequently used to measure banking competition: the H-statistic developed by Rosse and Panzar (1977) and Panzar and Rosse (1987). This indicator has in common with the Lerner index that both measure the deviation of firms' prices/revenues from their marginal costs/factor prices. Specifically, the H-statistic seeks to analyse the degree of response of revenues to changes in input prices. Subsequent papers have described situations in which the correspondence between values of H and market competition does not exist, notably Shaffer and Spierdijk (2017), who question the validity of this indicator of competition, with a devastating critique based on empirical evidence.[5] Despite the criticism, this statistic has been used in numerous studies, some of the most recent ones being those of Delis *et al.* (2016) and Apergis *et al.* (2016).

The introductory chapter by Bikker and Spierdijk (2017) of the recent *Handbook of banking competition* contains a detailed analysis of the various indicators of competition and opts for the Lerner index, given the problems involved with the H-statistic and the Boone indicator. However, in the case of the Lerner index, it is important to capture the differences in risk among firms for it to be reliable as an indicator of competition.

Focusing on Spain, a number of studies have analysed banking competition, notably those of Maudos and Pérez (2003), Salas and Saurina (2003), Fernández de Guevara and Maudos (2007), Carbó and Rodríguez (2007), Carbó *et al.* (2009) and Jiménez *et al.* (2013). Maudos and Pérez (2003) base their results on the Lerner index and on the Panzar-Rosse test; Salas and Saurina (2003) analyse the effect of deregulation on market power, approximating the latter by Tobin's q; Fernández de Guevara and Maudos (2007) analyse the determinants of market power, approximated by the Lerner index; Carbó and Rodríguez (2007) analyse market power (and its determinants) using various indicators of competition in the period 1986-2005; Carbó *et al.* (2009) analyse the effect of market power on the availability of credit, using market concentration and the Lerner index as indicators of competition. Jiménez *et al.* (2013) analyse the relationship between banking competition and financial stability, approximating market power by the Lerner index and market concentration indicators.

3 Competition in the Spanish banking industry: empirical approximation and results

In order to estimate the three indicators of competition described, panel data are used on Spanish deposit-taking institutions (commercial banks, savings banks and credit cooperatives) spanning the period 2005-2016. Table 1 sets out the descriptive statistics of the main variables of the analysis.

3.1 SAMPLE USED

The reason for starting the analysis in 2005 is that there was a change in the accounting standars in 2004, which affected the presentation of banks' financial statements,[6] making

5 The authors show that for a local market in the United States, characterised by a duopoly, estimation of the H-statistic finds the existence of competitive behaviour.

6 See Circular 4/2004 of the Banco de España.

DESCRIPTIVE STATISTICS OF THE MAIN VARIABLES TABLE 1

	Mean	Standard deviation	Median	25th percentil	75th percentil
Price of labour (€)	73,766.0	17,165.0	72,173.0	61,302.0	86,824.0
Price of physical capital	91.8%	333.4	38.3%	24.6%	82.3%
Price of loanable funds	1.9%	1.0	1.8%	1.3%	2.3%
Price of credit risk	1.2%	2.2	0.7%	0.4%	1.3%
Price of assets	3.8%	1.1	3.7%	3.0%	4.5%
Marginal cost	1.8%	0.7	1.7%	1.4%	2.2%
Marginal cost-risk	2.5%	1.1	2.4%	1.9%	3.0%
Lerner index	53.2%	8.1	53.6%	48.5%	58.5%
Lerner index-risk	33.9%	7.9	39.0%	33.0%	45.2%

SOURCES: Asociación Española de Banca, Confederación Española de Cajas de Ahorros and Unión Nacional de Cooperativas de Crédito.

comparability with subsequent years problematic. The information is obtained from the annual reports of the three employers' associations of the industry: the Asociación Española de Banca (AEB), the Confederación Española de Cajas de Ahorros (CECA) and Unión Nacional de Cooperativas de Crédito (UNACC). Those banks that had outlying values for any of the variables needed to estimate the indicators of competition were removed from the population.[7] The sample eventually used accounts for around 90% of the total assets of the banking industry, the number of banks varying from a total of 191 in 2005, to 180 in 2008 and 114[8] in 2016.

3.2 EMPIRICAL APPROXIMATION OF INDICATORS OF COMPETITION

a) The Lerner index

The Lerner index analyses the power of a bank to set price above marginal cost. The higher this margin the greater the bank's market power. Specifically, the Lerner index is defined as:

$$L_{i,t} = (P_{i,t} - mc_{i,t}) / P_{i,t} \quad [1]$$

where P is the average price of banking output, mc its marginal cost, and i and t refer to the bank and the year, respectively. The most frequent empirical approximation uses the total assets of a bank as an indicator of its activity, estimating its price as the ratio of total revenues to total assets. If price is equal to marginal cost there is no market power (L = 0), while if the index is equal to 1 the situation is interpreted as a monopoly.

Marginal costs are estimated as a function of translogarithmic costs,[9] where total costs depend on total assets and the prices of three inputs (labour, physical capital and loanable

7 The values of the variables approximating input prices considered to be outliers (those situated at either end of the distribution, i.e. below 1% or above 99% of the distribution) were removed from the sample. As a result, 9.95% of the institutions were removed from the sample in 2005 and 10.24% in 2016, this percentage being relatively similar every year.

8 According to the Banco de España, in 2016 there were 206 deposit-taking institutions in Spain, of which 82 were foreign branches (with a very small market share) and the other 124 Spanish. In 2005 there were 204 and in 2008 198 Spanish deposit-taking institutions. Our sample, which includes practically all the Spanish institutions and excludes the foreign branches (the information disseminated by the annual statistical publication of the AEB on foreign banks is less detailed), is highly representative and includes the country's main institutions.

9 The annex contains the results of the estimation of the translogarithmic cost function, with and without correcting for credit risk. As is standard practice, restrictions of symmetry and homogeneity of degree one are imposed on input prices. The cost function has been estimated without including the cost share equations.

funds) which are approximated as follows: the price of labour as the ratio of personnel costs to the number of workers; the price of loanable funds[10] as the ratio of financial costs to loanable funds; and the price of physical assets as the ratio of operating costs other than personnel costs to fixed assets.[11] Thus, the cost function we estimate is the following:

$$\ln C_{it} = \gamma_0 + \gamma_1 \ln A_{it} + \sum \rho_h \ln w_{hit} + \frac{1}{2}\gamma_2 \left(\ln A_{it}\right)^2 + \frac{1}{2}\sum\sum \rho_{hm} \ln w_{hit} \ln w_{mit} + \sum \rho_{hTA} \ln w_{hit} \ln A_{it} + \mu_1 \text{Trend} + \frac{1}{2}\mu_2 \text{Trend}^2 + \mu_{TA} \text{Trend} \ln A_{it} + \sum \alpha_h \text{Trend} \ln w_{hit} + v_i + u_{it} \quad [2]$$

where C is total costs (operating costs + financial costs), A total assets, w the prices of h inputs, Trend a linear trend capturing the influence of technical progress,[12] and vi fixed effects given the availability of panel data,[13] i and t referring to the bank and year, respectively.

Having estimated the cost function, marginal costs are calculated as:

$$mc_{Ait} = \left(\frac{\partial \ln C_{it}}{\partial \ln A_{it}}\right) \cdot \left(\frac{C_{it}}{A_{it}}\right) = \frac{C_{it}}{A_{it}} \cdot \left[\gamma_1 + \gamma_2 \ln A_{it} + \sum \rho_{hTA} \ln w_{hit} + \mu_{TA} \text{Trend}\right] \quad [3]$$

This approximation of the price of assets and marginal costs is used to obtain the Lerner index for each bank. The index for the industry as a whole is obtained as a weighted average of the individual indices, using assets as the weights.

The limitation of this traditional appoximation is that it takes no account of the risk borne by banks. If a bank sets a higher interest rate owing to the risk premium it applies, a higher price-marginal cost margin does not necessarily imply greater market power, but may simply reflect the higher cost of risk. For this reason, we re-estimate the cost function, including, in addition to financial and operating costs, the provisions set aside by the bank each year, as an ex-post approximation of the cost of risk. As the cost is included in the dependent variable, it is necessary to include as a determinant the unit cost of this productive input, which we can call "risk", approximating it as the ratio of financial asset impairment losses to the volume of lending.[14]

The approximation used for the cost of risk is dependent on the public information available. The lag in the setting aside of provisions makes the measurement of cost of credit risk used imperfect as a contemporaneous measurement in year t. The imperfection

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10 Loanable funds have been approximated by the sum of the deposits of central banks and credit institutions, customer deposits and deposits represented by negotiable securities; as well as short securities positions, subordinated liabilities and other financial liabilities. These items correspond both to the trading book and to other financial liabilities at fair value through profit or loss, and financial liabilities at amortised cost.

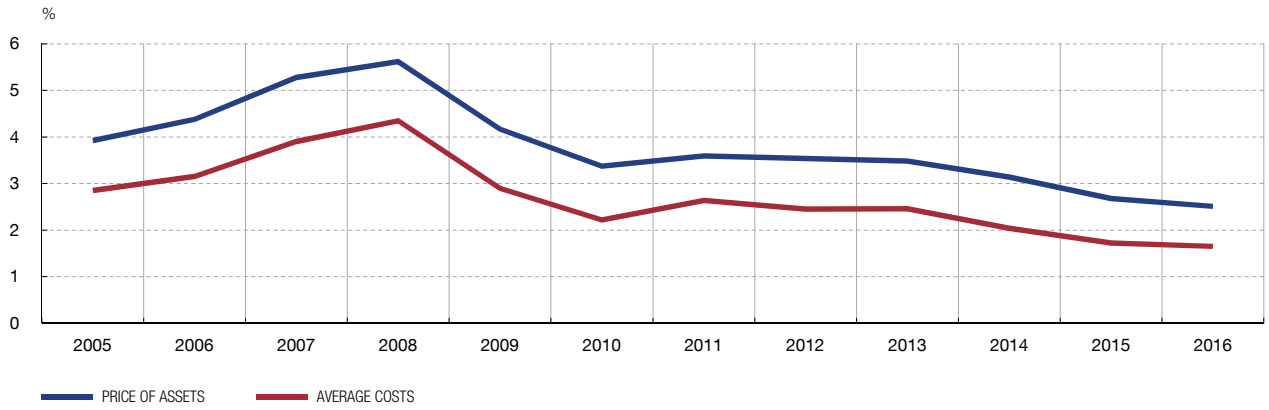
11 We are aware that the approximation used in the measurement of the price of output and inputs involves estimating average not marginal prices, since revenue/cost flows do not correspond to new transactions, but to balance-sheet stocks (assets, loanable funds, non-current assets) and to the number of employees. The approximation depends on the public information available in the annual statistical publications offered by the industry employers' associations.

12 The inclusion of a Trend variable is standard practice in the literature to capture the effect of technical change. See, *inter alia,* Angelini and Cetorelli (1999) and Fernández de Guevara, *et al.* (2005).

13 The estimation is robust to heteroskedasticity.

14 Jiménez *et al.* (2013), following the approximation of Martín *et al.* (2006), construct a risk-corrected Lerner index, using information on the probability of default (PD) from the Banco de España's Central Credit Registry (CCR), to which we do not have access. Martín *et al.* (2006) show that market power is clearly over-estimated when the risk premium is ignored in the marginal cost calculation.

AVERAGE PRICE AND AVERAGE COST OF BANKING OUTPUT CHART 3



SOURCES: Asociación Española de Banca, Confederación Española de Cajas de Ahorros and Unión Nacional de Cooperativas de Crédito.

is even greater if there are changes or regulatory measures that affect the recognition of the risk in the form of extraordinary provisions, like those that were made in Spain in 2012 to cover the exposure to real estate risk that will be discussed below.

Chart 3 shows the comparative evolution of the average price of assets and the average cost.[15] The average price of assets increases from 3.9% in 2005 to 5.6% in 2008 (a high coinciding with the peak in interest rates), after which it falls sharply in line with interest rates until 2010, remains relatively steady up to 2013, and falls to a low of 2.5% in 2016. The behaviour of average costs is similar, with a sharp fall from 2008, of 2.8 percentage points (pp), and a low of 1.51% being reached in 2016.

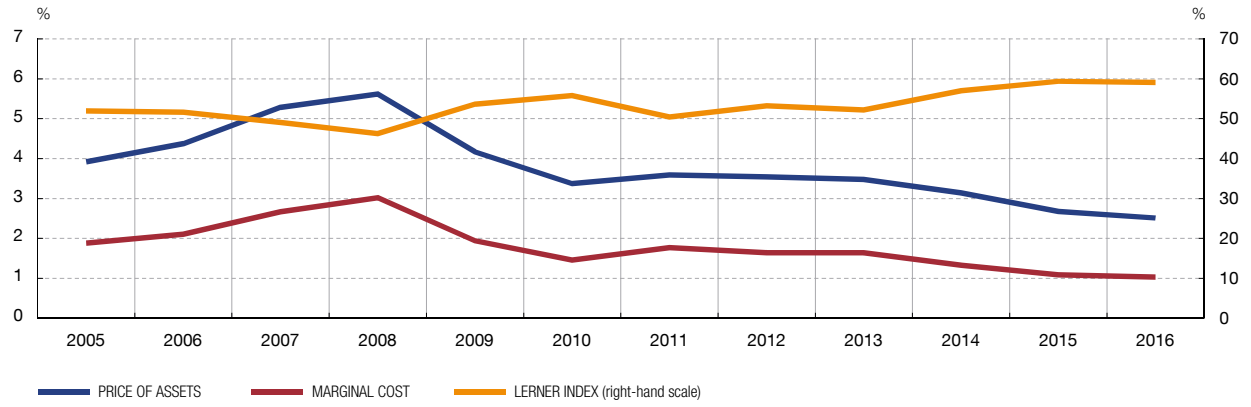
The evolution of the Lerner index of market power shown in Chart 4 enables different stages to be identified. During the years of expansion up to 2008, the index fell, meaning that prices rose to a lesser extent than marginal costs, reaching a low in 2008. With the turn in the cycle market power increased in 2009 and 2010, fell slightly in 2011 and, thereafter, increased to stand in 2015 and 2016 at a high of around 0.6. From their peak in 2008, prices and marginal costs have fallen by 55% and 66% respectively, so that market power has increased by 13%.

The above evolution of the Lerner index is similar to that reported by the ECB (2017) in its report on financial integration in Europe. In this report the ECB follows an approximation similar to ours, measuring the price of banking output as the ratio of total revenues to assets, and estimating a translogarithmic cost function for the period 2003-2015 for the euro area countries. Specifically, this study reports the value of the Lerner index for the years 2003, 2008 and 2015, which follows a similar path to ours: falling up to 2008 and rising thereafter up to 2015, with a higher level in the latter year than in the other two years. In the ranking of euro area countries, from lowest to highest, according to the value of the Lerner index in 2015, Spain stands in an intermediate position, at eighth out of nineteen. The rise in the index since 2008 is common to all the euro area countries. As discussed by the ECB, it is the result of a fall in marginal costs owing to gains in efficiency and a reduction

15 Both the level and the changes being similar to those obtained using the aggregate data for deposit-taking institutions offered by the Banco de España in its *Statistical Bulletin*.

LERNER INDEX

CHART 4



SOURCES: Asociación Española de Banca, Confederación Española de Cajas de Ahorros, Unión Nacional de Cooperativas de Crédito and Banco de España.

in the cost of borrowing, and is consistent with less competition. However, the low profitability of many European banks is not indicative of excessive market power.[16]

When credit risk is controlled for, by including financial asset impairment losses in the costs and their price or unit cost per unit of lending, marginal costs increase, which changes the level of the Lerner index (see Chart 5). Specifically, marginal costs are around 18% higher up to 2008, they rise thereafter, and notably have an exceptional value in 2012 as a consequence of the likewise exceptional balance-sheet clean-up that took place that year, with the approval of two royal decree-law[17] entailing large provisions for exposure to the construction and real-estate sectors. Thus, asset impairment losses totalled €83 billion in the case of financial assets and €33 billion in that of other assets.[18] In 2012 the estimated marginal cost is 3.85%, as against 1.6% if risk is not incorporated. In subsequent years the marginal cost declines as the asset impairment loss falls. Despite this reduction, in 2016 the marginal cost estimated with incorporation of *ex post* risk is 43% higher than that estimated without including the cost of risk.

The risk-corrected Lerner index, based on the aforementioned evolution of marginal costs, is lower and has a similar time profile to the uncorrected Lerner index, except in the case of the sharp fall in 2012, when the index turned negative, with marginal costs exceeding price, in line with the negative net profit that year.[19] In subsequent years the corrected Lerner index increases, but in 2015 and 2016 stands at similar levels to the initial levels in the expansionary years, unlike the uncorrected Lerner index, which in recent years has reached its highest levels above the initial levels.

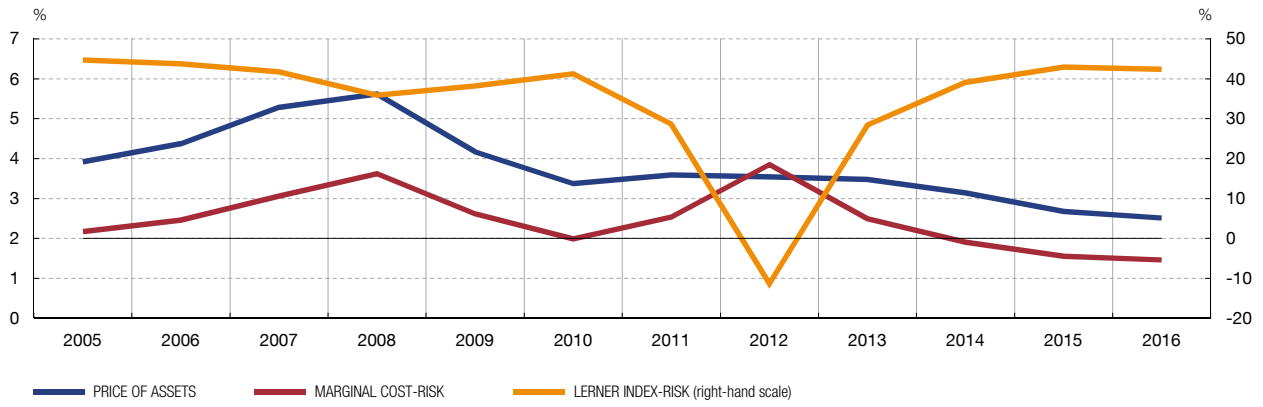
16 Another reference in the comparison of results is the Lerner index estimated by the World Bank for a large number of countries up to 2015. In the case of Spain, although the level of the index estimated by the World Bank is lower, it has a similar time profile, although there is a surprisingly sharp rise in 2014.

17 Royal Decree-Law 2/2012 on balance sheet clean-up of the financial sector and Royal Decree-Law 18/2012 on write-down and sale of financial sector real estate assets.

18 The marginal cost including risk does not incorporate the impairment of non-financial assets, given the difficulty of estimating their unit price.

19 The high marginal cost estimated in 2012 is due to the effect of the two royal decree-laws of 2012 which required a major provisioning of the real estate exposure. It should be taken into account that, although the provisioning is made in and applied to 2012, it is in fact an impairment (and therefore a cost) relating to past years. Therefore the marginal cost of 2012 is probably below the average cost of that year due to the extraordinary provisions.

RISK-CORRECTED LERNER INDEX CHART 5



SOURCES: Asociación Española de Banca, Confederación Española de Cajas de Ahorros, Unión Nacional de Cooperativas de Crédito and Banco de España.

a) The Boone indicator

The Boone competition indicator is approximated by means of the estimation of a regression where the market share[20] (s) of each bank depends on its marginal costs (mc):

$$\ln s_{it} = \alpha + \beta \ln mc_{it} + v_i + u_{it} \quad [4]$$

where i and t refer to the bank and year, respectively, and β must be negative. The higher the degree of competition the higher the absolute value of β, this parameter being the Boone competition indicator.

According to Van Leuvensteijn *et al.* (2011), the Boone indicator is a simplification of reality, since efficient banks may transfer part of their efficiency gains to their customers in the form of lower prices in order to gain market share or, alternatively, increase their profits. Another limitation of the Boone indicator is that it ignores the possible existence of differences in the quality of banking output. As indicated by Leuvensteijn *et al.* (2011), the estimates of the competition indicator are affected by these limitations more if they are made annually rather than for longer periods of time. For this reason we have opted to report estimates of equation [4] for the entire period 2005-2016 and for the sub-periods 2005-2008 and 2009-2016, which allows us to see if there have been changes in the level of competition. Also, when estimating the equation for these periods we can use panel techniques, controlling for the existence of individual effects (which are considered fixed).[21]

Table 2 contains the results of estimation of the Boone indicator. As expected the parameter is negative. Given that its absolute value decreases between the first and the second sub-period, the result implies that competition has fallen. This result coincides with the evolution of the value of the indicator reported by the World Bank. Specifically, the World Bank

20 In some studies profitability is used as the dependent variable instead of market share. The drawback of using profitability is that loss-making banks cannot be included in the sample, since the variable to the explained is in logarithms. That is why we have chosen to use market share.

21 The estimation is robust to heteroskedasticity.

BOONE INDICATOR TABLE 2

	Boone index
2005-2016	-0.33***
2005-2008	-0.59***
2009-2016	-0.30***

SOURCE: Banco de España.
Note: *** significant at 1%; **significant at 5%; *significant at 10%.

reports a value of -0.3 in 2005, which falls to -0.65 in 2008 (so that competition increases), returning to -0.3 in 2012 and increasing to -0.16 in 2015, the year in which it reaches its highest value. Hence, competition increases between 2005 and 2008, but decreases thereafter.

b) The H-statistic

The H-statistic or Panzar-Rosse revenue test (1987) is based on a reduced-form equation relating total revenue (TR) to the price of the "i" inputs (w) and "j" control variables (CVs). If we assume a production function with a single output only, the equation to be estimated is the following:

$$\ln TR = \sum_{i=1}^{n} \beta_i \ln w_i + \sum_{j}^{J} \ln CV_j + \varepsilon \quad [5]$$

The H-statistic is defined as the sum of the elasticities of revenues to input prices:

$$H = \sum_{i=1}^{n} \beta_i \quad [6]$$

As the authors demonstrate, under perfect competition, an increase in the price of inputs is passed through to consumers in the form of an increase in the output price with no change in the amount produced. Revenues increase by the same amount, so that the H-statistic is equal to 1. A value between 0 and 1 indicates monopolistic competition (since revenues do not grow in proportion to input prices), while values of 0 or less are consistent with monopolistic behaviour.

As mentioned above, this statistic has been the object of considerable criticism, with its use as an indicator of competition being called into question. Thus, as stated by Shaffer and Spierdijk (2017), "although the literature has demonstrated that the H test of Panzar and Rosse fails as a measure of competition, it is a popular method in banking". The authors provide evidence that their results with this statistic point to the existence of a competitive market in a non-competitive market (a duopoly). For this reason they prefer to use the Lerner index.

In our empirical application, we regress the logarithm of total revenues (financial and non-financial) on the price of the three inputs: labour, physical capital and loanable funds (the definition of which is the same as that used in the cost function estimation [2]), and we include as control variables the logarithm of the capital/assets ratio, the logarithm of the loans/assets ratio and the logarithm of the non-financial revenues/financial revenues

H-STATISTIC

TABLE 3

	H-statistic	Test H-statistic = 0 (p-value)	Test H-statistic = 1 (p-value)
2005-2016	0.52	0.0000	0.0002
2005-2008	0.20	0.0378	0.0000
2009-2016	0.55	0.0000	0.0006

SOURCE: Banco de España.

ratio.[22] The first variable controls for the level of solvency and the latter two for specialisation. Moreover, as we have panel data, individual and timing effects are included.

As Table 3 shows, for the complete period analysed, the null hypotheses that the H-statistic (0.52) is equal to zero and one are rejected, a situation compatible with some evidence of monopolistic competition. By sub-period, the statistic also differs from zero and one in the expansion and in the crisis, so that in both cases there is some evidence of monopolistic competition.

4 The regional dimension of competition

The assessment of the intensity of competition may change according to the geographical extent of the market analysed. The implicit assumption in the analysis carried out up until now is that competition takes place at national level, so that this is the relevant market. However, for many deposit-taking institutions, especially those without a presence throughout the national market, the geographical area of reference is regional, provincial or in some cases even municipal. For this reason, the provincial market is taken as reference in this section and the developments and differences in market concentration and competition, using the Lerner index in the latter case, are analysed.

4.1 PROVINCIAL MARKET CONCENTRATION

If we focus on the developments since 2008 – a turning point in the evolution of the banking industry after a change in cycle and the start of restructuring – an increase in market concentration is a feature common to almost all provinces.

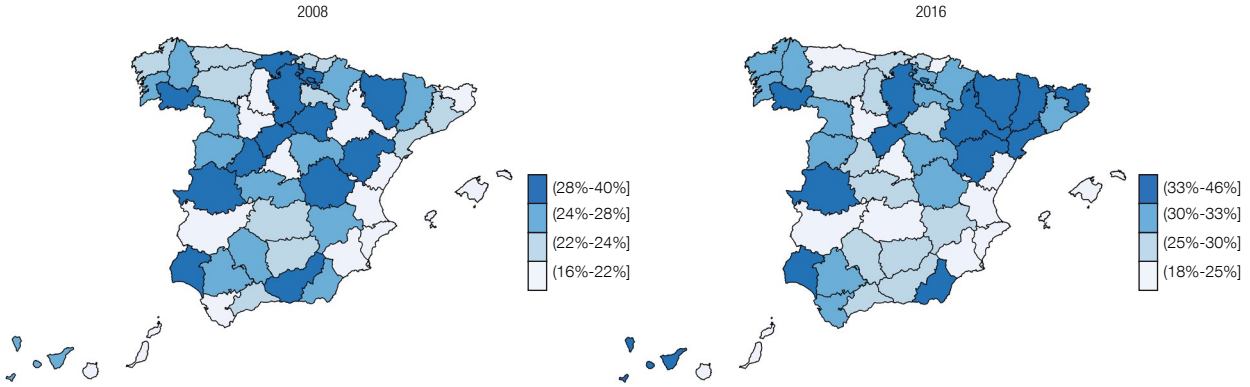
In terms of the CR5 (the market share of the five largest institutions by branches), between 2008 and 2016, market concentration only declined in five provinces (Salamanca, Segovia, Soria, Teruel, Toledo and Zamora), albeit in some cases sharply. For example, concentration in Teruel fell from 90% to 52% and in Zamora from 86.6% to 55.5%. Notably, in five of the provinces in which market concentration increased (Barcelona, La Coruña, Gerona, Lérida and Tarragona), it did so by more than 20 pp. In particular, it increased by 34 pp in Barcelona. If we focus on the latest data available, for 2016 (see Chart 6, in which the market is classified by quartile), the CR5 exceeded 80% in 18 provinces and 90% in three (Huesca, Melilla and Ceuta). As regards the CR1, it increased in all except nine provinces, with increases of 17 pp (almost doubling the share) in Zaragoza and Gerona. In 2016, the CR1 ranged from 17.6% in Valencia to 45.5% in Teruel. It was also above 40% in Orense, Huesca and Teruel.

Of more interest is the analysis of market concentration using the Herfindahl index, which takes into account all competitors and is the indicator used as reference in competition analyses. In the case of this index, the increase since 2008 has been more than 1,000 points in five provinces (Barcelona, Gerona, Tarragona, Teruel and Zaragoza), while at the other extreme there were increases of less than 200 points in Cáceres, Cuidad Real, Cuenca and

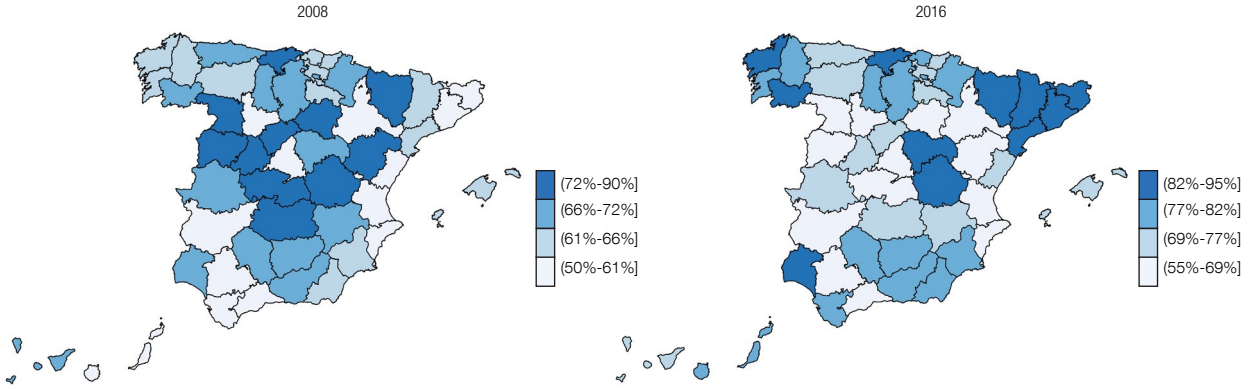
22 The estimation is robust to heteroskedasticity.

PROVINCIAL BANKING MARKET CONCENTRATION. 2008 AND 2016 CHART 6

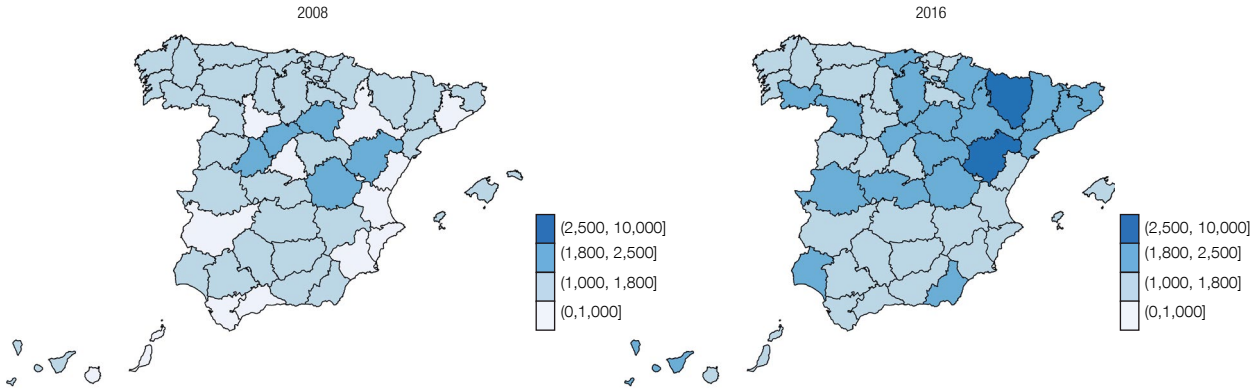
1 CR1



2 CR5



3 HERFINDAHL INDEX



SOURCE: Banco de España.

Granada. Ávila is the only province in which the index has fallen since 2008. In 2016, concentration was below 1,800 points (which corresponds to a moderately concentrated market) in 31 provinces, while in the remaining 21 it was above this threshold, so that in these provinces market concentration was high. Concentration was notably high in Teruel (3,576 points), followed at some distance by Huesca (2,663), Zamora (2,410) and Tarragona (2,365). Market concentration was lowest in Valencia, and was also below 1,200 in Madrid, Badajoz and Valladolid.

EVOLUTION OF DIFFERENCES IN PROVINCIAL MARKET CONCENTRATION TABLE 4

	CR1	CR3	CR5	Herfindahl index
		2008		
Mean	25.1%	51.5%	66.5%	1,268
Max.	39.6%	76.3%	90.0%	2,485
Min.	15.9%	36.6%	49.7%	694
Coefficient of variation	0.22	0.17	0.14	0.29
		2016		
Mean	29.6%	59.4%	75.7%	1,741
Max.	45.5%	79.4%	95.0%	3,576
Min.	17.6%	44.0%	55.5%	1,124
Coefficient of variation	0.21	0.14	0.12	0.26

SOURCE: Banco de España.

EVOLUTION OF DIFFERENCES IN PROVINCIAL MARKET POWER (LERNER INDEX) TABLE 5

	Lerner index	Lerner index (risk-corrected)
	2008	
Mean	45.4%	34.3%
Max.	48.3%	39.5%
Min.	41.3%	25.3%
Coefficient of variation	0.03	0.08
	2016	
Mean	55.3%	33.4%
Max.	63.1%	49.1%
Min.	40.3%	9.0%
Coefficient of variation	0.10	0.28

SOURCE: Banco de España.

As seen in Table 4, differences in the degree of banking market concentration across provinces have decreased slightly since 2008, with decreases in the coefficient of variation of 6%, 17% and 11% in the case of the CR1, CR3 and CR5, respectively, and of 13% in the case of the Herfindahl index.

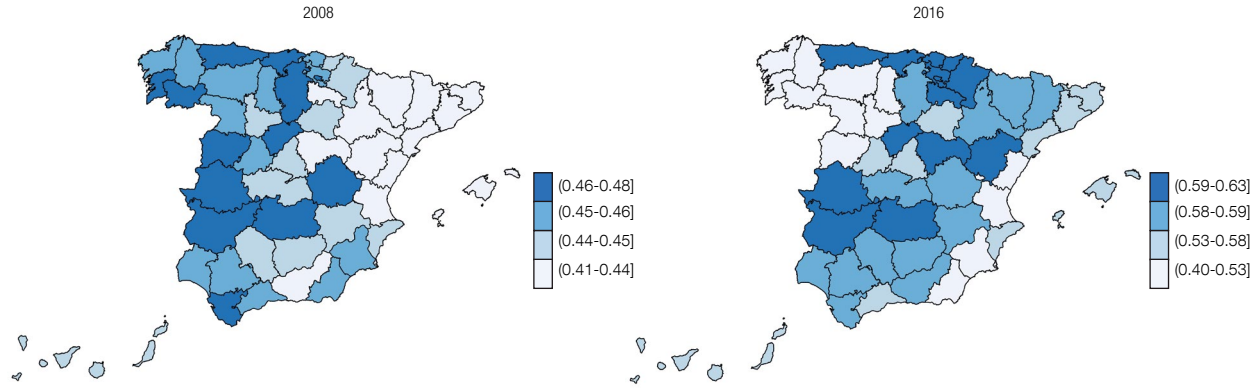
4.2 PROVINCIAL MARKET POWER: THE LERNER INDEX

Given that we have a Lerner index for each institution for each year, as well as the provincial distribution of each institution's branches, we are able to estimate an average Lerner index for each province for each year, by taking the weighted average of the indices of the institutions that have branches in the province. As mentioned above, the Lerner index is not strictly an index of market power in the province, but rather an average of the Lerner indices estimated at national level of the banks that compete in the province. However, it is reasonable to assume that if a bank has market power at national level, it will attempt to exercise this power in each province.

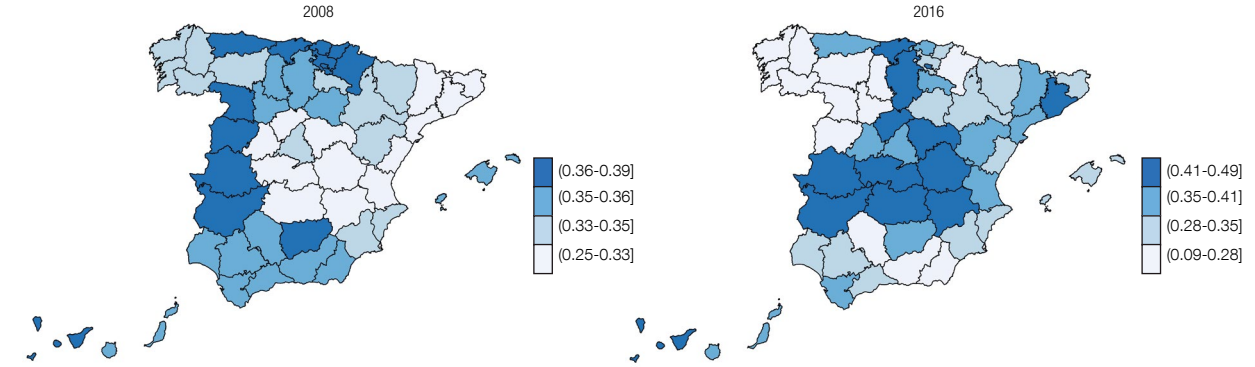
Focusing on the latest information available, for 2016, the Lerner index in the province in which it is highest (Teruel) is 57% higher than in the province in which it is lowest (Almería). According to the information by quartile, shown in Chart 7, Cáceres, Guadalajara, Segovia, Vizcaya, La Rioja, Gipúzcoa, Navarra, Álava, Badajoz, Cantabria, Asturias, Ciudad Real and Teruel are in the quartile with the highest Lerner indices, while

LERNER INDEX IN PROVINCIAL MARKETS. 2008 AND 2016 CHART 7

1 LERNER INDEX



2 RISK-CORRECTED LERNER INDEX



SOURCE: Banco de España.

Almería, Palencia, Orense, La Coruña, Valladolid, Lugo, Pontevedra, Castellón, Murcia, León, Salamanca, Valencia and Zamora are in the quartile with the lowest indices, in that order. Large provinces, like Madrid and Barcelona, have indices below the distribution median, at a similar level.

Comparing the situation in 2016 with that in 2008, the average Lerner index had increased in every province except for four (Almería, Orense, Pontevedra and Palencia), with increases of more than 30% in Navarra, Gipúzcoa, Granada, Zaragoza, Guadalajara, Huesca, La Rioja and Teruel. Apart from having the highest Lerner index, the latter province is also the one in which it had increased most (53%). Leaving aside the provinces in which the Lerner index had fallen, it had increased least (by less than 10%) in Lugo, La Coruña, Valladolid, Murcia, Salamanca, Castellón and León.

A positive correlation is found to exist between the change in market concentration and the change in the Lerner index at provincial level, but it is very low, amounting to only 6% in terms of the Herfindahl index, while in terms of the CR1, CR3 and CR5 it is negative (-3%, -4% and -13%, respectively). The correlation between the level of the Lerner index and the Herfindahl index in 2016, with a positive value of 22%, is greater. These results demonstrate the limitations of using market concentration (in particular, absolute indices, which only take into account a small number of banks) as an indicator of competition.

In the case of the risk-corrected Lerner index, the correlation between the change in the Herfindahl index and the Lerner index is -3%. On the basis of this corrected market power index, the picture regarding the developments between 2008 and 2016 changes, since it increased in 25 provinces and fell in the remaining 27. The largest falls, of more than 40%, were recorded in Zamora, Salamanca, León, Orense and Palencia, and the largest increases, also exceeding 40%, in Ciudad Real, Segovia, Albacete, Cuenca and Toledo. In large provinces, such as Madrid, Barcelona and Valencia, the Lerner index increased.

In 2016 there were significant differences in the Lerner index across provinces. Thus, as compared with a minimum value of 0.09 in Zamora, the index was more than five times higher in Cantabria. The provinces with the lowest levels were Zamora, Salamanca, León, Orense, while Ciudad Real, Segovia and Cantabria had the highest.

5 Conclusions

The far-reaching restructuring undergone by the Spanish banking industry to correct the imbalances that built up during the growth phase that ended with the onset of the crisis in 2008 has given rise to a scenario in which the number of competitors has been sharply reduced and market concentration has increased. Indeed, the growth in the latter has been so strong that, despite starting at a level below the European average in 2008, Spanish market concentration is currently above the European average, although still well below the thresholds used to define an excessively concentrated market. This increase in concentration raises the question as to what effects it may have on competition, the measurement of such effects being the objective of this paper.

The focus of our contribution is the analysis of the effect that banking reconstruction has had on concentration and competition, as well as the provision of additional information at the provincial level. In the case of market concentration, the analysis carried out shows that there are significant differences across provinces, so that the national picture is the aggregate of widely differing situations. In the case of competition, the Lerner index constructed at the provincial level also shows significant variation across provinces.

The results at the national level show that since 2008 there has been an increase in market power in the Spanish banking industry. However, the risk-corrected Lerner index, which despite its limitations is the most comprehensive indicator used in this study, stood in 2016 at a relatively similar level to that in 2008. However, the significant balance-sheet clean-up carried out in 2012 (as consequence of the two royal decree-laws that required provisioning for impairment losses linked to exposure to real estate construction and development) involved a large increase in the cost of credit risk, which translated into a fall in the price/marginal cost margin and consequently in market power. Since that year, marginal costs have fallen again, and the Lerner index has returned to its initial level.

At provincial level, concentration increased sharply in most cases and stands in some cases at high levels characterised as excessive. Comparing the situation in 2016 with that in 2008, the differences in the degree of concentration across provinces have been reduced.

The public information available is not sufficient for an analysis of competition at provincial level to be carried out. However, if we construct provincial Lerner indices as the average of the indices for each bank estimated at national level, the results show a significant dispersion across provinces, which has increased in recent years. Thus, on the hypothetical assumption that the intensity with which a bank competes in each province in which it is present is equal to its national average, the synthetic provincial Lerner indices would show differences in the level of competition across provinces. Despite the limitations of this

provincial analysis, the evidence shows that particular consideration should be given to the regional dimension of competition in merger processes.

Finally, given the data available, the results obtained from the competition analysis must be interpreted with caution, since the estimated Lerner index of market power does not strictly reflect the difference between the price and marginal cost of new transactions; the prices used (in the case of both output and inputs) are averages of the revenues and costs arising from past decisions, not present ones.

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Annex

ESTIMATION OF THE TRANSLOGARITHMIC COST FUNCTION

TABLE A.1

Parameter	Dependent variable:	Uncorrect for credit risk	Correcting for credit risk
		[log (Total Cost) – log(w_2)]	[log (Total Cost corrected for credit risk) – log(w_2)]
γ_1	log (Total Assets)	1.0851***	0.7485***
		(0.2646)	(0.2538)
γ_2	0.5·log (Total Assets)^2	-0.0028	0.118
		(0.0167)	(0.0165)
ρ_1	log (w_1) - log (w_2)	-0.0913	-1.5703***
		(0.4218)	(0.3290)
ρ_3	log (w_3) - log (w_2)	1.1262***	1.7871***
		(0.2684)	(0.2110)
ρ_4	log (w_4) - log (w_2)		0.4515***
			(0.1053)
ρ_{21}	[log (w_1) · log (w_2) - 0.5·log (w_1)^2 - 0.5·log (w_2)^2]	0.0130	-0.0136
		(0.0215)	(0.0200)
ρ_{31}	[log (w_1) · log (w_3) - 0.5·log (w_1)^2 - 0.5·log (w_3)^2]	-0.1572***	-0.2213***
		(0.0329)	(0.0298)
ρ_{32}	[log (w_2) · log (w_3) - 0.5·log (w_2)^2 - 0.5·log (w_3)^2]	0.0122	0.0256
		(0.0153)	(0.0169)
ρ_{41}	[log (w_1) · log (w_4) - 0.5·log (w_1)^2 - 0.5·log (w_4)^2]		-0.0567***
			(0.0139)
ρ_{42}	[log (w_2) · log (w_4) - 0.5·log (w_2)^2 - 0.5·log (w_4)^2]		0.0060
			(0.0065)
ρ_{43}	[log (w_3) · log (w_4) - 0.5·log (w_3)^2 - 0.5·log (w_4)^2]		0.0066
			(0.0095)
ρ_{1TA}	log (Total Assets)· [log (w_1) - log (w_2)]	-0.0481***	-0.0244***
		(0.0147)	(0.0122)
ρ_{3TA}	log (Total Assets)· [log (w_3) - log (w_2)]	0.0444***	0.0271***
		(0.0089)	(0.0075)
ρ_{4TA}	log (Total Assets)· [log (w_4) - log (w_2)]		0.0093***
			(0.0029)
μ_1	Trend	-0.0665	0.0810*
		(0.0433)	(0.0431)
μ_2	Trend^2	0.0011	0.0029*
		(0.0023)	(0.0016)
μ_{TA}	Trend·log (Total Assets)	0.0029**	0.0016
		(0.0013)	(0.0014)
α_1	Trend· [log (w_1) - log (w_2)]	0.0036	-0.0139**
		(0.0062)	(0.0062)
α_3	Trend·[log (w_3) - log (w_2)]	0.0005	0.0089*
		(0.0050)	(0.0053)
α_4	Trend·[log (w_4) - log (w_2)]		0.0051***
			(0.0019)
γ_0	Constant	0.9892	9.1655***
		(2.6713)	(2.3130)
R^2		0.9536	0.9567
Adjusted R^2		0.9532	0.9562

* p<0.10, ** p<0.05, *** p<0.01

SOURCE: Authors' own calculations.
Note: w_1 is the price of labour, w_2 is the price of physical capital, w_3 is the price of loanable funds and w_4 is the price of credit risk.