How Does Competition Impact Bank Risk Taking?

Gabriel Jiménez
Banco de España
gabriel.jimenenz@bde.es

Jose A. Lopez
Federal Reserve Bank of San Francisco
jose.a.lopez@sf.frb.org

Jesús Saurina
Banco de España[1]
jsaurina@bde.es

INCOMPLETE DRAFT -- Please do not cite without authors' permission.

Draft date: May 28, 2007

ABSTRACT: In the academic literature and in the actual supervision of banking systems worldwide, franchise value plays a key role in limiting the riskiness of individual banks and banking systems. The underlying source of franchise value is typically assumed to be market power, and hence reduced competition or, equivalently, market concentration has been considered to promote banking stability. In recent work, Boyd and De Nicoló (2005) propose an alternative view that market concentration could impact bank stability in different ways. Specifically, concentration in the loan market could lead to increased lending rates that both raise borrowers' debt loads and default probabilities as well as their incentive to engage in riskier projects. Using unique datasets for the Spanish banking system, we test for this "risk shifting" paradigm. Our dependent variable is a bank's ratio of non-performing commercial loans. After controlling for macroeconomic conditions and bank characteristics, we find that standard concentration measures do not affect bank NPL ratios. Using Lerner indexes based on bank-specific interest rates on loan and deposit products, we find a negative relationship between loan market power and bank risk; that is, as market power increases, bank NPL ratios decrease. This result is direct evidence in favor of the franchise value paradigm.

Key words: bank competition, franchise value, Lerner index
JEL: G21, L11

[1] The views expressed here are those of the authors and not necessarily those of the Banco de España or the Federal Reserve Bank of San Francisco.

1. Introduction

A standard principle of banking supervision is that too much competition among banks could threaten the solvency of particular institutions and, at an aggregate level, hamper the financial stability of the whole banking system. Competition arising from, say, the liberalization of the banking system could erode the franchise value of a bank, which might encourage the bank's shareholders to pursue riskier policies in order to try to maintain their former profits. Examples of riskier policies are taking on more credit risk in their loan portfolios, lowering capital levels, or both. More credit risk and less capital should increase the probability of higher non-performing loan ratios and more bank bankruptcies. In contrast, if competition is restrained, banks should have more incentives to protect their higher franchise values, and, thus, they are more likely to pursue less risky strategies that should cause fewer bank insolvencies and more financial stability for the whole banking system.

This "franchise value" paradigm has been supported both theoretically and empirically over time in the banking literature. Marcus (1984), Dermine (1986), Chan et al. (1986), Furlong and Keeley (1989), Keeley (1990), Besanko and Thakor (1993), Suárez (1994), Matutes and Vives (1996, 2000), Hellmann et al. (2000), and Repullo (2004) contain models that support a trade-off between competition and financial stability. Increased competition translates into riskier banking systems. Empirically, there is wide support for the franchise value paradigm. Keeley (1990) shows that the risk of US banks increased after the liberalization of the banking system brought about a decline in banks' market power. Demsetz et al. (1996), Brewer and Saidenberg (1996), Saunders and Wilson (1996) also find empirical support for this trade-off. Hellmann et al. (2000) have the view that financial-market liberalization in the 1990s increased competition and reduced the profitability and franchise value of domestic banks, which, jointly with other factors, lead to the East Asian financial and a weaker financial system in Japan. In Europe, Salas and Saurina (2003) find support for the franchise value paradigm as they study the liberalization of the Spanish banking system and the subsequent increase in competition and credit risk.

Recently, Boyd and De Nicoló (2005) have challenged the franchise value paradigm. They argue that less competition among banks could mean higher interest rates charged to business loans, which might increase the credit risk of borrowers and, in the end, increase bank problem loans and insolvencies. Firms facing higher interest rates could become riskier as they cope with larger interest payments and, moreover, because higher interest rates reinforce their moral hazard. The authors argue that the franchise value paradigm focuses only on the deposit side; that is, the economic rents that banks earn from depositors provide the only incentives to carry out conservative asset side policies. However, the authors argue that, apart from the deposit channel, there is also a loan market channel that could eliminate the trade-off between competition and financial stability. In fact, they argue for a new paradigm for banking supervisors: more competition decreases credit risk and enhances financial stability.

Boyd, De Nicoló and Al Jalal (2006) provide some empirical evidence of a positive relationship between a measure of bank risk (a Z-score) and an index of concentration in the banking market (the Herfindahl-Hirschmann index). Moreover, they argue that the empirical literature is not so clear cut regarding the franchise value paradigm. Jayaratne and Strahan (1998) find that non-performing loans decline after statewide branching was permitted in the US market. Nevertheless, Dick (2006) finds evidence of a positive relationship between deregulation and increases in credit risk.

Allen and Gale (2004) show that different models can provide different results regarding the competition and financial stability trade-off. Martínez (2006) extends the Boyd and De Nicoló (2005) model by allowing for imperfect correlation across individual firms' defaults. He identifies a risk-shifting effect accounting for more defaults when interest rates increase (i.e. lower competition environment) but realizes that, at the same time, there is a margin effect that means more revenue for the bank coming from those non-defaulted borrowers that pay a higher interest rate. The relation between competition and financial fragility is U-shaped; that is, as the number of banks increases, the probability of bank default first declines and latter on increases again. Regarding the empirical evidence, Beck et al. (2006) using data on 69 countries for the period 1980-1997 find strong support

for the concentration-stability view in the sense that the more concentrated a banking market is the lower the probability of a banking crisis. However, they point out that concentration might be an insufficient measure of the degree of competition in a banking market.

The objective of this paper is to test which of these two modeling paradigms is best supported empirically. We want to perform a test of the relationship between competition and bank risk. We focus on the Spanish banking market which allows us to use detailed databases to construct the most appropriate variables for our test. Specifically, we take advantage of an interest rate database that contains monthly information about the marginal interest rates charged by each bank for a set of banking products; in particular, loans and deposits for commercial firms. We also use the Banco de España's Credit Register database (CIR) to extract banks' risk premiums for the former marginal interest rates and to obtain their commercial non-performing loan ratios. Using the interest rate information, we can produce Lerner index measures of banking market power for commercial lending in order to address the Boyd-De Nicoló model as closely as possible. In addition to these measures of market power, we also use proxies based on standard market concentration, such as Herfindahl-Hirschmann indexes and the number of banks operating in a market.

The practical measure of bank risk used here is a bank's ratio of non-performing commercial loans to total commercial loans. In testing the trade-off between competition and financial stability, some papers have looked for cross country evidence. Although these broad analyses allow us to make inference taking into account quite different banking systems, it might come at the cost of a certain lack of comparability across variables (both dependent and independent) and less accurateness of the variables used. Our focus on the Spanish banking system should avoid this concern.

The contribution of our paper is to perform a limited (i.e., only focused on Spanish banking market) but rather precise, test of bank competition versus bank risk in order to provide some guidance for banking regulation policies related to competition and financial stability. Based on our empirical results, we reject the Boyd and De Nicoló (2005) model in most of the specifications, in

particular, in those that use the Lerner index as a measure of market power. Therefore, we find support for the traditional franchise value paradigm which underlies much of the banking regulation work done in the past decades (i.e., liberalization, reinforcement of capital requirements, increased attention to a proper measurement and management of banks' risks, and other related reforms).

The rest of the paper is organized as follows. Section 2 contains a brief discussion of the literature both theoretical and empirical. In Section 3, we present the databases, variables and methodology used to test the trade-off between competition and bank risk. In Section 4, we show the results whose robustness is analyzed further in Section 5. Section 6 concludes.

2. Literature review

2.1. Theoretical literature

The franchise value paradigm for bank risk taking, both with and without government regulation, is well established within the banking literature. Marcus (1984) used a one period model to show that franchise value declines as a bank engages in riskier policies. Dermine (1986) extended the Klein-Monti model to incorporate bankruptcy risk and deposit insurance and found a negative relationship between the level of bank credit risk and its deposit market power. Chan et al. (1986) showed that increased competition erodes the surplus that banks can earn by identifying high quality borrowers. The reduction in value leads banks to reduce their screening of potential borrowers and, thus, overall portfolio credit quality declines. Keeley (1990), following Furlong and Keeley (1989), used a state preference model with two periods to show that a decline in franchise value enhances bank risk taking. Broecker (1990) showed that increased competition, measured as an increased number of banks, had a negative effect on the average credit-worthiness of the banking system. Besanko and Thakor (1993) showed that increased competition erodes informational rents originated from relationship banking and enhances risk taking by banks. In a context of asymmetric information, Marquez (2002) showed that an increase in the number of banks in a market disperses the borrower-specific information and will result in higher funding costs for low-quality borrowers.

Suárez (1994), using a dynamic optimization model with an infinite horizon, showed a trade-off between market power and solvency. If the market power of the bank decreases, the incentives to take riskier policies augment significantly. The franchise value of the bank is one of the components of the bankruptcy costs so that it is an incentive to carry out prudent policies that increase the solvency of the bank.[2] Matutes and Vives (1996, 2000) in a framework of imperfect competition (i.e., product differentiation) showed that a higher market power reduces the probability of default of the bank. Hellmann et al. (2000) in a dynamic model of moral hazard showed that competition can have a negative impact on prudent bank behavior. Capital requirements are not enough to reduce the gambling incentives and they need to add deposit rate controls as a regulatory instrument.

In contrast to the franchise value paradigm, Boyd and De Nicoló (2005) develop a model where an increase in the market power of banks in the loan market, not just the deposit market, translates into higher loan rates charged to borrowers. In a moral hazard environment, entrepreneurs facing higher interest rates in their loans optimally choose to increase the risk of their investment projects which, eventually, brings about more problem loans for the lenders and a higher bankruptcy risk for banks. They find a monotonic declining relationship between the number of banks lending in a market and the equilibrium level of risk shifting, so that as the number of banks increases (i.e., competition increases), the level of bank risk declines. In a very recent paper, Martínez-Miera and Repullo (2007) find that it is possible to reconcile the franchise value theory and the Boyd and De Nicoló paradigm. He shows that the former monotonic relationship might become a U-shaped relationship as he allows for imperfect default correlation across firms. The risk shifting effect of Boyd and De Nicoló (2005) (i.e., higher risk of failure as interest rates increase) has to be balanced with a higher margin effect from those firms that are able to repay their loans at the higher interest rate. Depending on the assumption about default correlation among firms and the intensity of the risk shifting effect, it is possible to find an increase in bank risk as the number of banks increases (i.e., as bank competition increases).[3]

[2] Chan, Greenbaum and Thakor (2002) also consider the franchise value a component of the private cost of bankruptcy.
[3] Caminal and Matutes (2002) had already shown that the relationship between market power and banking failures is ambiguous.

2.2. Empirical literature

The empirical literature that we address in this paper focuses on the relationship between competition in banking markets and bank riskiness. The extant studies use different measures of bank competition, which often highlight deposit market competition, and bank risk exposures. Keeley (1990) measured the degree of bank competition using banks' market power as captured by Tobin's q, which is defined as the ratio of a bank's equity market valuation to its book value. He first showed that liberalization measures eroded Tobin's q, controlling for macroeconomic variables and bank characteristics. Secondly, he related a bank's solvency ratio, defined as the market value of capital divided by the market value of assets, and its funding costs for certificates of deposit as a measure of bank risk to the Tobin's q ratio, finding a positive relationship for the former (i.e., a higher market power means a larger solvency coefficient) and a negative for the latter (i.e., as the market power declines the perceived bankruptcy risk of the bank increases and so does the cost of uninsured large CD's). This evidence supports the franchise value paradigm.

Demsetz et al. (1996) showed that U.S. banks with higher market power also have the largest solvency ratios and a lower level of asset risk. Brewer and Saidenberg (1996), for a sample of publicly traded U.S. thrifts, found a negative relationship between their franchise value and the risk of the firms measured as the volatility of their stock prices. Saunders and Wilson (1996), for a sample of U.S. bank and a period of a century, found support for Keeley's results in the period from 1973 to 1992.[4] Salas and Saurina (2003) replicated Keeley's work for Spain, finding a very significant and robust relationship between Tobin's q and the solvency and non-performing loan ratios of Spanish banks. More market power was found to bring about higher bank solvency ratios and lower credit risk losses, as measured by the non-performing loan ratio.[5] Overall, there seems to be a significant amount of literature supporting the franchise value paradigm.

[4] In fact, Rhoades and Rutz (1982) had already found, using a quite different methodology, that banks with higher market power (measured using a concentration index) were more risk-averse.

[5] We are not aware of other similar studies in Europe. However, Arellano (2004) carried out a similar test for Mexican

However, Jayaratne and Strahan (1998) showed that bank performance, measured using return on assets, return on equity, and several indicators of credit quality, improved significantly after restrictions on bank expansion were lifted in the U.S. Moreover, loan losses decreased sharply after statewide branching was permitted. Thus, an increase in competition seems to have had the opposite effect of the franchise value paradigm. Nevertheless, Dick (2006) provides evidence of a positive and significant relationship between banking deregulation and increases in loan losses, while Hannan and Prager (1998) showed that liberalization of interstate branching and operations increased competition in the deposit market and reduced profitability, ceteris paribus. Moreover, regarding the literature on market concentration and bank risk focusing on new bank entrants, the general findings are that an increase in loan market competition may lead to increase loan losses due to the winner's curse arising from larger degrees of asymmetric information (see Shaffer, 1998). Bofondi and Gobbi (2004) found that a bank's loan default rate increases as the number of banks in a market increases.

In the above-mentioned studies, differences in the degree of bank competition were either cross-sectional or caused by key changes in regulation within one country. Several studies have examined this relationship in a cross-country setting. Beck et al. (2006), with banking data for 69 countries and a time period covering almost 20 years, found that more concentrated national banking systems are subject to a lower probability of a systemic banking crisis and hence are more stable. However, they cast doubts on the appropriateness of the share of assets of the three largest banks in the banking system of each country (i.e., their C3 measure), as a measure of competitiveness in a national banking system. Claessens and Laeven (2004) showed a positive and significant relationship between bank concentration measured as C5 and the H-statistic, a measure of the intensity of competition in a market according to Panzar and Rosse (1987). Robustness analyses of this result showed that the relationship between concentration and the H-statistic could also be insignificant. As a result of the positive sign, they concluded that bank concentration is not a good summary of the bank competitive environment.[6]

---

banks and found similar results.

Finally, Boyd et al. (2006) provide empirical evidence supporting the risk shifting model using different measures of bank risk and bank competition. For the former, they use a z-score measure based on bank returns on assets (ROA), its dispersion measured as σ(ROA), and the ratio of equity to total assets. For the latter, they use a Herfindahl-Hirschmann index. They have two samples. The first one is a cross section of around 2,500 small, rural banks operating in only one market area within the U.S. The second sample involves around 2,700 banks from 134 countries, excluding Western countries. In both samples, they found a negative and significant relationship between the bank concentration index and z-score; thus, more concentrated banking markets are associated with greater risk of bank failures.

All in all, it seems that only Boyd and De Nicoló (2005) and Boyd et al. (2006) and, to a certain extent, Jayaratne and Strahan (1998) challenge the franchise value paradigm, in general, a well-established theoretical and empirical relationship between bank competition and bank stability. In this paper, we use precise measures of bank risk and bank market power to test whether the franchise value paradigm or the risk-shifting paradigm applies to the Spanish banking system.

3. Data and model description

3.1. Data

The dependent variable measure of bank risk used in our analysis is banks' commercial non-performing loan (NPL) ratios. Non-performing loans are an ex post measure of credit risk that has been widely used. We focus on commercial credit risk for two reasons. First, the model proposed by Boyd and De Nicoló (2005) is based importantly on the behavior of commercial borrowers, and second, credit risk is the primary driver of risk for most banks, although other risks are present. The NPL ratios are obtained from the Spanish Credit Register (CIR) maintained by the Banco de España. The CIR contains information on any loan above a minimum threshold of 6,000 euros granted by any bank operating in Spain. Therefore, it contains almost all commercial loans in Spain. We have

[6] A survey of the literature on bank concentration and competition is in Berger et al (2004).

monthly information starting in 1984, but for practical reasons, we use only December information without loss of generality.

As discussed previously, various measures of the degree of bank competition have been used in the banking literature. While many papers have used concentration measures as proxies for bank competition, we share the concern expressed by Claessens and Laeven (2004) regarding the meaning of these concentration variables. For our paper, we take advantage of a database maintained by the Banco de España that records the marginal interest rate each bank charges on an array of banking products -- credit lines, receivables (defined as credit granted against invoices or other payment documents), mortgages, term deposits, repo deposits guaranteed with government debt, etc. -- each month during the period from 1989 through 2003. That is, for each bank and each banking product, we have its average interest rate set on that product for new transactions.[7]

Using this interest rate information, we can produce a Lerner index for commercial loan products for each bank in our sample. The Lerner index is a commonly used measure of market power that captures the degree to which a firm can increase their marginal price beyond their marginal cost. Hence, we attempt to address the Boyd and De Nicoló (2005) model as closely as possible by focusing on the market power that banks have in the commercial loan market. Nevertheless, to avoid being criticized for being to narrow on that we also produce a Lerner index of total loans.

The Lerner index is a much more accurate measure of market power than any concentration measure could be.[8] However, the computation of the Lerner index requires a proper estimation of the marginal cost of the product which in bank loans requires, among other things, to evaluate the risk premium charged. Failure to take into account the risk premium results in significant biases in measuring the market power of the bank.[9] If the market-determined interest rate of the loan is R_1, the Lerner index or gross profit margin relative to the market price will be equal to $(R_1 - R)/R_1$, where R

[7] A more detailed description of this database can be found in Martin et al (2007).
[8] Under conventional assumptions Tirole (1988) shows that the Lerner index can be related to measures of welfare losses such as the Harberger's (1964) triangle.

is the marginal cost of the loan. The interbank market separates loan and deposit pricing decisions if we introduce the realistic assumption that the marginal operating costs of loans and deposits are either quasi-fixed in the very short term or impossible to calculate separately for each of the multiple products and services supplied by the bank. Therefore, the assumption we make is that banks have a lower bound on the marginal cost for the loans they grant equal to the risk free interest rate offered in the money/interbank market.[10]

However, banks also face credit risk (i.e., there is a positive probability that the loan will be in default at some point in the future). Let *PD* be the probability that a loan, with a normalized face value of one, will default over a specified horizon, and let *LGD* be the amount of the face value of the loan that the bank cannot collect from the defaulted loan, known as the loss given default. If the interbank risk-free interest rate is *r*, the marginal opportunity cost of the loan for a risk-neutral bank will be the interest rate *R* that satisfies the condition that the risk-free value of the loan equals the expected value of the loan, given the risk of default, at the end of the period. Building from that, it can be obtained that the marginal cost $R = (r+PD \cdot LGD)/(1-PD \cdot LGD)$. Therefore, the computation of the marginal cost requires estimations of the risk-free interest rate, as well as the *PD* and *LGD* parameters for each bank. The risk-free interest rate *r* is the average daily quoted annual interbank interest rate. The bank-specific, not borrower-specific, *PD* is obtained directly from the Credit Register: for a given bank and loan product at the end of year t, PD equals the ratio of defaulted commercial loans divided by total commercial loans outstanding. Since there is no detailed information regarding *LGD*, we use the value 45% set by the Basel Committee of Banking Supervisors in its new capital framework.

We focus on two commercial banking products: receivables and credit lines. Nevertheless, we also compute Lerner indexes for deposits (assuming again separability and that the money market rate acts as upper bound for deposits rates) and for loans and deposits jointly in order to increase the robustness of our results. In addition to these more accurate measures of market power, we also examine standard concentration variables, such as C5, Herfindahl-Hirschmann indexes

[9] We follow Martín et al. (2006) in what follows in order to properly build the Lerner index.

(HHI) and the number of banks operating in each market, as proxies for market power. Note that the latter variable is the one used in the Boyd-De Nicoló model. Given that our endogenous variable is the level of credit risk of each bank and that the Spanish credit market is segmented geographically into 50 provinces, the concentration measures reflect the degree of concentration each bank faces in each of the regional markets where it operates. We construct an aggregate measure for each bank using a weighted average, where the weights are the market share each bank holds in each province. If a bank only operates in a province, it faces the concentration indicators of that province; whereas if a bank operates nationwide, it has a nationwide weighted concentration index for each of the concentration measures. Again, the concentration variables refer to the commercial loan market to be consistent with our other risk and competition measures and to test the risk shifting paradigm.

Finally, in our analysis, we also use a database on banks' balance sheets and profit and loss data in order to control for individual bank characteristics. The time period covers all Decembers from 1988 to 2003 as the marginal interest rate database becomes binding in terms of years to be included. We focus on commercial and savings banks, 95% of the credit market to firms. Credit cooperatives and specialized lenders are excluded because of lack of data of interest rates although their market share is very small (the remaining 5%).

Table 1 shows the statistical analysis of the variables used. We have information about 107 commercial and savings banks, with a final 1,262 bank-year observations.[11] The average NPL ratio is around 4.4% but with huge dispersion across banks, some of which reach a ratio above 38% while others, for a particular year, show almost no non-performing loans. As shown in Figure 1, there is a significant variability over time in this variable, with the average NPL ratio at around 1% in recent years and around 2% at the beginning of the sample period, to nearly an average value of 7% in 1993. These time dynamics are tied to the Spanish business cycle, which experienced a deep recession around 1993 and two important expansion periods just before those years and from the second part of the nineties onwards. Real interest rates have been declining steadily but significantly

[10] Freixas and Rochet (1997) review bank pricing models in different competitive regimes and information conditions.
[11] These are the final number of observations used to run the regressions after taking differences and allowing for lags in the instruments. The original number of observations is 1,632. The data is uniformly distributed across the 14 years of the

along the period, as the Spanish economy was converging to the euro zone countries.

Next, we summarize our various measures of the degree of bank competition. There are a large number of banks operating in each provincial credit market. However, again, there is high dispersion with provinces with only 22 banks while others have at some point close to a hundred and fifty banks. We do not have more detailed geographical market breakdowns but, in general, it is easy to see a significant correlation between the size of the province (in terms of population) and the number of banks operating there. Madrid and Barcelona, by far the largest populated provinces, have a much higher number of banks. The correlation coefficient for the log province population and the log of the number of banks in the province is stable at 0.88 in 1990 and 0.85 in 2000. Across provinces, we observe a variety of patterns regarding the number of banks.

C5, the market share of the first five lenders to firms in each province is relatively high on average (58%), with a minimum market share of 40% and a maximum close to three fourths. In any case, there is significant variability but no geographical market seems to be dominated by a few banks. Across provinces and along time there are from time to time significant jumps in the C5 index as some large banks merge. Regarding mergers, we have treated banks merged as two separate entities before the merge and as a new one after it. Thus, we avoid the sometimes used shortcut of considering mergers as if they had happened at the beginning of the sample period. The latter might bias the results and, certainly, goes against the economic rational of mergers.

The Herfindahl-Hirschmann index for commercial loans is around 8, which roughly means 12 banks of equal size per market. Since this number is much below the 75 average number of banks per province, it must be that there is a significant amount of banks in each market with a tiny market share; that is, they might only have one branch in the province or several ones with a small market share. Similarly, it points towards a careful use of the variable number of banks as a proxy for competition in a market, even though it is the one that comes out of theoretical models. The loan HHI shows no clear pattern across provinces; that is, steady increases mix up with significant

---

estimation sample.

declines.

The average Lerner index for receivables is positive, although relatively small; receivables margins, once the risk premium has been taken into account, are only a 15% of receivables rates. For credit lines, the index is even negative on average and zero for the median, suggesting that the interest rate set to credit lines by the median bank only covers the funding cost plus the risk premium applied to the borrower. The Lerner index for the whole loan portfolio is on average positive, but quite small; banks in our sample earn an average 5% margin on loan rates; see Figure 2A. It is important to realize that for credit lines, the Lerner index was particularly low around the recession years as the risk premium increased the marginal cost of those loans significantly. Later on, it recovered positive values for a significant number of banks. For receivables during the whole period and for credit lines and total loans once the recession was over, the Lerner index has shown an increasing trend with the last year of the sample period showing the highest value of the whole period. On the other hand, the Lerner index for deposits declined during the first half of the sample period and later on fluctuated at 33% of average deposits rates; see Figure 2B. For repo transactions, the Lerner index is quite close to zero while for sight accounts is higher. Taking jointly loans and deposits, the Lerner index is on average 0.4 with a maximum value of one but still, negative values; i.e., the loan interest rate does not cover the deposit rate and the risk premium.

Finally, Table 1 also shows that commercial and savings banks have an average return on assets (ROA) of 0.66% for the period analyzed, with strong volatility (very profitable and unprofitable banks) and not a large difference between the average and the median bank. In the sample we have large banks, with a market share in terms of total assets close to 10% and very small banks with an almost negligible one. There is a significant difference in specialization among the commercial and savings banks analyzed as some of them concentrate their loan business in firms (as high as 90% of total assets are loans to firms) or almost do not operate in that market segment.

3.2. Model description

To examine the various hypotheses regarding the traditional franchise value paradigm and the risk shifting hypothesis of Boyd and De Nicoló (2005), we use the general regression model:

$$RISK_{it} = f(COMPETITION\ INDEX_{it}, BUSINESS\ CYCLE_{it}, BANK\ CONTROL\ VARIABLES_{it}),$$

where the i subscript refers to a bank and the t subscript refers to the year. The model sets the relationship between the specified bank risk measure and the specified bank market competition measure, controlling for bank characteristics and the state of the business cycle. A positive and significant relationship between the measures of risk and competition would provide evidence in support of the franchise value paradigm. The actual model specification we examine is:

$$\ln\left(\frac{\mathrm{NPL}_{it}}{100-\mathrm{NPL}_{it}}\right) = \alpha + \beta \ln\left(\frac{\mathrm{NPL}_{it-1}}{100-\mathrm{NPL}_{it-1}}\right) + \delta_1 \mathrm{COMPETE}_{it} + \delta_2 \mathrm{COMPETE}_{it}^{\ 2} + \gamma_1 \mathrm{GDPG}_t + \gamma_2 \mathrm{GDPG}_{t-1} + \phi_1 \mathrm{ROA}_{it} +$$
$$\phi_2 \mathrm{MARKET\ \ SHARE}_{it} + \phi_3 \mathrm{LOAN\ \ RATIO}_{it} + \eta_i + \varepsilon_{it},$$

The dependent bank risk variable is the log-odds transformation of a bank's NPL ratio. We use the logit transformation to change the variable's support from the unit interval to the real number line. There is a significant degree of persistence in the transformed NPL variable; for our sample, the first-order autocorrelation is 0.68. Hence, we include the lagged endogenous variable as an explanatory variable.[12]

We control for the business cycle by introducing the GDP real growth rate, current and lagged one year, since problem loans evolve significantly along the cycle. We also control for the profitability of the bank (using its contemporaneous ROA), its size (through its market share in terms of total assets) and its specialization (percentage of total assets that represent loans to firms).

Our primary variables of interest here are those related to the degree of bank market competition, denoted $\mathrm{COMPETE}_{it}$. For the loan market, we use the number of banks, C5, the HHI as well as the Lerner index for receivables, credit lines and all loans. For the deposit market, we use

[12] See Salas and Saurina (2002) for the Spanish case.

the Lerner index for deposits, repo operations, and sight accounts, defined as deposits that can be drawn at any time. We also examine the sum of the Lerner indexes for the broadest loan and deposit categories. As noted in our model specification, we also include the squared $COMPETE_{it}$ term in our regressions. As mentioned in Section 2, Martinez-Miera and Repullo (2007) shows that in the Boyd and De Nicoló (2005) framework, it is possible that the relationship between the number of banks and bank risk might not be linear. We include the bank fixed effect η_i to control for unobservable bank characteristics constant over time. Finally, ε_{it} is a random error that has a normal distribution.

It could be possible that bank unobservable characteristics are correlated with the bank NPL ratios; for example, the risk aversion of bank managers and/or shareholders. In this case, a level estimation of model (2) would produce biased parameters due to the lagged dependent variable. Similarly, an OLS estimation of model (2) would also bias the results. To address these estimation problems, we use the Arellano and Bond (1991) procedure and estimate the model in first-difference form using the Generalized Method of Moments estimator (GMM). We thus treat bank characteristics as endogenous and use up to three lags of the dependent variable to instrument for them. The validity of these instruments is tested using the standard Sargan test. Since we take first differences, we should observe first-order autocorrelation and no second-order autocorrelation in the residuals.

In our model specification, positive and significant values for δ_1 and δ_2 would support the Boyd-De Nicoló risk shifting proposition, while negative and significant values would support the franchise value paradigm. We expect a positive and significant value for the lagged endogenous variable, and a negative and significant effect for the GDPG variables, since problem loans increase in bad times and *vice versa*. We do not have a priori clear cut signs for bank characteristics. In general, there should be a positive relationship between risk and return at long term but banks with high non-performing loans might experience significant losses in a particular year. The specialization of a bank should be indicative of improved monitoring and screening of borrowers, while, at the same time, more specialized banks might be willing to take more risks. Finally, there is no general support for a certain relationship between the size of the bank and its risk level. A larger

bank benefits from risk diversification but, at the same time, bank managers could take advantage of that in order to push further the risk profile of the bank.[13]

4. Empirical results

4.1. Correlations

Before presenting the results of the regressions, it might be useful to look at Table 2 and discuss some of the partial correlations between the variables. We find a negative relationship between all our measures and proxies of bank market power in both, the loan and deposit markets and bank's commercial NPL ratios, our measure of bank risk. The Lerner index correlation for loans range from -0.56 to -0.20, while for the deposit market, these values are generally smaller, ranging from -0.44 to +0.03. Both the C5 and HHI measures for both markets show a negative, although low correlation, with ex post credit risk. Therefore, simple correlation analysis points towards a negative relationship between market power and bank risk, supporting the franchise value paradigm.

As expected, commercial NPL ratios are correlated negatively with the business cycle. It seems that specialization in lending to firms has a positive effect on screening and monitoring of borrowers by bank while current problem loans have a negative impact on current profitability. The correlation between size of the bank and risk in business loans seems weak. Profitability of banks seems to be inversely related to the number of banks operating in each local market and positively related to the standard concentration measures as well as market power indicators. However, the absolute value of correlation coefficients is, in general, low and in the range of [0.16, 0.24] for loans and [-0.18, +0.11] for deposits. The correlation with the number of banks is actually -0.36.

With the data available for this study, we can examine in greater empirical detail the key theoretical concept on bank market concentration proposed by Boyd and De Nicoló (2005); namely, the distinction between concentration in the deposit and the loan markets. Between concentration

[13] See, for instance, Hughes et al. (1996) for this last result.

measures, there is a strong negative correlation between the number of banks operating in a market and the C5 and HHI measures for both loan and deposit markets, ranging from -0.67 to -0.42. Across the two markets, the correlations based on these two concentration measures are also high at +0.82 for the C5 measure and +0.59 for the HHI measure. The C5 and HHI measures for both loan and deposit markets are highly correlated (around 0.85) with each other. Even the correlation between the C5 measure for loans and deposits and of the Herfindahl-Hirschmann indexes of loans and deposits are also high (always above 0.5) as well as cross correlations between both concentration variables across loans and deposits. Therefore, both variables seem to be interchangeable as concentration proxies.

However, a very different picture emerges for the Lerner measures of market power. Within markets, the correlations between the Lerner measures and the other two measures drop sharply to between +0.15 and +0.21. Across the deposit and loan markets, the correlation between the Lerner indexes is quite low at +0.12, suggesting that loan and deposit markets might be separated (i.e., the interbank market can help to split apart both markets). The correlation between concentration and market power variables (i.e., Lerner indexes) is generally positive but with a low value (maximum 0.25 with many values around 0.2). Thus, concentration and market power seem to go hand in hand although the relationship seems to be week. A proper test of the franchise value paradigm needs, therefore, a more direct measure of market power than the usual concentration proxies used in the literature.

Finally, it should be noticed that, in general, market power is procyclical, in particular, that coming from the asset side of the bank balance sheet (maximum correlation around 0.3). Concentration measures are also positively correlated with the business cycle indicator but with low values.

4.2 Regression results

Table 3 presents the estimation result for our baseline model. The table's six columns differ

on the concentration or market power measures used. The validity of the instruments for our specification is satisfactory in all cases, as shown by the Sargan test results. Moreover, as expected since we estimate the model in first differences, there is significant first-order serial autocorrelation of the residuals but no significant second-order autocorrelation.

In all six regressions, the lagged endogenous variable is significant at the 1% level with a parameter value around 0.5, confirming the persistence shown in the NPL ratios. The contemporaneous GDP growth rate is negative and significant at the 1% level, while the lagged GDP growth rate is always negative but only significant in the last four columns based on the Lerner measures. In any case, the parameter of the lagged value is, in absolute terms, always lower than half of the contemporaneous one indicating that business cycle changes go quite quickly into firms' problem loans.[14]

Turning to bank characteristics, larger banks have lower NPL ratios in all six regressions. Thus, it seems that portfolio diversification and possibly better managerial ability at larger banks play a role in mitigating credit risk in Spain.[15] The more specialized is a bank on loans to firms, the lower its credit losses on those loans. This result is statistically significant for the first four regressions at the 1% level, insignificant for the fifth, and significant only at the 10% level for the sixth. In general, our results suggest that specialization improves the screening and monitoring abilities of banks. Finally, ROA as a measure of bank profitability is insignificant, although negative, in the six regressions.

Regarding the main variables of our interest, the first column of Table 3 shows that the number of banks operating in a market does not seem to have any effect of the risk behaviour of banks. Therefore, the risk shifting claim in Proposition 2 of Boyd and De Nicoló (2005) is not confirmed by the data.[16] We have claimed that concentration measures are rough proxies for market

[14] Probably, if we had as an endogenous variable the loan losses of loans to households (in particular, of mortgages) the business cycle impact would take more time.
[15] Recall that we are focusing on domestic businesses, not taking into account international diversification.
[16] Proposition 2 in Boyd and De Nicoló (2005) states that, in a symmetric interior Nash equilibrium, the equilibrium level of risk shifting is strictly decreasing in the number of banks.

power, and the results for the C5 and HHI measures support this claim. If we look at columns 2 and 3, we find that the C5 concentration measure for commercial loans has no significant impact on NPL ratios, while the HHI measure for loans is only significant at the 10% (in the linear term). In fact, the sign is negative, suggesting that an increase in concentration brings about a decline in credit risk, which is in line with the franchise value paradigm if we accept that concentration is a proxy of market power.

More interesting are the three last columns based on the Lerner market power measures. δ_1 and δ_2 are both negative and significant at the 1% level in these cases. An increase in market power for commercial loans, measured as an increase in the Lerner indexes for receivables, credit lines and total loans produces a decline in the risk profile of the bank; recall that risk premium has been properly accounted. Thus, we find clear and very significant empirical evidence supporting the franchise value paradigm. Moreover, since we have focused narrowly on commercial loans regarding both the endogenous variable and the competition variables, we are able to reject the Boyd and De Nicoló (2005) testable hypothesis.

What if the source of market power does not come from the asset side (i.e., loan markets) but from the liability side (i.e., deposit markets)? It might be that banks earn monopoly rents in the deposit market and that has a different impact on the loan market. For instance, more market power in deposits could allow banks to be more aggressive in the loan market and be prepared to lend to riskier borrowers with the short term objective of increasing market share or total assets.[17] Table 4 presents our empirical analysis of these issues using our baseline specification, but with deposit market measures. Using these concentration measures, the regression results in the first two columns show that the relationship is not linear, but instead fits the non-linear pattern proposed by Martínez-Miera and Repullo (2007). For low values of the concentration measures, increases in concentration cause an increase in NPL ratios, but beyond an inflection point situated at roughly a C5 value of 60.5% and an HHI value of 14.7, increases in concentration are correlated negatively with NPL

[17] If there is an agency problem between bank shareholders and managers, the latter might be interested in expanding the volume of business in order to maximize a utility function subject to a minimum profitability level. That might explain why they are riskier.

ratios. Intuitively, in both cases, the linear term (δ_1) goes against the franchise value paradigm in that a positive sign means more concentration and more risk, while the quadratic one (δ_2) goes in favor. For low values of the concentration indexes the linear one dominates. However, the calculated inflection points are situated in the sixth percentile for the C5 measure and in the 24th percentile for the HHI measure. In a sense, the franchise paradigm is not rejected 94% and 76% of the times.

However, the following four columns are also very informative. The market power in repo transactions and sight accounts do not seem to have any significant impact on the credit risk of the bank. Only for total deposits (column 5), but only at a 10% significance level, more market power is negatively correlated with risk. This results support the hypothesis of separation between loan and deposit markets used before to derive the marginal cost for the Lerner indexes, and, weakly, the franchise value paradigm. The last column in Table 4 shows clear evidence against the risk shifting hypothesis as more global market power (either coming from loans or deposits) means a less risky behavior by banks.

All in all, we find clear evidence supporting the franchise value paradigm: more market power in commercial loan markets leads to less credit risk in those markets. Concentration in the loan market has no impact on problem loans while deposit concentration, in most of the cases, also supports the franchise value paradigm.

5. Robustness analysis

In this section, we conduct robustness tests to see if our results hold. First, Table 5 shows the results after including the current and the lagged level of real interest rates as an additional control variable. The new variables are positive and significant, except in the last three columns where only the lagged value is significant. The GDP growth rate variable is still negative and significant although its absolute value has declined, in particular, for the contemporaneous period. These results suggest that real interest rates are important macroeconomic determinants of NPL ratios, but they do not displace the standard business cycle indicator. Bank characteristics are now less significant, and

the results do not change much overall. Regarding the main variables of interest, the concentration measures of the number of banks and the C5 index are again found not to be significant, while the HHI linear parameter is now positive and significant at the 10% level. The last three columns show negative and very significant parameters for the three loan market Lerner indexes. Therefore, we find again a positive relationship between market power and the solvency of Spanish banks as measured by NPL ratios. Alternatively, more competition brings about more risk for banks. If we add up loan and deposit Lerner indexes (not shown), we find again negative and significant at the 1% level δ_1 and δ_2 parameters.

Coming back to the baseline model, if we use all the available instruments instead of only lags two and three, we still find (not shown) negative and significant at the 1% level δ_1 and δ_2 parameters for the Lerner index of receivables, credit lines, total loans and loans plus deposits.

Table 6 shows the results of model (2) estimation taking only into account the linear term for concentration and market power measures. Before comparing those variables, we see that the instruments used are satisfactory, that the autocorrelation tests are passed satisfactorily and the lagged endogenous, the GDP growth rate variable and the bank characteristics have both the same signs and significance level as in Table 3. Regarding the number of banks (column 1 in Table 6), we find a positive and very significant effect which goes directly against the Boyd and De Nicoló result. As the number of banks increases in markets where a bank operates, its risk profile worsens. The C5 parameter is negative although only significant at the 10%, so that, weakly, more concentration means less risk. The Herfindahl-Hirschmann index is also negative but not significant. Regarding Lerner indexes, the three are negative, thus, supporting the franchise value paradigm, although only those for receivables and credit lines are significant (at the 1% level). If we include all the lags as instruments (not shown) we find a negative impact of C5 on credit risk (no impact for number of banks and Herfindahl-Hirschmann index) and negative values for the Lerner indexes parameters (significant at the 10% level for receivables and at the 1% level for credit lines). If we include real interest rates (not shown) we still find the Lerner index of receivables and credit lines negative and significant (the former one at the 5% level).

Overall, Table 3 baseline results seems reasonably robust to changes in the specification of the variables. Therefore, we claim that we have found very robust support for the franchise value paradigm and rejected the Boyd and De Nicoló (2005) claim that more competition brings about less bank risk and more financial stability. At least for Spanish banks during the last 16 years, there has been a trade-off between competition and stability.

6. Conclusions

In the academic literature and in the actual supervision of banking systems worldwide, the dominant paradigm is that franchise value plays a key role in limiting the riskiness of individual banks and hence of banking systems more broadly. That is, as a bank's franchise value increases, its management and shareholders will typically limit and/or reduce its risk exposure to preserve this value. The underlying source of franchise value is typically assumed to be market power, and hence reduced competition or, equivalently, market concentration has been considered to promote banking stability.

In recent work, Boyd and De Nicoló (2005) as well as Boyd et al. (2006) propose an alternative view. They argue that market concentration could impact bank stability in different ways, depending on the net effect across deposit and loan markets. In particular, they claim that the current consensus has ignored the "loan market channel" and hence may lead to incorrect conclusions. Specifically, the authors suggest that concentration in the loan market could lead to increased lending rates that both raise the borrowers' debt loads and default probabilities as well as their incentive to engage in riskier projects.

Using unique datasets regarding the Spanish banking system, we explicitly test whether the Boyd-De Nicoló "risk shifting" paradigm is present in the data. Our dependent variable is a bank's ratio of non-performing commercial loans, which is the variable directly addressed in their framework. After controlling for macroeconomic conditions and bank characteristics, we examine

the impact of various measures of concentration in both the loan and deposit markets. We find that the number of banks, which is the measure highlighted in this alternative paradigm, has no effect on NPL ratios. In addition, other concentration measures, such as the C5 and HHI indexes for loan and deposit markets separately and together, do not affect bank NPL ratios.

These measures of market concentration are typically used as a proxy for measures of market (or pricing) power, which are more direct measures of an institution's ability to collect monopoly rents. For the Spanish banking system, we are able to construct market power measures based on Lerner indexes that use bank-specific interest rates on a variety of loan and deposit products. Our empirical results show that Lerner measures of loan market power do have a negative relationship with bank risk; that is, as market power increases, bank NPL ratios decrease. This result is direct evidence in favor of the franchise value paradigm. With respect to Lerner measures of deposit market power, most of them have no relationship with the level of bank risk taking. Joint loan and deposit Lerner indexes have a negative and very significant impact on banks' non-performing loan ratios.

Our empirical results for the Spanish market provide additional support for the franchise value paradigm. While our study is limited to a single country, the long time period of study and the closeness of the empirical variables to the theoretical constructs should weaken the empirical standing of alternative market power paradigms.

References

Allen, F. and D. Gale, 2004. "Competition and financial stability", *Journal of Money, Credit and Banking* 36, 3, June part 2, 453-480.

Arellano, M. and Bond, S., 1991. "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations," *Review of Economic Studies*, 58, 277-297.

Beck, T., A. Demirgüç-Kunt and R. Levine, 2006. "Bank concentration, competition, and crises: first results", *Journal of Banking and Finance*, 30, 1581-1603.

Berger, A., A. Demirgüç-Kunt, R. Levine and J. Haubrich, 2004. "Bank concentration and competition: An evolution in the making", *Journal of Money, Credit and Banking* 36, 3, June part 2, 433-451.

Besanko, D. and A. Thakor, 1993. "Relationship banking, deposit insurance and bank portfolio choice", in C. Mayer and X. Vives, eds., Capital markets and financial intermediation. Cambridge University Press.

Bofondi, M. and Gobbi, G., 2004. "Bad loans and entry into local credit markets," Temi di Discussione del Servizio Studi #509, Bank of Italy.

Boyd, J.H. and De Nicoló, G., 2005. "The theory of bank risk taking and competition revisited," *Journal of Finance*, 60, 1329-1343.

Boyd, J.H., De Nicoló, G. and Al Jalal, A., 2006. "Bank risk taking and competition revisited: New theory and new evidence," Manuscript, Carlson School of Management, University of Minnesota.

Brewer III, E. and M. R. Saidenberg, 1996. "Franchise value, ownership structure, and risk at savings institutions", Federal Reserve Bank of New York, Research paper 9632

Broecker, T., 1990. "Creditworthiness Tests and Interbank Competition," *Econometrica*, 58, 429-452.

Caminal, R. and C. Matutes, 2002. "Market power and banking failures", *International Journal of Industrial Organization*, 20, 1341-1361.

Chan, Y., S. Greenbaum and A. Thakor, 1986. "Information reusability, competition and bank asset quality", *Journal of Banking and Finance* 10, 243-253.

Claessens, S. and L. Laeven, 2004. "What drives bank competition? Some international Evidence", *Journal of Money, Credit and Banking* 36, 3, June part 2, 563-583.

Demsetz, R.S., M. R. Saidenberg and P. E. Strahan, 1996. "Banks with something to lose: The disciplinary role of franchise value", *FRBNY Economic Policy Review* October, 1-14.

Dermine, J., 1986. "Deposit rates, credit rates and bank capital", *Journal of Banking and Finance* 10, 99-114.

Dick, A., 2006. "Nationwide branching and its impact on market structure, quality and bank performance", *Journal of Business*, 79, forthcoming.

Freixas, X. and J. C. Rochet, 1997. *Microeconomics of Banking*. The MIT Press.

Furlong, F. T. and M. C. Keeley, 1989. "Bank capital regulation and risk taking: A note", *Journal of Banking and Finance*, 13, 883-891.

Hannan, T.H. and Prager, R.A., 1998. "The relaxation of entry barriers in the banking industry: An empirical investigation," *Journal of Financial Services Research*, 14, 171-188.

Harberger A.C., 1964. "The Measurement of Waste", *American Economic Review* 54:3, 58-76.

Hellmann, T. F., K. C. Murdock and J. E. Stiglitz, 2000. "Liberalization, moral hazard in banking, and prudential regulation: Are capital requirements enough?", *American Economic Review*, 90, No 1, March, 147-165.

Hughes, J. P., W. Lang, L. J. Mester and C. Moon, 1996. "Efficient banking under interstate branching", *Journal of Money, Credit and Banking* 28, 4, November, 1045-1071.

Jayaratne, J. and P. E. Strahan, 1998. "Entry restrictions, industry evolution, and dynamic efficiency: evidence from commercial banking", *Journal of Law and Economics*, XLI, April, 239-273.

Jiménez,G. and Saurina, J., 2004. "Collateral, type of lender and relationship banking as determinants of credit risk". *Journal of Banking and Finance*, 28, 2191-2212.

Jiménez, G., Salas Fumás, V. and Saurina, J., 2006. "Determinants of collateral," *Journal of Financial Economics,* 81, 255-281.

Keeley, M.C., 1990. "Deposit insurance, risk and market power in banking," *American Economic*

Review, 80, 1183-1200.

Marcus, A. J., 1984. "Deregulation and bank policy", *Journal of Banking and Finance* 8, 557-565.

Marquez, R., 2002. "Competition, adverse selection, and information dispersion in the banking industry", *Review of Financial Studies*, Vol.15, 901-926.

Martín, A., V. Salas and J. Saurina, 2007. "A test of the Law of One Price in retail banking". Forthcoming, *Journal of Money, Credi,t and Banking*.

Martín, A., V. Salas and J. Saurina, 2006. "Risk premium and market power in credit markets", forthcoming *Economic Letters*.

Martínez-Miera, D. and R. Repullo, 2007. "Does competition reduce the risk of bank failure? Unpublished manuscript, CEMFI.

Matutes, C. and X. Vives, 1996. "Competition for deposits, fragility, and insurance", *Journal of Financial Intermediation*, 5, 184-216.

Matutes, C. and X. Vives, 2000. "Imperfect competition, risk taking, and regulation in banking", *European Economic Review* 44, 1-34.

Panzar, J. C. and J. N. Rosse, 1987. "Testing for monopoly' equilibrium", *Journal of Industrial Economics* 35, 443-456.

Rhoades, S. A. and R. D. Rutz, 1982. "Market power and firm risk. A test of the 'Quiet Life' hypothesis", *Journal of Monetary Economics*, 9, 73-85.

Repullo, R., 2004. "Capital requirements, market power, and risk-taking in banking", *Journal of Financial Intermediation*, 13, 156-182.

Salas, V. and J. Saurina, 2002. "Credit risk in two institutional regimes: Spanish commercial and savings banks", *Journal of Financial Services Research* 22:3 pp. 203-224, 2002.

Salas, V. and J. Saurina, 2003. "Deregulation, market power and risk behavior in Spanish banks", *European Economic Review*, 47 pp. 1061-1075.

Saunders, A. and B. Wilson, 1996. "Bank capital structure: charter value and diversification effects", Working Paper S-96-52, New York University Salomon Center.

Shaffer, S., 1998. "The winner's curse in banking," *Journal of Financial Intermediation*, 7, 359-

392.

Suárez, F. J., 1994. “Closure rules, market power and risk-taking in a dynamic model of bank behavior”, Discussion Paper 196, LSE, Financial Markets Group.

Tirole, J. 1988. “The theory of industrial organization”, MIT Press, Cambridge, MA.

Figure 1. Time series of the non-performing loan ratio

This figure shows the time evolution of the non-performing loan ratio (%) of the sample of banks used in the study by quartiles (i.e., Q25, Median and Q75). The time period analyzed spans from 1988 to 2003

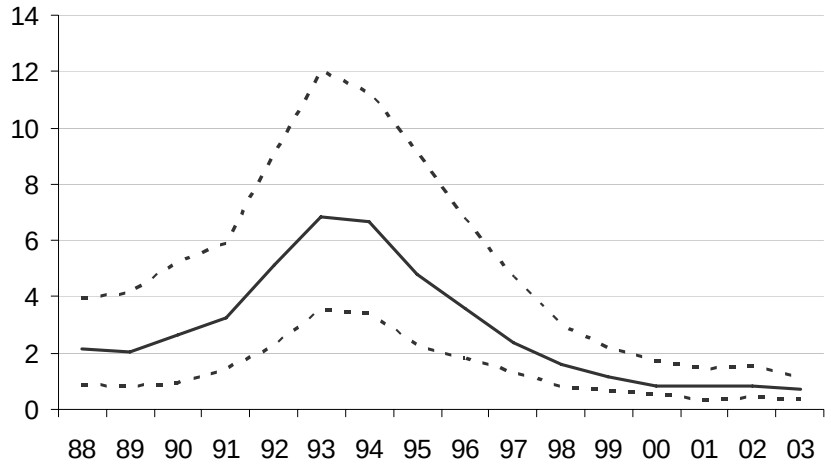

Figure 2A. Time series of the Lerner index for the whole loan portfolio

This figure shows the time evolution of the Lerner index for the whole loan portfolio of the sample of banks used in the study by quartiles (i.e., Q25, Median and Q75). The time period analyzed spans from 1988 to 2003

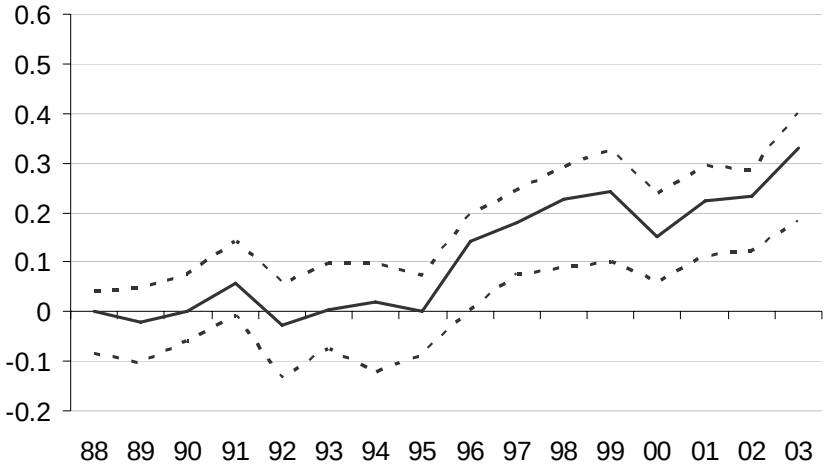

Figure 2B. Time series of the Lerner index for all deposits

This figure shows the time evolution of the Lerner index for all deposits of the sample of banks used in the study by quartiles (i.e., Q25, Median and Q75). The time period analyzed spans from 1988 to 2003

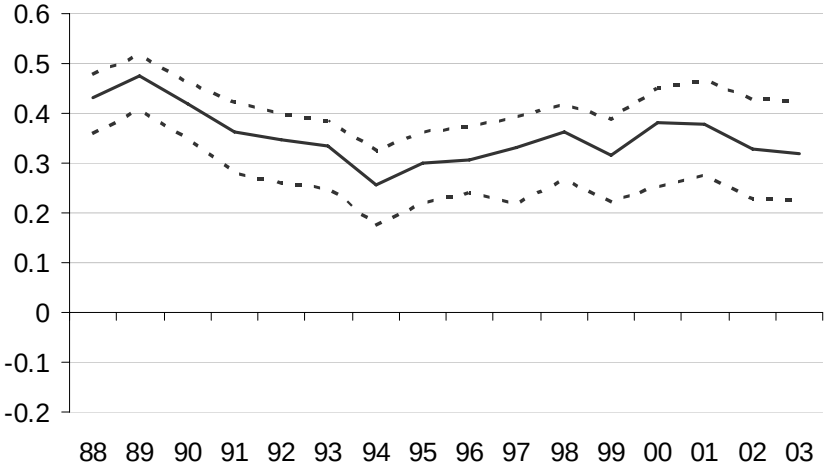

Table 1. Descriptive statistics for bank-year observations

NPL_{it} is the commercial non-performing loan ratio of bank i at time t; $GDPG_t$ is the real GDP growth rate of the Spanish economy at time t; *Real interest rate*$_t$ is the one-day interbank interest rate at time t; *Share of the bank*$_{it}$ is the market share of bank i at time t in terms of total loans; *Loans to firms/Total assets*$_{it}$ measures the specialization of firm i at time t in the non-financial sector; ROA_{it} is the return on assets of bank i at time t; *Number of banks*$_{it}$ is the number of banks that has the representative province for bank i at time t, calculated as the weighted average (by total loans) over all the provinces where the bank grants loans (the other concentration and competition measures are obtained in the same way); C5 denotes the share of the 5 largest banks in the representative province for bank i at time t; Her_{it} is the Herfindahl index of concentration for the representative province of bank i at time t, calculated in each province as the sum of banks' squared market shares in loans granted in the province; $Lerner_{it}$ is the Lerner index of bank i in year t defined for product l of the asset side as $(R_l - R)/ R_l$, where R is the credit risk adjusted marginal cost of product l for bank j granted in year t, while it is defined as $(R- R_l)/ R$ when the product l is a liability. The time period analyzed spans from 1988 to 2003. We have 1,632 observations from which, after taking first differences and instrumenting remain 1,262 corresponding to 107 unique banks (commercial and savings banks).

Variables	Mean	S.D	Median	Minimum	Maximum
NPL_{it}	4.44	4.93	2.66	0.00	38.02
$GDPG_t$	2.92	1.56	2.76	-1.03	5.04
Real interest rate$_t$	3.57	2.85	3.56	-0.67	8.12
Share of the bank$_{it}$	0.70	1.27	0.28	0.00	9.32
Loans to firms/Total assets$_{it}$	25.41	12.55	23.00	0.08	90.14
ROA_{it}	0.66	1.19	0.72	-16.19	11.08
Number of banks$_{it}$	75.93	24.77	73.00	22.00	148.00
C5_loans$_{it}$	57.73	6.60	58.44	40.00	74.25
Her_loans_firms$_{it}$	8.22	1.86	8.09	4.14	15.02
Lerner_receivables$_{it}$	0.15	0.39	0.19	-7.96	0.64
Lerner_credit_lines$_{it}$	-0.10	0.50	0.00	-6.09	0.70
Lerner_loans$_{it}$	0.05	0.53	0.11	-12.27	0.52
C5_deposits$_{it}$	68.00	5.61	67.35	53.70	84.64
Her_deposits$_{it}$	16.77	3.67	16.33	7.58	28.57
Lerner_REPO_operations$_{it}$	0.09	0.11	0.07	-1.24	0.67
Lerner_sight_accounts$_{it}$	0.45	0.17	0.43	-0.35	0.77
Lerner_deposits$_{it}$	0.35	0.11	0.36	-0.49	0.68
Lerner_loans+Lerner_deposits$_{it}$	0.40	0.56	0.47	-11.82	1.05

Table 2. Correlation coefficients

NPL_{it} is the commercial non-performing loan ratio of bank i at time t; $GDPG_t$ is the real GDP growth rate of the Spanish economy at time t; *Real interest rate*$_t$ is the one-day interbank interest rate at time t; *Share of the bank*$_{it}$ is the market share of bank i at time t in terms of total loans; *Loans to firms/Total assets*$_{it}$ measures the specialization of firm i at time t in the non-financial sector; ROA_{it} is the return on assets of bank i at time t; *Number of banks*$_{it}$ is the number of banks that has the representative province for bank i at time t, calculated as the weighted average (by total loans) over all the provinces where the bank grants loans (the other concentration and competition measures are obtained in the same way); C5 denotes the share of the 5 largest banks in the representative province for bank i at time t; Her_{it} is the Herfindahl index of concentration for the representative province of bank i at time t, calculated in each province as the sum of banks' squared market shares in loans granted in the province; $Lerner_{it}$ is the Lerner index of bank i in year t defined for product l of the asset side as $(R_l - R)/ R_l$, where R is the credit risk adjusted marginal cost of product l for bank j granted in year t, while it is defined as $(R- R_l)/ R$ when the product l is a liability. ***; **; *; significant at the 1%, 5% and 10% levels

Variables																				
NPL_{it}	1																			
$GDPG_t$	-0.458 ***	1																		
Real interest rate$_t$	0.414 ***	-0.544 ***	1																	
Share of the bank$_{it}$	-0.095 ***	-0.010	-0.017	1																
Loans to firms/Total assets$_{it}$	-0.377 ***	0.135 ***	-0.263 ***	0.088 ***	1															
ROA_{it}	-0.216 ***	0.090 ***	0.012	-0.025	0.061 **	1														
Number of banks$_{jt}$	0.040	-0.069 **	0.169 ***	0.179 ***	-0.062 **	-0.355 ***	1													
C5_loans$_{jt}$	-0.216 ***	0.252 ***	-0.508 ***	-0.095 ***	0.162 ***	0.227 ***	-0.649 ***	1												
Her_loans_firms$_{jt}$	-0.106 ***	0.165 ***	-0.392 ***	-0.132 ***	0.115 ***	0.206 ***	-0.630 ***	0.853 ***	1											
Lerner_receivables$_{jt}$	-0.189 ***	0.033	-0.106 ***	0.018	0.180 ***	0.158 ***	-0.167 ***	0.013	0.046	1										
Lerner_credit_lines$_{jt}$	-0.557 ***	0.269 ***	-0.329 ***	-0.033	0.125 ***	0.240 ***	-0.251 ***	0.237 ***	0.189 ***	0.142 ***	1									
Lerner_loans$_{jt}$	-0.465 ***	0.303 ***	-0.429 ***	-0.019	0.135 ***	0.240 ***	-0.299 ***	0.213 ***	0.186 ***	0.551 ***	0.719 ***	1								
C5_deposits$_{jt}$	-0.177 ***	0.155 ***	-0.448 ***	-0.167 ***	0.111 ***	0.196 ***	-0.676 ***	0.820 ***	0.773 ***	0.101 ***	0.276 ***	0.288 ***	1							
Her_deposits$_{jt}$	-0.109 ***	0.082 ***	-0.280 ***	-0.155 ***	0.076 ***	0.128 ***	-0.428 ***	0.537 ***	0.591 ***	0.083 ***	0.199 ***	0.202 ***	0.837 ***	1						
Lerner_REPO_operations$_{jt}$	0.034	-0.127 ***	0.487 ***	0.000	0.014	0.138 ***	-0.034	-0.100 ***	-0.127 ***	-0.021	0.001	-0.118 ***	-0.182 ***	-0.187 ***	1					
Lerner_sight_accounts$_{jt}$	-0.097 ***	0.133 ***	-0.195 ***	-0.155 ***	-0.105 ***	0.040	-0.155 ***	0.187 ***	0.159 ***	-0.059 **	0.108 ***	0.096 ***	0.216 ***	0.227 ***	-0.075 ***	1				
Lerner_deposits$_{jt}$	-0.089 ***	0.086 ***	0.047 *	-0.090 ***	-0.181 ***	0.180 ***	-0.185 ***	0.171 ***	0.145 ***	-0.005	0.183 ***	0.123 ***	0.160 ***	0.155 ***	0.312 ***	0.749 ***	1			
Lerner_loans+Lerner_deposits$_{jt}$	-0.446 ***	0.301 ***	-0.366 ***	-0.049 *	0.056 **	0.278 ***	-0.333 ***	0.251 ***	0.217 ***	0.490 ***	0.706 ***	0.936 ***	0.314 ***	0.235 ***	0.006	0.352 ***	0.465 ***	1		

Table 3. Baseline estimations. Loan market

$$\ln\left(\frac{\mathrm{NPL}_{it}}{100-\mathrm{NPL}_{it}}\right)=\alpha+\beta\ln\left(\frac{\mathrm{NPL}_{it-1}}{100-\mathrm{NPL}_{it-1}}\right)+\delta_1\mathrm{COMPETE}_{it}+\delta_2\mathrm{COMPETE}_{it}^{\ 2}+\gamma_1\mathrm{GDPG}_{t}+\gamma_2\mathrm{GDPG}_{t-1}+\phi_1\mathrm{ROA}_{it}$$

$$+\phi_2\mathrm{MARKET\ \ SHARE}_{it}+\phi_3\mathrm{LOAN\ \ RATIO}_{it}+\eta_i+\varepsilon_{it},$$

NPL_{it} is the commercial non-performing loan ratio of bank i at time t; $GDPG_t$ is the real GDP growth rate of the Spanish economy at time t; *Share of the bank*$_{it}$ is the market share of bank i at time t in terms of total loans; *Loans to firms/Total assets*$_{it}$ measures the specialization of firm i at time t in the non-financial sector; ROA_{it} is the return on assets of bank i at time t; *Number of banks*$_{it}$ is the number of banks that has the representative province for bank i at time t, calculated as the weighted average (by total loans) over all the provinces where the bank grants loans (the other concentration and competition measures are obtained in the same way); C5 denotes the share of the 5 largest banks in the representative province for bank i at time t; Her_{it} is the Herfindahl index of concentration for the representative province of bank i at time t, calculated in each province as the sum of banks' squared market shares in loans granted in the province; $Lerner_{it}$ is the Lerner index of bank i in year t defined for product l of the asset side as $(R_l - R)/ R_l$, where R is the credit risk adjusted marginal cost of product l for bank j granted in year t, while it is defined as $(R- R_l)/ R$ when the product l is a liability. The time period analyzed spans from 1988 to 2003. We have 1,632 observations from which, after taking first differences and instrumenting remain 1,262 corresponding to 107 unique banks. Standard errors (SE) of estimated coefficients consistent to any pattern of heteroskedasticity within banks . ***, **, *, mean statistically significant at 1%, 5% and 10%, respectively.

Dependant variable	$Ln(NPL_{it}/(100-NPL_{it}))$		Ln(NPLiit/NPLit)		Ln(NPLiit/NPLit)		$Ln(NPL_{it}/(100-NPL_{it}))$		$Ln(NPL_{it}/(100-NPL_{it}))$		$Ln(NPL_{it}/(100-NPL_{it}))$	
X_{it}	Ln(# banks)		C5_loans		Her_loans_firms		Lerner_receivables		Lerner_credit_lines		Lerner_loans	
Estimation method	GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences	
	Coefficient	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*
Persistence												
$Ln(NPL_{it-1}/(100-NPL_{it-1}))$	0.529	7.24 ***	0.516	7.98 ***	0.522	8.04 ***	0.503	9.03 ***	0.436	7.42 ***	0.494	8.72 ***
$GDPG_t$	-0.147	-12.03 ***	-0.155	-12.10 ***	-0.151	-12.03 ***	-0.134	-11.39 ***	-0.118	-10.36 ***	-0.122	-10.58 ***
$GDPG_{t-1}$	-0.035	-1.75	-0.024	-1.54	-0.036	-2.21 **	-0.063	-5.12 ***	-0.041	-3.17 ***	-0.059	-4.66 ***
X_{it}	-5.584	-1.11	-0.040	-0.58	-0.215	-1.83 *	-0.694	-4.7 ***	-1.423	-6.43 ***	-0.937	-5.1 ***
X_{it}^2	1.645	1.39	0.000	0.41	0.010	1.48	-0.074	-4.15 ***	-0.443	-3.97 ***	-0.079	-4.46 ***
Share of the $bank_{it}$	-0.711	-3.00 ***	-0.570	-2.85 ***	-0.535	-2.69 ***	-0.451	-2.99 ***	-0.393	-2.80 ***	-0.498	-3.34 ***
Loans to firms/Total $assets_{it}$	-0.028	-4.24 ***	-0.032	-3.97 ***	-0.028	-3.53 ***	-0.023	-2.97 ***	-0.011	-1.65	-0.014	-1.89 *
ROA_{it}	-0.028	-0.66	-0.031	-0.69	-0.025	-0.56	-0.072	-0.91	-0.055	-1.06	-0.017	-0.26
No. Observations	1,262		1,262		1,262		1,155		1,155		1,155	
F test (p-value)	0.000		0.000		0.000		0.000		0.000		0.000	
Test 1^{rst} order serial correlatoin (m1) /p-value	-3.90	0.00	-5.23	0.00	-5.26	0.00	-4.48	0.00	-4.36	0.00	-4.36	0.00
Test 2nd order serial correlatoin (m2) /p-value	-1.47	0.14	-1.60	0.11	-1.54	0.12	-1.46	0.14	-1.23	0.22	-1.34	0.18
Hansen test (p-value)	1.00		1.00		1.00		1.00		1.00		1.00	
Bank fixed effects, η_i	yes		yes		yes		yes		yes		yes	

Table 4. Baseline estimations. Deposit market

$$\ln\left(\frac{NPL_{it}}{100-NPL_{it}}\right)=\alpha+\beta\ln\left(\frac{NPL_{it-1}}{100-NPL_{it-1}}\right)+\delta_1 COMPETE_{it}+\delta_2 COMPETE_{it}^{\ 2}+\gamma_1 GDPG_t+\gamma_2 GDPG_{t-1}+\phi_1 ROA_{it}$$

$$+\phi_2 MARKET\ \ SHARE_{it}+\phi_3 LOAN\ \ RATIO_{it}+\eta_i+\varepsilon_{it},$$

NPL_{it} is the commercial non-performing loan ratio of bank i at time t; $GDPG_t$ is the real GDP growth rate of the Spanish economy at time t; *Share of the bank*$_{it}$ is the market share of bank i at time t in terms of total loans; *Loans to firms/Total assets*$_{it}$ measures the specialization of firm i at time t in the non-financial sector; ROA_{it} is the return on assets of bank i at time t; *Number of banks*$_{it}$ is the number of banks that has the representative province for bank i at time t, calculated as the weighted average (by total loans) over all the provinces where the bank grants loans (the other concentration and competition measures are obtained in the same way); C5 denotes the share of the 5 largest banks in the representative province for bank i at time t; Her_{it} is the Herfindahl index of concentration for the representative province of bank i at time t, calculated in each province as the sum of banks' squared market shares in loans granted in the province; $Lerner_{it}$ is the Lerner index of bank i in year t defined for product l of the asset side as $(R_l - R)/ R_l$, where R is the credit risk adjusted marginal cost of product l for bank j granted in year t, while it is defined as $(R- R_l)/ R$ when the product l is a liability. The time period analyzed spans from 1988 to 2003. We have 1,632 observations from which, after taking first differences and instrumenting remain 1,262 corresponding to 107 unique banks. Standard errors (SE) of estimated coefficients consistent to any pattern of heteroskedasticity within banks . ***, **, *, mean statistically significant at 1%, 5% and 10%, respectively.

Dependant variable	Ln(NPLiit/NPLit)		Ln(NPLiit/NPLit)		Ln(NPL_{it}/(100-NPL_{it}))		Ln(NPL_{it}/(100-NPL_{it}))		Ln(NPL_{it}/(100-NPL_{it}))		Ln(NPL_{it}/(100-NPL_{it}))	
X_{it}	C5_deposits		Her_deposits		Lerner_REPO_operations		Lerner_sight_accounts		Lerner_deposits		Lerner_loans+Lerner_deposits	
Estimation method	GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences	
	Coefficient	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*
Persistence												
Ln(NPL_{it-1}/(100-NPL_{it-1}))	0.505	7.38 ***	0.498	7.30 ***	0.577	10.19 ***	0.541	7.42 ***	0.572	9.14 ***	0.496	8.07 ***
$GDPG_t$	-0.139	-10.06 ***	-0.138	-11.11 ***	-0.147	-14.27 ***	-0.151	-13.47 ***	-0.149	-12.90 ***	-0.126	-10.57 ***
$GDPG_{t-1}$	-0.041	-2.36 **	-0.046	-2.68 ***	-0.048	-4.04 ***	-0.030	-1.74 *	-0.012	-0.75	-0.037	-2.77 ***
X_{it}	0.426	2.48 **	0.161	2.43 **	0.191	0.46	0.218	0.31	0.440	0.51	-0.855	-4.88 ***
X_{it}^2	-0.004	-2.660 ***	-0.005	-3.15 ***	0.075	0.08	-0.924	-1.340	-1.719	-1.69 *	-0.078	-4.99 ***
Share of the $bank_{it}$	-0.609	-3.17 ***	-0.531	-2.87 ***	-0.435	-2.60 **	-0.445	-2.98 ***	-0.534	-3.31 ***	-0.534	-3.23 ***
Loans to firms/Total $assets_{it}$	-0.017	-1.98 **	-0.028	-3.86 ***	-0.026	-3.30 ***	-0.033	-3.88 ***	-0.035	-4.49 ***	-0.017	-2.31 **
ROA_{it}	-0.035	-0.77	-0.013	-0.32	0.003	0.08	-0.086	-0.90	-0.068	-0.83	-0.013	-0.26
No. Observations	1,262		1,262		1,155		1,155		1,155		1,155	
F test (p-value)	0.000		0.000		0.000		0.000		0.000		0.000	
Test 1^{rst} order serial correlatoin (m1) /p-value	-5.17	0.00	-5.15	0.00	-4.42	0.00	-4.25	0.00	-4.40	0.00	-4.23	0.00
Test 2nd order serial correlatoin (m2) /p-value	-1.26	0.21	-1.43	0.15	-0.68	0.50	-1.31	0.19	-1.13	0.26	-1.22	0.22
Hansen test (p-value)	1.00		1.00		1.00		1.00					
Bank fixed effects, η_i	yes		yes		yes		yes		yes		yes	

Table 5. Baseline including real interest rates

$$\ln\left(\frac{NPL_{it}}{100-NPL_{it}}\right)=\beta\ln\left(\frac{NPL_{it-1}}{100-NPL_{it-1}}\right)+\delta_1 COMPETE_{it}+\delta_2 COMPETE_{it}^2+\gamma_1 GDPG_t+\gamma_2 GDPG_{t-1}+\gamma_3 Interest\ \ Rate_t$$
$$+\gamma_4 Interest\ \ Rate_{t-1}+\phi_1 ROA_{it}+\phi_2 MARKET\ \ SHARE_{it}+\phi_3 LOAN\ \ RATIO_{it}+\eta_i+\varepsilon_{it},$$

NPL_{it} is the commercial non-performing loan ratio of bank i at time t; $GDPG_t$ is the real GDP growth rate of the Spanish economy at time t; *Real interest rate*$_t$ is the one-day interbank interest rate at time t; *Share of the bank*$_{it}$ is the market share of bank i at time t in terms of total loans; *Loans to firms/Total assets*$_{it}$ measures the specialization of firm i at time t in the non-financial sector; ROA_{it} is the return on assets of bank i at time t; *Number of banks*$_{it}$ is the number of banks that has the representative province for bank i at time t, calculated as the weighted average (by total loans) over all the provinces where the bank grants loans (the other concentration and competition measures are obtained in the same way); C5 denotes the share of the 5 largest banks in the representative province for bank i at time t; Her_{it} is the Herfindahl index of concentration for the representative province of bank i at time t, calculated in each province as the sum of banks' squared market shares in loans granted in the province; $Lerner_{it}$ is the Lerner index of bank i in year t defined for product l of the asset side as $(R_l - R)/ R_l$, where R is the credit risk adjusted marginal cost of product l for bank j granted in year t, while it is defined as $(R- R_l)/ R$ when the product l is a liability. The time period analyzed spans from 1988 to 2003. We have 1,632 observations from which, after taking first differences and instrumenting remain 1,262 corresponding to 107 unique banks. Standard errors (SE) of estimated coefficients consistent to any pattern of heteroskedasticity within banks . ***, **, *, mean statistically significant at 1%, 5% and 10%, respectively.

Dependant variable	$Ln(NPL_{it}/(100-NPL_{it}))$		Ln(NPLiit/NPLit)		Ln(NPLiit/NPLit)		$Ln(NPL_{it}/(100-NPL_{it}))$		$Ln(NPL_{it}/(100-NPL_{it}))$		$Ln(NPL_{it}/(100-NPL_{it}))$	
X_{it}	Ln(# banks)		C5_loans		Her_loans_firms		Lerner_receivables		Lerner_credit_lines		Lerner_loans	
Estimation method	GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences	
	Coefficient	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*
Persistence												
$Ln(NPL_{it-1}/(100-NPL_{it-1}))$	0.534	7.88 ***	0.528	7.89 ***	0.496	7.55 ***	0.567	9.91 ***	0.511	7.64 ***	0.547	8.66 ***
$GDPG_t$	-0.097	-5.50 ***	-0.081	-4.11 ***	-0.078	-4.05 ***	-0.069	-4.25 ***	-0.069	-5.17 ***	-0.071	-4.62 ***
$GDPG_{t-1}$	-0.051	-2.49 **	-0.045	-2.21 **	-0.053	-2.76 ***	-0.057	-3.92 ***	-0.032	-2.14 **	-0.052	-3.12 ***
Real interest rate$_t$	0.035	2.30 **	0.050	2.91 ***	0.053	2.78 ***	0.022	1.54	0.010	0.85	0.012	0.96
Real interest rate$_{t-1}$	0.040	2.04 **	0.056	3.02 ***	0.063	3.79 ***	0.072	4.57 ***	0.066	4.99 ***	0.070	4.70 ***
X_{it}	-5.676	-0.71	0.081	1.27	0.199	1.76 *	-0.544	-4.08 ***	-1.173	-5.82 ***	-0.742	-4.29 ***
X_{it}^2	1.477	0.78	-0.001	-1.19	-0.007	-1.35	-0.051	-3.06 ***	-0.386	-3.62 ***	-0.066	-4.25 ***
Share of the bank$_{it}$	-0.441	-1.96 *	-0.339	-1.89 *	-0.363	-2.13 **	-0.257	-2.27 **	-0.169	-1.36	-0.309	-2.89 ***
Loans to firms/Total assets$_{it}$	-0.007	-0.84	-0.006	-0.69	-0.007	-0.87	0.006	0.58	0.009	1.16	0.009	1.09
ROA_{it}	-0.046	-0.96	-0.059	-1.12	-0.045	-0.92	-0.181	-1.89 *	-0.132	-2.10 **	-0.101	-1.27
No. Observations	1,262		1,262		1,262		1,155		1,155		1,155	
F test (p-value)	0.000		0.000		0.000		0.000		0.000		0.000	
Test 1^{rst} order serial correlatoin (m1) /p-value	-4.08	0.00	-4.17	0.00	-5.47	0.00	-4.84	0.00	-4.62	0.00	-4.65	0.00
Test 2nd order serial correlatoin (m2) /p-value	-1.50	0.13	-1.45	0.15	-1.59	0.11	-1.20	0.23	1.00	0.32	-1.12	0.26
Hansen test (p-value)	1.00		1.00		1.00		1.00		1.00		1.00	
Bank fixed effects, η_i	yes		yes		yes		yes		yes		yes	

Table 6. Baseline. Linear relationships

$$\ln\left(\frac{\mathrm{NPL}_{it}}{100-\mathrm{NPL}_{it}}\right)=\beta\ln\left(\frac{\mathrm{NPL}_{it-1}}{100-\mathrm{NPL}_{it-1}}\right)+\delta_1\mathrm{COMPETE}_{it}+\gamma_1\mathrm{GDPG}_t+\gamma_2\mathrm{GDPG}_{t-1}+\phi_1\mathrm{ROA}_{it}+\phi_2\mathrm{MARKET\ \ SHARE}_{it}$$
$$+\phi_3\mathrm{LOAN\ \ RATIO}_{it}+\eta_i+\varepsilon_{it},$$

NPL_{it} is the commercial non-performing loan ratio of bank i at time t; *$GDPG_t$* is the real GDP growth rate of the Spanish economy at time t; *Share of the $bank_{it}$* is the market share of bank i at time t in terms of total loans; *Loans to firms/Total $assets_{it}$* measures the specialization of firm i at time t in the non-financial sector; *ROA_{it}* is the return on assets of bank i at time t; *Number of $banks_{it}$* is the number of banks that has the representative province for bank i at time t, calculated as the weighted average (by total loans) over all the provinces where the bank grants loans (the other concentration and competition measures are obtained in the same way); C5 denotes the share of the 5 largest banks in the representative province for bank i at time t; *Her_{it}* is the Herfindahl index of concentration for the representative province of bank i at time t, calculated in each province as the sum of banks' squared market shares in loans granted in the province; *$Lerner_{it}$* is the Lerner index of bank i in year t defined for product l of the asset side as $(R_l - R)/ R_l$, where R is the credit risk adjusted marginal cost of product l for bank j granted in year t, while it is defined as $(R- R_l)/ R$ when the product l is a liability. The time period analyzed spans from 1988 to 2003. We have 1,632 observations from which, after taking first differences and instrumenting remain 1,262 corresponding to 107 unique banks. Standard errors (SE) of estimated coefficients consistent to any pattern of heteroskedasticity within banks . ***, **, *, mean statistically significant at 1%, 5% and 10%, respectively.

Dependant variable	$\ln(NPL_{it}/(100-NPL_{it}))$		$\ln(NPLiit/NPLit)$		$\ln(NPLiit/NPLit)$		$\ln(NPL_{it}/(100-NPL_{it}))$		$\ln(NPL_{it}/(100-NPL_{it}))$		$\ln(NPL_{it}/(100-NPL_{it}))$	
X_{it}	Ln(# banks)		C5_loans		Her_loans_firms		Lerner_receivables		Lerner_credit_lines		Lerner_loans	
Estimation method	GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences		GMM First Differences	
	Coefficient	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*	*Coefficient*	*t-statistic*
Persistence												
$\ln(NPL_{it-1}/(100-NPL_{it-1}))$	0.517	7.20 ***	0.517	8.21 ***	0.499	7.39 ***	0.515	8.95 ***	0.457	7.13 ***	0.530	9.41 ***
$GDPG_t$	-0.150	-10.62 ***	-0.153	-12.01 ***	-0.151	-11.90 ***	-0.140	-11.50 ***	-0.128	-10.98 ***	-0.143	-12.39 ***
$GDPG_{t-1}$	-0.041	-2.25 **	-0.021	-1.23	-0.034	-2.02 **	-0.051	-4.03 ***	-0.033	-2.66 ***	-0.039	-3.08 ***
X_{it}	1.905	3.57 ***	-0.016	-1.69 *	-0.030	-0.8	-0.202	-1.48	-0.986	-5.15 ***	-0.077	-0.85
Share of the $bank_{it}$	-0.647	-2.63 ***	-0.592	-2.87 ***	-0.551	-2.62 ***	-0.413	-2.58 **	-0.499	-3.27 ***	-0.401	-2.36 **
Loans to firms/Total $assets_{it}$	-0.024	-3.32 ***	-0.032	-4.00 ***	-0.036	-4.69 ***	-0.026	-3.42 ***	-0.015	-2.32 **	-0.027	-3.25 ***
ROA_{it}	-0.040	-0.84	-0.030	-0.70	-0.013	-0.33	-0.060	-0.71	-0.035	-0.52	-0.056	-0.64
No. Observations	1,262		1,262		1,262		1,155		1,155		1,155	
F test (p-value)	0.000		0.000		0.000		0.000		0.000		0.000	
Test 1^{rst} order serial correlatoin (m1) /p-value	-3.85	0.00	-5.29	0.00	-5.29	0.00	-4.39	0.00	-4.22	0.00	-4.37	0.00
Test 2^{nd} order serial correlatoin (m2) /p-value	-1.32	0.19	-1.59	0.11	-1.63	0.10	-1.36	0.17	-1.30	0.19	-1.32	0.19
Hansen test (p-value)	0.97		0.96		0.96		1.00		1.00		1.00	
Bank fixed effects, η_i	yes		yes		yes		yes		yes		yes	