This thesis is dedicated to my family Lida, Mehdi, and Parsa for their love, support and encouragement.

Banks' Lending during the Financial Crisis

by

Leila Aghabarari

Lombardy Advanced School of Economic Research

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Summary of the Thesis

There are two hypotheses that I test in this paper. First, more concentrated banking system leads to less changes of bank lending in response to volatile interbank funding costs. The second hypothesis is the lending reaction of banks to interbank rates differs for different banks, and better banks can keep their lending more stable after Euribor shocks. I empirically test these two hypotheses, using data from banks in ten European countries during years 2004 to 2012.

The market in the European Union has a bank-based model, in which only banks finance most of the corporations and customers. Bank loan in Europe is a form of finance that is not substitutable for most of the agents. The European Central Bank reported that shares of banks in credit intermediation in the EU represents around 70% -75% of debt financing to households and non-bank corporations, while in the USA this number is around 20% - 30%. Due to this structure, the impact of interbank funding cost on banks' lending in Europe is a critical topic for a successful conduct of monetary policy in the interbank market. Any decline or miss-behavior of banks in their lending volume can lead to a recession in the Euro-zone economy. The transmission of policies across a coalition of different European countries may have diverse effects across countries. An important factor that may influence the transmission of interbank funding costs to the banks' lending volume is the banking sector concentration. An increase in the interbank rates may cause some banks to reduce their loan supply. This reduction may, however, be asymmetric across different banks. Whether or not banks have access to alternative sources of their funding can change their lending responses. This asymmetry depends on the bank characteristics as well as the structure of the banking sector. In a highly-concentrated banking sector, banks with less market share may have less access to alternative funding sources than their larger rivals, or, on the other hand, large banks with large market share have easier access to external financing. Thus, an increase in interbank funding costs may have less effect on larger banks in the highly concentrated banking sector, compare to banks in the less concentrated sector.

The aim of this study is to shed light on how bank characteristics and concentration affect the bank respond to interbank funding costs variation in Euro area. Moreover, I explore the effect of Euribor (an indicator of the European interbank funding cost) on bank lending growth before and after the global financial crisis. I use a panel of banks from ten European countries for the period 2004 to 2012. The

choice of Eurozone countries is with the intention of investigating the effect of a unique funding rate on banks in countries with different levels of concentration but the same set of regulations.

Chapter 1: Banks' Characteristics, Banking Sector Concentration, and Banks' Lending Channel

Leila Aghabarari

Introduction

There are two hypotheses I test in this paper. First, more concentrated banking system leads to less changes of bank lending in response to volatile interbank funding costs. The second hypothesis is the lending reaction of banks to interbank rates differs for different banks, and better banks can keep their lending more stable after Euribor shocks. I empirically test these two hypotheses, using data from banks in ten European countries during years 2004 to 2012.

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This study aims to shed light on how bank characteristics and concentration affect the bank respond to interbank funding costs variation in Euro area. Moreover, I explore the effect of Euribor (an indicator of the European interbank funding cost) on bank lending growth before and after the global financial crisis. I use a panel of banks from ten European countries for the period 2004 to 2012. The choice of Eurozone countries is with the intention of investigating the effect of a single funding rate on banks in countries with different levels of concentration but the same set of regulations.

The changes in the interbank rates affect rates of bank lending and deposits for households and firms, which leads to changes in consumption, savings and investment decisions in the economy. This channel is the so-called interest rate channel in Euro area. According to articles by ECB, the interest rate channel in the eurozone is the channel with the most substantial effect on the economy. [1] The role of the money market is crucial to determine the interest rates in the marketplace. Banks' refinancing conditions are the most important determinants of the rates on loans and deposits of firms and households. In normal times, the ECB influences money market by setting its key interest rates. ECB allocates the amount of liquidity needed by the banking sector. There is a minimum reserve system for the banks which ensures that they can afford their reserve requirements on average over a maintenance period of one month. This reserve system guarantees that the overnight money market rate reflects the official interest rate. This is the way through which the ECB's interest rate decisions flow to the financial markets and with some delay to the real economy.

At the end of the day banks taking into account the reserve requirements imposed by ECB take action to borrow or lend funds. The most prominent part of liquidity provision takes place in the interbank money market. Cash market, short-term security market and the market for derivatives are the three kinds of interbank market. Cash market consists of the unsecured market, the Repo market, and the foreign exchange swap market. Overnight maturity segment is the segment with Eonia (Euro Overnight Index Average) as a reference rate in Europe. Euribor (Euro Interbank Offered Rate) is the rate with which one prime bank offers euro interbank term deposits to another prime bank [2]. In other words, Eonia is the short maturity of Euribor, which is the reference rate for maturities of more than one week. In addition to Eonia, there is another rate used in the interbank market in Europe and the United States, which is Libor (London Interbank Offered Rate). Libor is the average interbank interest rate at which a selection of banks on the London money market are prepared to lend to one another. [3]

There is an extensive literature analyzing the lending and credit channel in the real economy. The effect of interbank funding cost on bank lending in Europe has one specific characteristic. Euribor affects different European countries with the various banking sector. The primary aim of this paper is to tackle the heterogeneous responses of the bank to the unique interbank rate.

[1] See the article entitled "Recent findings on monetary policy transmission in the euro area", Monthly Bulletin, ECB, October 2002; and the article entitled "Monetary policy transmission in the euro area", Monthly Bulletin, ECB, July 2000.

[2] Euribor was first published on 30 December 1998 (value 4 January 1999). 1 January 1999 was the day that the Euro as a currency was introduced. In the years before, a lot of domestic reference rates like Pibor (France) and Fibor (Germany) existed.

[3] Just like Euribor, Libor comes in 15 different maturities. The main difference is that Libor rates come in 10 different currencies.

The rest of the paper is organized as follows. In section two I examine the related literature and explain the contributions of this research to the field. Section three presents the dataset and the main descriptive statistics. Section four discusses the empirical strategy and the model I propose. Section five contains the results of the baseline specifications. Finally, section six concludes with the paper.

Literature

To test the bank lending channel, it is crucial to identify the loan supply effect of monetary policy. This effect is not alike among different banks. The presence of the information asymmetry between the market participants leads to the different impacts of monetary policy on various banks. For example, some banks find it harder to maintain their loan portfolio in case of a drop in their resolvable deposits. This kind of implication has been analyzed using individual bank data. Bank characteristics serve as a proxy for different levels of banks' access to the funding. Most of the studies considered three bank characteristics to be the determinant of bank lending behavior. The size of the bank, the level of liquidity, and level of capitalization. According to Kashyap and Stein (1995) size is a crucial factor in banks' balance sheet to affect the transmission of monetary policy for US banks. Small banks decrease their lending more than large ones after a positive monetary policy shock. This is due to their severe problem of informational asymmetry. Small banks find it harder to raise funds in times of monetary tightening. Kashyap and Stein (1997), find the lending channel in the USA via small and less liquid banks. Kishan and Opiela (2000) and Van den Heuvel (2002) find that better-capitalized banks in the US have more access to external non- deposit financing, and they reduce their lending less than poorly capitalized banks do. Kashyap and Stein (2000) and Ashcraft (2004), show that more liquid banks can use their liquid assets to compensate for any drop in their assets and thus the decline in their lending volume after a monetary shock is less than that for less liquid banks. However, the literature on European bank lending channel is not conclusive. Altenbas et al. (2002) using a dataset from largest European banks find the bank lending channel works via less capitalized banks in Europe. Using a dataset for European banks, Ehrmann et al. (2001) see that less liquid banks change their lending supply in response to monetary policy changes. Gambacorta (2005) use a dataset from Italian banks and see that bank lending channel works through illiquid and less capitalized banks. Favero, et al. (1999) in a cross-sectional analysis using BankScope dataset, do not find the significance of bank size to explain the reaction of bank lending to monetary policy for several European countries. The result in the paper by Ehrmann et al. (2003) has the same finding as for the paper by Favero et. (1999). They do not find the bank size as the discriminating

variable. On the other hand, DeBondt and Prast (2000) using the same dataset, in a panel analysis detects the size of the banks crucial to the lending channel.

This paper also connects to the literature on the banking sector concentration and its effect on banks during the crisis. According to some theoretical literature and country comparisons, the less concentrated banking sector is more prone to financial crisis, while a concentrated banking sector with a few large banks is considered to be less fragile (Allen and Gale (2000, 2003)). According to Beck et al. (2003) more concentrated banking system is less prone to crisis and it is less volatile. Large banks can diversify better, and this causes less fragility in the more concentrated banking system. On the other hand, higher profit, which is enhanced in higher banking sector concentration, can provide the system with a buffer against shocks. In addition to that, concentrated banking system brings more profit and. Therefore, it provides a buffer against shocks (Hellmann et al. (2000)).

Data

The sample used in the study consists of annual observation of more than 2000 commercial banks, savings banks, cooperative banks and real estate and mortgage banks during years 2004 to 2012. The balance-sheet data for the banks is obtained from BankScope, a database by International Bank Credit Analysis Ltd. and the Brussels-based Bureau van Dijk. I use the data for all the banks active in the ten Euro-zone countries. **C**ountries in this paper are as following: Austria, Belgium, Estonia, France, Germany, Italy, Netherlands, Portugal, Spain, Slovenia. To analyze the impact of interbank funding cost on bank lending behavior, I use Euribor with different maturities and its spread as the representative for funding costs. For the first part of the analysis, I calculate the number of outstanding loans by summing up the data for each country in each year and then calculating the growth of those loans for each period. So the main dependent variable is the annual growth of lending in each country.

I follow Favero et al (1999), Allen et al (2010), Stein (1995), Ehrmann et al. (2003) and Beck et al. (2013) in choosing the bank characteristics in this analysis. Many different bank elements affect the lending behavior of banks. Several features of the banking sector structure of different countries is essential for the response of bank lending to short-term interest rate changes.

Bank Specific variables:

The dependent variable in the analysis is the outstanding amount of loans for each bank to non-banks. Bank specific ratios in the analysis are chosen to represent the dimensions of size, capital strength, liquidity, and profitability. Size is the number of banks' total assets; capital strength is measured by the ratio of equity to total assets; liquidity is measured by the ratio of liquid assets to customer and short-term funding ratio; profitability is the ratio return on average equity. I expect larger banks in respond to higher interbank rates, decrease their lending less than smaller banks. More capitalized banks have more buffers thus I expect them to react less to higher funding costs. More liquid banks are expected to have less reaction to variations of Euribor. Finally, banks with higher profit should decrease their lending less when Euribor increases. As control variables in the analysis, I also use deposit (ratio of deposit to total assets) and interbank positions (ratio of interbank assets to interbank liabilities).

Country-specific variables:

I obtain the data for the GDP and inflation of the countries from the World Bank online database. As an indication of the banking sector concentration in different countries, I use the C5 index retrieved from World Bank Financial Development dataset. C5, which is the sum of the share of the assets of the five largest banks in each country and during each year.

$$C5 = \sum_{i=1}^{5} S_i$$

Empirical Strategy

Monetary policy transmits via several channels to the real economy. Traditional interest rate channel has highlighted the direct impact of interest rates on loan demand. The demand for credit decreases after monetary tightening since it causes interest rates to increase. The credit channel amplifies the effects of the interest rate channel by influencing the supply of bank loans. The risk-taking channel highlights the impact of monetary policy on the quality of bank lending.

There is a simple theoretical model in the literature to define the bank lending channel, by Bernanke and Blinder (1998). This framework assumes that in equilibrium deposit demand (D) equals money supply (M) and the money demand depends on monetary policy (mp) and another factor (σ):

$$D=M=-(mp)+\sigma \quad (1)$$

Loan demand, on the other hand, depends on GDP (Y), Inflation (P) and loan interest rate (r) :

$$L_d = \mu_1 Y + \mu_2 P - \mu_3 r \quad (2)$$

Loan supply depends on the funds such as deposits (D), loan interest rate (r), and the monetary policy (mp):

$$L_s = \tau_1 D + \tau_2 r + \tau_3 mp \quad (3)$$

Where D is also a function of monetary policy according to equation (1).

Following Kashyap and Stein (2000) and Ehrmann et al. (2001), I assume that banks are affected by deposits according to their characteristics (X_i). Size, liquidity, Capitalization are the three characteristics used in the literature. I add bank profitability to these characteristics, and in addition to that I add banking sector concentration (BC) to the analysis to test for the impact of bank concentration on the lending channel.

Thus, we will have the following equation in equilibrium:

$$L= \lambda_1 Y + \lambda_2 P + \lambda_3 mp + \lambda_4 X_i + \lambda_5 BC + \lambda_6 mp*X_i + \lambda_7 mp*BC + \lambda_8 X_i*BC + constant \quad (4)$$

Which implies that loan supply depends on the economic output, the level of prices, monetary policy stance, bank-level characteristics, Banking sector concentration, the interaction of bank characteristics with concentration and monetary policy, the interaction of concentration with bank characteristics and the interaction of monetary policy and banking concentration.

In the literature, typically this correlation is analyzed as a dynamic equation as in Erhmann et al. (2003), which used difference GMM method (Arellano and Bond (1991)). In their method, lagged valued of loan growth has a significant effect on banking lending. However, I use a simple fixed effect in this paper. This is because the coefficient of lagged value of loan growth is not significant in my analysis. This can be due to the nature of my dataset that is annual. I regress loan growth on lagged values of dependent variables, and I did not find any reason for the effect of lending on the variables in the previous period. So, I believe that in this analysis I can use a normal fixed-effect method.

I run the following panel fixed effect specification:

$$\mathbf{Y_{jt} = \beta_1 Euribor_{t-1} + \beta_2 Euribor_{t-1}.\, Post_{crisis} + \beta_3 Spread_{t-1} + \beta_4 Spread_{t-1}.\, Post_{crisis} + \delta X_{jt} + \alpha_j + \varepsilon_{it}} \quad (5)$$

Where Y_{jt} is the growth of outstanding loan of banks in country *j* at time t. $Euribor_{t-1}$ is the Euribor with one week maturity. $Spread_{t-1}$ is the spraed of one-week and one-year Euribor and we use these variables with one time lag to minimize the possible endogeneity issue. $Post_{crisis}$ is a dummy variable that takes the value one from 2009 to 2012 and zero otherwise. We exclude the year 2008 since it was the year when the Lehman collapse happened. Since the residuals may be correlated across banks and across time, we cluster standard errors at the bank level. X_{it} which is the vector of bank controls. X_{jt} is the vector of country contorls. α_j is the country fixed effects. ε_{jt} is the error term. Results of this regression are reported in Table 3. In this stage the growth of outstanding loan of banks is an aggregate level.

As the next step in the analysis, we interact the dependent variables with W, which is a dummy variable for four bank characteristics. These variables are as following; Large, Capitalized, Liquid, ROE. Where Large is a dummy that is one if the bank is among the top 75% in size and zero otherwise. Capitalized is a dummy that takes the values one if the bank is among the top 75% capitalized banks in the sample and takes the values zero otherwise. The liquid is a dummy that is one if the bank is among the 75% most liquid banks in the sample and zero otherwise. The dummy ROE is one if bank's return of average equity is among the highest 75% banks in the sample, and it is zero otherwise.

Results

In Table 3, I report the main outcomes of the analysis before and after the crisis. In column (1) of this table, I have the regression without controls and fixed effects. In column (2), I show the results with only bank and country-specific controls and in column (3) I have both controls and fixed effects. The coefficient for Euribor is negative and highly significant in all three columns for the years after the crisis. This implies that, after global financial crisis banks are more sensitive to the changes in short terms interbank rates compare to the times of crisis. The coefficient of spread is positive and highly significant for years after the crisis. This indicates that, as the rate of longer-term funding costs increases banks enhance their lending to non-banks, since those loans are usually longer-term loans, and banks can impose the longer-term cost on their non-bank borrowers. Therefore, in this table I find evidence of the larger negative effect of short-term funding cost on bank lending growth after financial crisis compares to the years before the crisis.

In the next set of analysis, I run the regression for the bank level lending growth and add two dummies to the regression. First, is the dummy if the bank is large, second is the dummy if the bank is located in a high banking sector concentration. Table 4 shows the results of the analysis with the two dummies, Large, and BC. In column (1), I compare the large banks with their smaller rivals before and after the financial crisis. The coefficient of Euribor for small banks after crisis shows that when Euribor increases by one basis point smaller banks reduce their lending volume by 3.6% more compared to larger banks. These results provide evidence that after crisis large banks were less exposed to changes in interbank funding costs. In column (2), of Table 4 I compare the large banks in countries with low banking concentration and those in high banking concentration. Results show that there is no effect from concentration level on the lending channel. Column (3), shows that large banks located in countries with high banking sector concentration compare to large banks in other countries increase their lending by 5.2% more to non-banks when Euribor increases by one basis point. The main result from this table is that larger banks were less vulnerable to changes in interbank rates than smaller banks, in both high and low level of concentration. Moreover, there is no evidence of the impact of banking sector concentration on bank lending for banks with different sizes.

In Table 5, I compare banks with lower and higher level of liquidity. In column (1) of this table, the coefficients of Euribor is negative and significant for less liquid banks during years before and after the crisis. This result implies that less liquid banks are more negatively affected by interbank rate shocks compare to more liquid banks. In columns (2), more liquid banks in lower banking sector concentration

after an increase of one basis point in Euribor, decrease their lending by 2% more compared to liquid banks in higher concentrated markets.

In column (3), all the coefficients are insignificant. This result implies that less liquid banks are more prone to drop in their lending volume compare to more liquid banks when facing changes in interbank funding costs.

In Table 6, I compare banks' lending responses to Euribor according to their capitalization level. When Euribor increase by one basis point, banks with a lower level of capitalization decrease their lending to non-banks by 22% compare to better-capitalized banks. In column(2) of this table, I show that well-capitalized banks located in less concentrated banking sectors decrease their lending volume after a positive shock to Euribor, compare to well-capitalized banks in the higher concentrated banking market. These results imply that higher banking sector concentration leads to less reaction to monetary policy for better-capitalized banks.

Finally Table 7 shows the results for banks with high profitability compared to other banks. In the column , (1) the coefficient of Euribor indicates that after a positive shock to Euribor by one basis, less profitable banks cut their lending by 21% more than their more profitable rival. In column (2), results show that when Euribor increases by one basis point more profitable banks in less concentrated banking industry decrease their lending by 1.7% more before crisis compares to their rivals in the higher concentrated market. This number is almost 2% after the crisis. This finding indicates that more profitable banks in higher banking sector concentration are less vulnerable to interbank funding rates shocks.

Conclusion

This paper provides empirical evidence in favor of the negative and significant impact of Euribor variation on banks' lending volume. Especially after the financial crisis the effect of Euribor as an index on interbank funding cost on bank lending is negative and significant. I investigate bank and country-specific characteristics to shed light on the asymmetric reactions of banks with different characteristic being located in different banking industry concentration level. Using more than 2000 banks in ten European countries during the year 2004 to 2012, I find that banks are more vulnerable to external funding rates after the global financial crisis.I interpret this result as the existence of a stronger and more significant

bank lending channel after the world financial crisis. Moreover, this paper provides evidence that after a positive shock to Euribor, smaller, less liquid, less capitalized, less profitable banks are more prone to decrease their lending. Finally, I find that banking sector concentration influences the lending channel. Better banks located in the higher concentrated banking sector, are less affected by interbank costs. This may be because, more capitalized, more liquid and more profitable banks in higher concentered banking sector have better buffers against external funding shocks. This finding is in line with the Basel III focus on banks' core capital and on funding liquidity risks. Banks with weaker core capital positions, greater dependence on market funding and non-interest sources of income-restricted the loan supply more strongly during the crisis period. My findings lead to two conclusions. One, the lending channel in Europe is stronger after the global financial crisis. Second, banking sector concentration matters for monetary policy transmission. The bank lending channel is weaker in higher concentrated markets. Therefore, the monetary transmission is less effective in a highly-concentered banking sector.

Tables

Table 1

In this table, we report the variables and their descriptions.

Variable	Descriptions
Lending	Log of amount of outstanding loan of each bank to non-bank firms winsorized on 99%/1% level
Euribor	Euribor rate of one-week maturity
Spread	Spread of one-week and one-year Euribor
Post_crisis	Dummy variable that takes the value one from 2009 to 2012 and zero otherwise
Size	Log of total assets of the bank winsorized on 99%/1% level
Deposit	Ratio of deposits to total assets winsorized on 99%/1% level
Capital	Ratio of capital to total assets, winsorized on 99%/1% level
Return of equity	Average return of equity winsorized on 99%/1% level
Liquidity	Ratio of liquid asset to total assets winsorized on 99%/1% level
Interbank Position	Ratio of interbank assets to interbank liabilities, winsorized on 99%/1% level
GDP	Growth of real GDP in each country
Inflation	Rate of inflation of each country

Table 2

Panel A: Banking Sector Concentration (the year 2006)					Panel B: Lending (the year 2006)		
Country	Mean	Sd	Min	Max	Number of banks	Sum of outstanding loans (billion Euros)	Mean of outstanding loans (Million Euros)
Austria	0.62	0.418	-6.046	9.845	236	5,790	2,970
Belgium	0.96	0.57	-6.641	3.784	42	7,060	22,120
Germany	0.57	0.183	-4.410	3.181	1577	29,600	2,226
Spain	0.5	0.442	-7.281	2.639	92	10,400	17,050
Finland	0.20	0.913	-5.020	6.047	15	1,200	11,860
France	0.76	0.281	-3.195	2.735	203	27,800	17,740
Italy	0.83	0.203	-4.488	4.158	518	13,800	4,108
Netherlands	0.43	0.413	-4.174	1.301	30	14,800	67,240
Portugal	0.43	0.339	-2.795	1.320	24	2,040	12,660
Slovenia	0.59	0.193	-0.387	0.897	16	230	1,770

Table 3

The dependent variable is the annual growth rate of bank lending in each country. The first column shows the OLS regression. Columns (2) and (3) show the fixed effect regressions. The impact of Euribor on the growth of lending is highly significant after the financial crisis.

	(1)	(2)	(3)
Euribor	-0.0034	-0.0163***	0.0088
	-0.0029	-0.0029	-0.0988
Euribor*post_crisis	-0.0496***	-0.2487***	-0.0354***
	0.0097	-0.0474	-0.0036
Spread	0.0377**	0.0514***	-0.609
	0.0179	0.0171	-0.5473
Spread*post_crisis	0.0380***	0.1478***	0.0319***
	0.0069	-0.03	-0.0082
Country fixed effects	NO	NO	YES
Country controls	NO	YES	YES
Observations	80	80	80
R-squared	0.17	0.32	0.39

Panel estimation.
The dependent variable is the growth of lending to non-bank industry. The explanatory variables are lagged one period.
Standard errors in parentheses clustered on bank level
Covariates (bank characteristics): ln(Total assets), Deposits, Liquid assets / Total assets, Capital, Interbank ratio, ROE (all winsorized on 1% level), GDP-growth and Inflation.
* p<0.10 ** p<0.05 *** p<0.01

Table 4

The dependent variable is the number of outstanding loans.

	(1)	(2)	(3)
Euribor	-0.0084		
	-0.0989		
Euribor*Post_crisis	-0.0366***		
	-0.0036		
Spread	-0.6166		
	-0.5517		
Spread* Post_crisis	0.0351***		
	0.0082		
Euribor*Large	0.0074	0.0112	
	0.0168	0.0203	
Euribor*post_crisis*Large	0.0944	0.0577	
	0.421	0.892	
Spread*Large	0.0906	0.0212	
	(0.1122	0.1356	
Spread*post_crisis*Large	0.0803	0.0888	
	0.274	0.334	
Euribor*Large*BC		0.0601	0.0526**
		0.354	0.0028
Euribor*		0.1148	0.0573
Post_crisis*Large*BC			
		0.514	0.0728
Spread*Large*BC		0.3769	-0.3801**
		0.2373	-0.1721
Spread*		0.0242	0.0647
Post_crisis*Large*BC			
		0.0581	0.0475
Euribor*BC			-0.0364
			-0.0188
Euribor* Post_crisis*BC			-0.0184
			-0.0229
Spread*BC			-0.2155
			-0.1476
Spread* Post_crisis*BC			-0.0387
			-0.0224
Bank fixed effects	YES	YES	YES
Country fixed effects	YES	YES	YES
Observations	17199	17199	17199
R-squared	0.2	0.27	0.17

Panel estimation.
The dependent variable is the growth of lending to non-bank industry. The explanatory variables are lagged one period. Large is a dummy for banks with total asset larger than 75% quartile in the sample. BC is a dummy for the banking sector concentration above 75% quartile in the sample.
Standard errors in parentheses clustered on bank level
Covariates (bank characteristics): Deposits, Liquid assets / Total assets, Capital, Interbank ratio, ROE (all winsorized on 1% level), GDP-growth and Inflation.
* p<0.10 ** p<0.05 *** p<0.01

Table 5

Comparing bank lending channel for more liquid and less liquid banks, high and low banking sector concentration

	(1)	(2)	(3)
Euribor	-0.009**		
	-0.009		
Euribor*Post_crisis	-0.035***		
	-0.003		
Spread	-0.618		
	-0.552		
Spread* Post_crisis	0.028***		
	0.008		
Euribor*Liquid	-0.018	-0.028**	
	-0.023	-0.004	
Euribor*post_crisis*Liquid	-0.14	-0.165	
	-0.104	-0.104	
Spread*Liquid	-0.162	0.228***	
	-0.157	0.001	
Spread*post_crisis*Liquid	-0.063	-0.085	
	-0.068	-0.068	
Euribor* Liquid*BC		-0.029	-0.015
		-0.172	-0.016
Euribor* Post_crisis*Liquid*BC		-0.113	-0.081
		-0.074	-0.075
Spread* Liquid*BC		-0.198	-0.093
		-0.416	-0.114
Spread* Post_crisis*Liquid*BC		0.102	-0.085
		0.469	-0.479
Euribor* BC			-0.029
			-0.018
Euribor* Post_crisis*BC			-0.014
			-0.022
Spread* BC			-0.170
			-0.147
Spread* Post_crisis*BC			-0.023
			-0.022
Bank fixed effects	YES	YES	YES
Country fixed effects	YES	YES	YES
Observations	17199	17199	17199
R-squared	0.12	0.17	0.19

Panel estimation.
The dependent variable is the growth of lending to non-bank industry. The explanatory variables are lagged one period. Liquid is a dummy for banks with the liquidity of larger than 75% quartile in the sample. BC is a dummy for the banking sector concentration above 75% quartile in the sample.
Standard errors in parentheses clustered on bank level
Covariates (bank characteristics): ln(Total assets), Deposits, Capital, Interbank ratio, ROE (all winsorized on 1% level), GDP-growth and Inflation.
* p<0.10 ** p<0.05 *** p<0.01

Table 6

Comparing bank lending channel for better capitalized and less capitalized banks, high and low banking sector concentration

	(1)	(2)	(3)
Euribor	-0.010		
	-0.026		
Euribor*Post_crisis	-0.219**		
	-0.018		
Spread	-0.092		
	-0.167		
Spread* Post_crisis	-0.050		
	-0.078		
Euribor*Capitaliaze	-0.046	-0.011**	
	-0.084	-0.004	
Euribor*post_crisis*Capitaliaze	-0.217	-0.228***	
	-0.223	-0.053	
Spread*Capitaliaze	-0.373	-0.023	
	-0.546	-0.023	
Spread*post_crisis*Capitaliaze	-0.192	-0.144***	
	-0.172	-0.032	
Euribor*Capitaliaze*BC		-0.073	-0.012
		-0.201	-0.036
Euribor* Post_crisis*Capitaliaze*BC		-0.137	-0.009
		-0.396	-0.092
Spread*Capitaliaze*BC		-0.150	-0.033
		-1.296	-0.244
Spread* Post_crisis*Capitaliaze*BC		-0.142	-0.008
		-0.226	-0.061
Euribor*BC			-0.034
			-0.187
Euribor* Post_crisis*BC			-0.017
			-0.022
Spread* BC			-0.202
			-0.147
Spread* Post_crisis*BC			-0.034
			-0.021
Bank fixed effects	YES	YES	YES
Country fixed effects	YES	YES	YES
Observations	17199	17199	17199
R-squared	0.21	0.33	0.37

Panel estimation.

The dependent variable is the growth of lending to non-bank industry. The explanatory variables are lagged one period. Capitalized is a dummy for banks with capitalization ratio larger than 75% quartile in the sample. BC is a dummy for the banking sector concentration above 75% quartile in the sample.

Standard errors in parentheses, clustered on bank level

Covariates (bank characteristics): ln(Total assets), Deposits, Liquid assets / Total assets, Interbank ratio, ROE (all winsorized on 1% level), GDP-growth and Inflation.

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

Table 7

Comparing bank lending channel for more profitable and less profitable banks, high and low banking sector concentration

	(1)	(2)	(3)
Euribor	-0.023		
	(-0.05)		
Euribor*Post_crisis	-0.21***		
	(-0.001)		
Spread	-0.19		
	(-0.33)		
Spread* Post_crisis	-0.042		
	(-0.076)		
Euribor*ROE	0.0417	-0.017***	
	(0.06)	(-0.005)	
Euribor*post_crisis*ROE	-0.12	-0.196***	
	(-0.14)	(-0.05)	
Spread*ROE	-0.32	-0.059**	
	(-0.39)	(-0.029)	
Spread*post_crisis*ROE	0.057	-0.11***	
	(-0.09)	(-0.037)	
Euribor*ROE*BC		0.031	0.034
		(0.19)	(0.171)
Euribor* Post_crisis*ROE*BC		-0.043	0.045
		(-0.05)	(0.055)
Spread*ROE*BC		-0.1218**	-0.20*
		(-0.06)	(-0.11)
Spread* Post_crisis*ROE*BC		-0.025	-0.001
		(-0.032)	(-0.34)
Euribor*BC			-0.034***
			(-0.001)
Euribor* Post_crisis*BC			-0.014
			(-0.023)
Spread*BC			-0.101
			(-0.16)
Spread* Post_crisis*BC			-0.02
			(-0.02)
Bank fixed effects	YES	YES	YES
Country fixed effects	YES	YES	YES
Observations	17199	17199	17199
R-squared	0.11	0.13	0.24

Panel estimation.

The dependent variable is the growth of lending to non-bank industry. The explanatory variables are lagged one period. ROE is a dummy for banks with a return on average equity larger than 75% quartile in the sample. BC is a dummy for the banking sector concentration above 75% quartile in the sample.

Standard errors in parentheses, clustered on bank level

Covariates (bank characteristics): ln(Total assets), Deposits, Liquid assets / Total assets, Capital, Interbank ratio (all winsorized on 1% level), GDP-growth and Inflation.

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

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Chapter 2: Relationship Lending and Credit Unions

Leila Aghabarari*

Andre Guettler[‡]

Bernardus Van Doornik[4]

[‡] Ulm University, Institute of Strategic Management and Finance, Helmholtzstraße 22, 89081 Ulm, Germany, Email: andre.guettler@uni-ulm.de.
[4] Tilburg University, Department of Finance, Warandelaan 2, 5037 AB Tilburg, The Netherlands, Email: B.F.Nazarvandornik@uvt.nl

Introduction

Financial intermediaries play an important role by collecting households' savings to provide credit to firms. This asset transformation is undertaken by three types of depository institutions: private commercial banks, savings banks, and credit unions. While an increasing number of papers analyze the former two types, and, in particular, their role in the financial crisis of 07/09, relatively little is known about credit unions (CUs). These depository institutions feature a distinct governance structure that is membership based in which each member has one vote.

In this paper, we analyze the role of CUs in the financial crisis. We assess how CUs changed their lending volume during the financial crisis compared to non-credit unions. The direction of this effect is not clear, however. Credit unions are prototypical relationship lenders, which should provide members strong insurance against credit constraints in dire times (e.g., Angelini, Di Salvo, and Ferri, 1998). Compared to non-credit unions we thus expect credit union borrowers to cut back less on lending during the financial crisis (*insurance effect*). On the other hand, credit unions' unique membership-based governance structure also features a potential disadvantage that members can walk away during distressed times and hence decrease a CU's capital base. Thus, even though a CU might desperately like to keep lending volume high, it might not be able to do so because the lack of capital (*equity effect*). Which of the effects dominates is an open empirical question that we address in this paper.

We use an extensive dataset provided by the Central Bank of Brazil that is covering the complete financial system. We have access to all individual loans above a very low threshold of Brazilian Real 5,000 (around US-Dollars 2,500) for all banks active in the Brazilian credit market. The data level is triplets on the firm-bank-time level. It permits us very powerful identification within borrowers to disentangle between the insurance effect and the equity effect. Specifically, we investigate the impact on the extensive margin of the *same* firm at the *same* point in time for credit unions versus non-credit unions. Our identification strategy controls for demand shocks at the firm level, for other potential determinants of credit supply at the bank group-by-
time level, and for unobserved cross-sectional heterogeneity at the bank-firm level.

We find that credit unions provided their members larger loans compared to what the other banks provided the *same* firms at the *same* time during the financial crisis. Hence, we find evidence that the membership-based credit unions provided insurance during times of distress. Also, credit unions did not cut back as much on credit during the crisis as their equity was decreasing compared to non-credit unions. We interpret this second finding as strong evidence that credit unions tried particularly hard to maintain their lending volume even when their capital cushion was getting thinner.

Institutional Background

Credit unions (or credit cooperatives) are depository institutions, which provide credit and financial services to their members. Historically, credit unions were founded to provide financial services to farmers, (small) firms, and poorer households, which were not covered by traditional banks. There are two principal characteristics of credit unions that make them distinct from other types of banks: First, in a credit union the members are both the owners of the organization and its customers. This stands in sharp contrast to private commercial banks, which are privately owned and often publicly traded on the stock market. Savings banks often have public ownership (e.g., in Germany, see Hackethal, 2004) or at least close ties to local governments. Second, in a credit union the membership provides both the demand for and supply of loanable funds.

In recent years, the number of loans and services provided by credit unions and cooperative banks to their members has been increasing. According to a report by WOCCU (World Council of Credit Unions) in the year 2012, in aggregate loans paid by credit unions were US-Dollars 1,083 billion with the total of over 200 million members around the world.[5]

The first credit union of Latin America was founded in Brazil in 1902. Today credit unions are among the largest financial institutions in this country. As of the year 2012 the network of these credit unions represents 18% of bank branches in Brazil, with the total managed asset

[5] World council of credit unions, 2012.

representing 2.3% of the total assets of the country, occupying the 6th position.[6] The number of credit union members in Brazil from the year 2005 to the year 2011 increased from 2.6 million to 5.8 million individuals. Over the last 30 years in Brazil, the numbers and assets of credit unions have increased significantly. The amount of net worth, assets, deposits and credit operations in Brazilian credit unions has been increasing during years 2000 until 2012.

There are substantial differences between the credit unions and the commercial banks in Brazil. Interest rates of financial services provided by credit unions are much lower than the average interest rates of services provided by other financial institutions. According to the report by Brazilian Central Bank, to December 2011, the average interest rate on personal loans provided by Brazilian credit unions to their members was 26% per year, compare to the average interest rate of 110% for the same type of loans from other financial institutions in Brazil.

Credit unions have an important role in Brazilians financial system. They mainly serve otherwise "under-banked" small and medium-sized enterprises (SMEs) and households and are a textbook example for credit unions. It thus makes much sense to use the Brazilian banking market as a laboratory for our research question on whether credit unions were able to provide insurance to their members during the financial crisis of 07/09.

Literature

Our paper relates to several strands of the literature. The first one aims at explaining the transmission of liquidity shocks to the real economy via the *bank lending channel*. There are various works providing evidence on this channel across banks (e.g., Kashyap and Stein, 2000; Peek and Rosengren, 1997; Paravisini, 2008; Campello, 2002). They find that liquidity and/or capital constrained banks are more prone to transmit liquidity shocks to the economy by cutting back on lending. The lending channel, however, is only one side of the game. During times of economic distress, not only banks are hit but also firms are affected. Firms tend to reduce their investment activities in response to a crisis. This decrease in investment leads to a smaller loan

[6] Portal do cooperativismo de credito. http://cooperativismodecredito.coop.br/cenario-brasileiro/

demand (*firm borrowing channel*). The main empirical challenge is the simultaneous nature of these two channels.

One approach to tackling this identification challenge is the inter-country transmission of liquidity shocks that was pioneered by Peek and Rosengreen (1997).[7] They find that the liquidity shock in the Japanese market resulted in a declined lending activity of Japanese subsidiaries in the US. The implicit assumption in this natural experiment is that credit demand is not different between firms borrowing from Japanese subsidiaries and other banks such as domestic banks or other foreign, non-Japanese banks.

Other authors have access to rich credit registry datasets and are thus able to use within-firm estimators that completely rule out credit demand effects (e.g., Khwaja and Mian, 2008; Jimenez, et al., 2011; Schnabl, 2012; Bofondi et al. ,2012). This approach is feasible for firms that borrow at least from two banks at the same time and enables estimates for the same firm at the same point in time. We use this approach to investigate how credit unions changed credit supply during the financial crisis compared to other lenders.

This paper contributes to the literature on the link between relationship banking and intertemporal smoothing from financial institutions to their borrowers. The insurance provided by financial intermediaries to their clients is the option, which arises, to smooth borrowers' credit issues during distress times. According to Freixas and Rochet (1997) it is efficient for banks to provide insurance to their borrowers because of two reasons. First, bank portfolio is better diversified than those of the firms and second; banks have better access to funding and financial markets while risk can have a much more severe effect on firms. Allen and Gale (1997), justify the financial intermediation by insurance provision of financial institutions to their customers. Banks provide insurance only if they benefit from it. The biggest profit for banks from liquidity insurance provision is having the ex-post information monopoly (Freixas and Rochet,1997). Credit unions are particular in having a relationship with their borrowers. Relationship banking is a particular connection between the bank and a firm and with this assumption, firms with a closer relationship to their banks can enjoy being partly or fully insured

[7] See also Schnabl (2012), Chava and Purnanandam (2011)

in bad times. Berlin and Mester (1999), argue that the form of insurance agents demand from their banks during a crisis is more in the form of liquidity insurance. They provide evidence that in a competitive system banks with higher core deposits provide more liquidity insurance to their borrowers. Those banks that rely more on the liabilities and funding from outside market have to pay higher interest rates and will be able to provide less insurance to their customers.

Our paper also complements the literature on credit unions. In general, **c**redit unions' members benefit by receiving higher deposit rates or by paying lower loan rates than current market rates (Smith, Cargill, and Meyer, 1981; Smith, 1984). In addition, Angelini, Di Salvo, and Ferri (1998) find that on average credit cooperative bank members enjoy lower rates and easier access to credit than non-members. We contribute to this line of literature by investigating the insurance effect in times of financial distress.

Finally, another strand of literature is about lending in developing markets and in particular in the Brazilian market. Schnabl (2012), show that bank liquidity shock transmits from country to country through international lending between banks. During the financial crisis originated from the collapse of Lehman Brothers in 2008, Brazilian private banks reduced the fraction of deposits they use to lend out. Coleman and Feler (2013) show that Brazil's government banks extended lending to prevent a sharper economic downturn. We extend this line of research by concentrating on credit unions as another type of financial institutions that might have stabilized the financial sector during the financial crisis.

Empirical Strategy

We use credit registry data on the firm-bank-quarter level. We use the following specification to investigate whether credit unions differ with respect to the lending volume during the financial crisis compared to other banks. We start with a specification without any fixed effects and covariates

$$LoanAmount_{ibt} = \alpha + CreditUnion_b + Crisis_t + ßCreditUnion_b * Crisis_t + \varepsilon_{ibt} \quad (1)$$

Where $LoanAmount_{ibt}$ equals the total outstanding credit volume of bank *b* towards firm *i* at time *t* (Jimenez et al., 2011), *CreditUnion* takes the value 1 if bank *b* is a credit union and 0 otherwise, and Crisis equals 1 between 2007Q4 to 2009Q4 and 0 otherwise.

The main challenge is the simultaneous nature of the *bank lending channel* (credit supply) and the *firm borrowing channel* (credit demand). We completely capture any demand shocks at the firm level by using firm-time fixed effects controls, α_{it}. This comes at the cost that we need to constrain our analysis to those firms with multiple bank relationships at the same time. Our most saturated specification is

$$LoanAmount_{ibt} = \alpha_{it} + \alpha_{ib} + \alpha_{Bt} + ßCreditUnion_b * Crisis_t + X_{bt} + \varepsilon_{ibt} \quad (2)$$

Where the second set of fixed effects, α_{ib}, controls for unobserved cross-sectional heterogeneity at the bank-firm pair level. The third set of fixed effect, α_{Bt}, controls for other potential determinants of credit supply at the bank group level *B* of time *t*. We use three different bank groups in Brazil. *CreditUnion* is not a bank group on its own but that we add several banks to the bank group that includes credit unions that have similar characteristics. Vector X controls for a set of observable characteristics of bank *b* at time *t* such as the capital ratio, bank size etc. to control for further bank-specific determinants of credit supply not captured by the bank group-time fixed effects.

The *insurance effect*, i.e., whether credit unions provide insurance in dire times to their members by maintaining the extensive margin of credit, is identified by within-firm differences of firms that have lending relationships to credit unions and other banks at time *t*. The coefficient of interest in the specification (2), *ß,* is the interaction of *CreditUnion* with *Crisis*. We concentrate on the financial crisis because this was a period when insurance against credit constraints was most important to firms. Overall, we expect a negative effect of the crisis on the outstanding loan amount, which is driven by both credit supply and demand. We saturate this by the time fixed effects in the specification (2). If the coefficient of interest turns out to be positive, credit unions would have decreased the loan amounts to the *same* firm at the *same* point in time to a lesser extent than other lenders. This case would lend support to the

insurance effect.

We further investigate the impact of the *equity effect*, i.e., whether credit unions behave differently with respect to their capital ratio than other lenders because they fear that members leave during the crisis, by running specification (2) separately for banks with below and above median capital ratios (or by triple interaction terms with the equity ratio). In case of an adverse equity effect on credit unions, we would expect that the coefficient of interest is larger (meaning less negative) in case of credit unions with below median equity ratios. These credit unions would not be able to provide as much insurance to their members because they fear further members walking away. In the opposite case, credit unions with below median equity ratios would even try harder to provide insurance to their members during the crisis. This is also plausible because it may reduce the risk that members with outstanding loans have an actual incentive to walk away.

Data and Descriptive Statistics

In this paper, we use a rich dataset from the central bank of Brazil. This dataset contains all the information on bank-firm relationships in Brazil. We use all the individual loans data above a threshold of Brazilian Real 5,000 (around US-Dollars 2,500) for all the domestic banks active in the Brazilian credit market. It permits a very powerful identification within borrowers to disentangle between the insurance effect and the equity effect. Specifically, we investigate the impact on the extensive margin of the *same* firm at the *same* point in time for credit unions versus non-credit unions. We obtain the data for an individual bank-firm level relationship from the Brazilian credit register. In our analyzes, we use the lending relationships data of 708 credit

unions and 126 non-credit unions in Brazil. These credit unions issue loans to 4,249 and there are 19,198 firms, which have relation to both credit unions and non-credit unions. In

In Table 8**,** we show the number of the banks active in Brazil in the period 2007 to 2010.

[Table 8 here]

We proceed with quarterly loans from the beginning of 2006 to the end of 2011. The data levels are triplets on the firm-bank-time level. To control for the firm lending channel, we select only agents with relationship to at least two banks. Our identification strategy is to compare the behavior of credit unions versus other types of banks borrowing to the same firm at the same point of time. We want to investigate these differences in the behavior of banks and credit unions during the recent financial crisis**.** We choose our firms sample in two stages. First, following Schnabl (2012), we only include firms that borrow from more than one bank before the liquidity shock. Second, following Khwaja and Mian(2008), we exclude firms that immediately and entirely stop borrowing from their banks after the shock. We also keep firms that had a relationship with domestic banks and foreign banks, but not with credit unions. Table 9**,** reports the number summary statistics for the bank control variables over the whole sample.

[Table 9 here]

In the panel A of Table 10**,** we report the sample description for credit unions and non-credit unions. We show the number of banks for each group, the number of firms with relation to each group and the total outstanding amount of loan per each group. In the panel B of this table, we report the summary statistics of the lending volume (the dependent variable) and the equity ratio for a credit union and non-credit unions.

[Table 10 here]

Empirical Results

In this section, we show the results of our specifications. In the first stage, we examine the transmission of liquidity shock to the banks in Brazil. The first hypothesis is whether during the crisis credit unions cut their landings less than non-credit unions. This specification poses the identification issue of the shock transmission, which affects both lenders and borrowers. In order to address this problem, exploiting the detailed nature of our dataset, we control for both demand (firm) and supply (bank) fixed effects. The demand or borrower fixed effect lets us mitigate the average change in credit demand by firms. The supply fixed effect, on the other hand, lets us control for the average variation of banks in Brazil. We use specifications (1) and (2) for this stage.

If the coefficient of interest turns out to be positive, credit unions would have decreased the loan amounts to the *same* firm at the *same* point in time to a lesser extent than other lenders. This case would lend support to the insurance effect.

Table 11 Shows the main results for this first stage. Column (1) shows the results for OLS regression (1)**,** without adding any control variable.

[Table 11 here]

Column (2) shows the result of regression (2) after adding all the controls with no fixed effects. In column (3) we added all the bank controls and firm by time fixed effects. Columns (4) and (5) contain the results with more than one set of fixed effects. We find that credit unions decreased their lending amount to the same firm at the same point in time by 16 % less than non-credit unions. The coefficient of Credit Union*Crisis increase to 20 % and remains statistically significant in the last column.

The coefficient for Crisis (although not significant) is negative as we expected. This shows the negative impact of the financial crisis on credit driven by both demand and supply.

For the next stage, we investigate the impact of the equity ratio of the credit unions on their lending behavior during the crisis. The result of this stage are shown in Table 12**.**

[Table 12 here]

The main coefficient of interest is the Credit Union * Equity ratio * Crisis. The sign and the significance of this interaction show us whether the credit unions with lower equity ratio during crisis tried hard not to compress their lending to their clients. Looking at the coefficient for the interaction of credit unions and equity ratio in the fifth row shows that, during the normal times, a credit union with higher equity ratio borrow more. However, this changes during the crisis. Credit unions with higher equity ratio during distress times, decrease their lending more than those with lower equity ratios. This shows that indeed those credit unions with lower equity ratios during crisis try hard to provide credit to their members to not suffer from their members running away.

Conclusion

In this paper we provide empirical evidence that credit unions provide insurance to their borrowers during distress times. Using a unique dataset from the Brazilian Central Bank and Credit Registry, we could track individual loans from 708 credit unions to 4,249 firms in Brazil. Credit unions are special since their borrowers are also their lenders. Thus, we expect them to provide more insurance to their borrowers during crisis, compare to other types of banks. Our analysis in this paper shows that this is indeed the case. Credit unions decrease their lending during financial distress compare to non-credit unions. In addition to that, due to the particular member-based governance structure of these institutions, they may face problem of negative equity shock since their member may run even during crisis. This problem may add to their lending issues. Therefore, as their equity decreases they may cut back their lending more than non-credit unions. In this paper, we found that credit unions did not cut back as much on their lending during the crisis as their equity was decreasing compared to non-credit unions. This implies that these institutions with lower equity ratio try harder to keep their lending from falling in order to not lose their members (borrowers).

Tables

Table 8: Number of Banks in Brazil by Type of the Institution

The table shows the number of banks that were officially chartered by the Central Bank of Brazil. The data are from the Financial Stability Report of the Banco Central do Brazil (2010). Brazilian banks are authorized to operate various types of financial activities as "multiple banks," offering commercial banking, investment banking, development banking, mortgage finance, leasing, and other financial activities. Multiple banks are usually members of a banking conglomerate that can include commercial banks as well as other financial institutions (see Robitaille, 2011). Associations in this table consist of leanings, consumer finance companies, saving and loan companies and savings and loan associations, securities brokers, exchange brokerage companies and securities dealers.

Type of institution	12/2007	12/2008	12/2009	06/2010
Multiple banks	135	140	139	139
Commercial banks	20	18	18	19
Saving banks	1	1	1	1
Credit unions	1,465	1,453	1,405	1,388
Associations	343	369	324	318
Development agencies	12	12	14	15
Mortgage companies	6	6	6	6
Microcredit institutions	52	47	45	45
Consortium managers	329	317	308	302
Others	21	21	20	20
Total	2,437	2,409	2,339	2,315

Table 9: Summary Statistics of the Control Variables

This table provides the summary statistics of the bank control variables of the whole sample. Variables are reported in natural logarithm.

Variable (in log)	Mean	Std. Dev.	Min	Max
Total assets	22.3	2.3	16.56	25.39
Credit Assets	0.57	0.2	0.17	0.98
Liquid assets	0.27	0.22	0.001	0.74
Deposits	0.44	0.2	0.08	0.86
Return on Average Equity	0.34	0.53	-1.04	2.01
Bank Capital	0.12	0.07	0.03	0.36

Table 10: Bank Summary Statistics

Panel A of this table demonstrates the number of credit unions and other bank types in our dataset. Moreover, it reports the number of firms with lending relationship to the banks and the lending volume. Panel B shows the summary statistics of loan volume and equity ratio for credit unions and those of non-credit unions.

Panel A: Overall sample description

Group	Number of banks	Number of firms	Total outstanding loan amount (million)
Credit unions	708	4,249	31,900
Non-credit unions	126	19,198	1,210,000

Panel B: Distribution of the outstanding loan volume and equity ratio

Group	Mean	N	Std. dev.	Min.	Median	Max.
I: Credit unions						
Outstanding loan volume	265,507	120,089	1,810,537	5,000	65,967	191,000,000
Equity ratio	0.21	12,477	0.09	0.03	0.19	0.40
II: Non-credit unions						
Outstanding loan volume	2,211,887	547,098	10,900,000	5,000	231,704	961,000,000
Equity ratio	0.20	2,220	0.11	0.03	0.17	0.40

Table 11: Transmission of Liquidity Shock to Brazilian Credit Unions vs. Other Banks in Brazil

This table shows the effect of liquidity shock on bank lending for credit unions. The dependent variables are the natural log of the total outstanding amount of loans. We restrict our data to firms with lending relationships to more than one bank before the financial crisis. In addition to that, we exclude firms that immediately and entirely stop borrowing from their banks after the liquidity shock. Columns (1) shows the results for the OLS regression in the specification (1). Column (2) is the result of OLS regression after adding bank specific controls. Columns (3) to (5) report the results of the regression (2) after adding different sets of fixed effects.

	(1)	(2)	(3)	(4)	(5)
Crisis	-0.0197	-0.0835			
	(0.0852)	(0.0995)			
Credit union	-1.1002***	-0.6401*	0.8121***		
	(0.2012)	(0.3875)	(0.1973)		
Credit union * Crisis	0.0057	0.0685	0.1633**	0.1966**	0.2082***
	(0.0865)	(0.1069)	(0.0750)	(0.0768)	(0.0749)
Fixed effects					
Firm-by-time	No	No	Yes	Yes	Yes
Firm-by-bank	No	No	No	Yes	Yes
Bank group-by-time	No	No	No	No	Yes
Covariates	No	Yes	Yes	Yes	Yes
Observations	667187	667187	667187	667187	667187
R-squared					

Standard errors in parentheses, clustered on bank level
Crisis is a dummy variable that takes the value one from 2007Q4 to 2009Q4 and zero otherwise (sample period starts in 2006Q1 and ends in 2011Q4)
Covariates (bank characteristics): ln(Total assets), Total credit / Total assets, Liquid assets / Total assets, Deposits / Total assets, Equity / Total assets (= Equity ratio), ROA (all winsorized on 98%/2% level)

Including only borrowers with multiple bank relationships at t (at least one of those banks was a credit union)

Excluding loans below regulatory threshold of 5,000 Real

Excluding non-performing loans (arrears > 90 days)

Table 12: The Effect of Equity Ratio of the Transmission of Liquidity Shock

This table reports the results of the regression (2) for the second hypothesis. The dependent variable is the log of the outstanding amount of loans of borrower i from bank b in quarter t. We interact equity ratio with crisis and credit union dummy. The coefficient of interest is the coefficient for the Credit Union * Equity ratio * Crisis.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Crisis	-0.0197	-0.0835						
	(0.0852)	(0.0995)						
Credit union	-1.1002***	-0.6401*	0.8121***					
	(0.2012)	(0.3875)	(0.1973)					
Credit union * Crisis	0.0057	0.0685	0.1633**	0.1966**	0.2082***	0.3892***	0.5080***	0.5154***
	(0.0865)	(0.1069)	(0.0750)	(0.0768)	(0.0749)	(0.0888)	(0.1451)	(0.1327)
Equity ratio		-0.7498	0.0892	-0.9869**	-0.6780*	-1.9665***	-1.6540***	-1.3038***
		(1.9602)	(0.7028)	(0.3936)	(0.3670)	(0.6779)	(0.5205)	(0.4622)
Credit union * Equity ratio						2.5504***	3.5480***	3.4610***
						(0.4075)	(0.8236)	(0.8080)
Equity ratio * Crisis						1.3273***	1.3690***	1.2201***
						(0.4687)	(0.5141)	(0.4161)
Credit union * Equity ratio * Crisis						-2.2934***	-2.8900***	-2.9272***
						(0.4470)	(0.7720)	(0.7109)
Fixed effects								
Firm-by-time	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Firm-by-bank	No	No	No	Yes	Yes	Yes	Yes	Yes
Bank group-by-time	No	No	No	No	Yes	No	No	Yes
Further covariates	No	Yes	Yes	Yes	Yes	No	Yes	Yes
Observations	667187	667187	667187	667187	667187	667187	667187	667187
R-squared								

Standard errors in parentheses clustered on bank level
Crisis is a dummy variable that takes the value one from 2007Q4 to 2009Q4 and zero otherwise (sample period starts in 2006Q1 and ends in 2011Q4)
Covariates (bank characteristics): ln(Total assets), Total credit / Total assets, Liquid assets / Total assets, Deposits / Total assets, Equity / Total assets (= Equity ratio), ROA (all winsorized on 98%/2% level)
Including only borrowers with multiple bank relationships at t (at least one of those banks was a credit union)

Excluding loans below regulatory threshold of 5,000 Real
Excluding non-performing loans (arrears> 90 days)

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Chapter 3: Banking Sector Concentration and Lending Risk: Are the Too-Big-To-Fails Also the Riskiest?

Leila Aghabarari

I. Introduction

In this paper, I investigate the empirical relationship between banking sector concentration and banks' lending risk. Addressing the relation between concen- tration and lending risk of banks is important because, a high banking sector con- centration is a double-edged sword. It can help financial stability, but, equally, it can trigger fragility. Despite the many studies on the relation between bank- ing concentration and financial stability, there is no conclusive evidence on this relation. During the recent financial crisis, the amount of non-performing loans has increased dramatically increasing the fragility of the financial system. Large banks have been suspected of triggering the fragility by their delinquency to mon- itor their loans. According to few studies, larger banks are often more likely to receive public guarantees or subsidies, which is discussed as the "too big to fail"- doctrine (Mishkin, 1999). As a consequence, the moral hazard problem of larger banks' managers encourages them to take on risky investments under a govern- ments' safety net. The increase in the concentration level of the banking sector has been occurring at a rapid pace in many countries around the globe; among the other countries Europe has witnessed the fastest consolidation speed after the formation of EMU. Consequently, there are a number of pressing questions: Should we slow down the concentration? And does the size of new financial in- stitutions cause concerns about financial stability?

In this paper, I show empirical evidence that banking structure matters when an- alyzing the impact of size and credit supply on the lending quality of the banks. There is indeed a correlation between the level of concentration and the ratio of non-performing loans. However, this higher lending risk is driven bysmaller

banks in the more concentrated banking sector and not, by the large banks or not

only because of the increase in credit provision. These findings have several impli- cations, particularly for policy makers. This paper supports the ”concentration- fragility” view, which implies that higher concentration leads to financial fragility. Therefore, encourages the anti-trust and pro-competition policies and regulations. In addition to that the paper unlike the previous studies suggests that in order to ensure the stability of the banking system, we should focus on supervising small banks more than large banks, as smaller banks can amplify the risk of the banking system. The analysis in this paper complements and extends pre- vious empirical studies (Schaeck and Ĉihak, 2007; Beck et al., 2006a,b; Schaeck et al., 2006; De Nicolo et al., 2004) on this issue. Previous literature such as: Beck et al., 2006a,b; Demirgüç−Kunt and Detragiache, 2002 have studied the relation between banking concentration and episodes of banking crises. Another strand of the literature focused on analyzing the effect of banking concentration on banks' capital ratio as a proxy for financial soundness (Schaeck and Ĉihak, 2007; Schaeck et al.,2006). In this study, I estimate the relation between bank- ing sector concentration and the level of non-performing loans using instruments for the concentration. Nonetheless, I recognize that banking concentration may be affected by the level of non-performing loans, this is the concern of reverse causality. To precisely identify the role of banking concentration we require an exogenous variable that affect the banking concentration and not the level of non-performing loans. In particular to control for reverse causality I instrument for banking concentration using the political preferences across countries and find that my findings are unchanged.

II. How can banking sector concentration affect the lending risk of the banking industry?– the relation to the literature

There are several different lessons that may explain the relationship between the concentration level of the banking sector and the lending risk of banks.

First, higher concentration can lead to higher lending risk of the banking industry via the higher market share of the big banks.

The market share of large banks following their consolidation may raise the moral hazard issue through the unwillingness of governments to allow the large banks to fail. Larger banks, who enjoy potentially high public support, may take more risk in their lending behavior by decreasing their monitoring actions or lending requirements, which can lead to an increase in their number of non-performing loans. Regarding the theoretical research on the ”Financial-Fragility” view, Mishkin (1999) discusses the moral hazard issue in ”too-big-to-fail” institutions that rely on public guarantees more. This public support frees up managers in large banks to take more risk. This can lead to larger amounts of loan defaults and a greater probability of bank failures. Government guarantees to support banks may reduce their incentive to priorities (Bagehot, 1873). Government guarantees regarding future bailouts may induce excessive risk-taking by banks (Rochet and Vives, 2004; Goodhart and Huang,1999; and Mailath and Mester, 1994). Also, the higher risk of larger banks may come from their abuse of the monopolistic power in pricing. Boyd and De NicolÂťo (2006) argue that monopolistic banks are more likely to charge higher interest rates, which in turn encourages borrowers to take more risky actions to compensate for the higher loan repayments.

Second, higher banking sector concentration may lead to higher lending risk of

the banking industry via smaller banks.

Institutions created by consolidation, either through mergers or acquisitions, may shift away from providing retail-oriented services for small depositors and borrowers because of new opportunities to provide wholesale services for larger capital market participants. The larger institutions created by consolidation may also choose to provide fewer retail services to small customers because of Williamson (1967,1988) type organizational diseconomies. That is, there may be scope for inefficiency for one institution to provide services that may require the implementation of altogether different policies and procedures. Literature has established a link between the size of a banking institution and its lending to small businesses, indicating that larger institutions typically devote smaller proportions of their assets to small business lending than do smaller banking institutions. Berger et al. (1998) find that the effects of consolidation reduce small business lending, but are mostly offset by the reactions of other banks. Moreover, Peek and Rosengren (1998), based on a small sample of mergers that occurred in New England during 1993-1994, find that small business lending falls following mergers. The findings of Berger et al. (1998) suggest that small business lending increases following small bank mergers but falls following large bank mergers. Moreover, several static analyses of Berger, Kashyap, and Scalise (1995), Keeton (1995), Levonian and Soller (1995), Berger and Udell (1996), Peek and Rosengren (1996), Strahan and Weston (1996), and Cole, Goldberg, and White (1997) have shown that larger banks devote fewer proportions of their assets to small business loans than do small banking organizations.

Third, higher banking concentration can lead to lower risk via large banks.

On the contrary, an increase in the assets of large banks can also make more

funding and resources available to monitor better their loans or widen the diversification in their lending portfolio, which therefore decreases the number of loan defaults. The "concentration-stability" view implies that larger banks with higher market share and monopoly power in more concentrated systems gain more profits which, by providing higher capital buffers against liquidity shocks, may lead to less fragility in the financial system (Boyd et al., 2004). In any case, a significant change in the level of risk of large bank lending can lead to a significant shift in the lending risk of the whole banking system. Keeley (1990) shows a correlation between higher franchise values of banks and less risky loan approvals from bank managers. Park and Peristiani (2007) show that larger franchise values lead to higher opportunity costs of bankruptcy. This causes bank managers and shareholders to limit the risky actions that could threaten to jeopardize their future profits. The higher market power of the banks is linked to higher profits. This reduces the incentive for managers and owners alike to assume excessive risk; consequently, it lessens the probability of systemic failure (Hellmann et al., 2000; Allen and Gale, 2000). Boyd and Prescott (1986) provide evidence that larger banks can diversify the risk of their loan portfolio, which is the result of economy of scale and scope. Demsetz and Strahan (1997) show that larger bank holding companies are better diversified compared to their smaller rivals. Financial services diversification accredits managers to offer a wider range of services and spread the risks of lending across a generous number of asset categories, thereby reducing monitoring costs (Diamond, 1984). Meon and Weill (2005) suggest that larger banks engage more in cross-border activities, which help them to diversify their risks geographically. Moreover, having a limited number of large banks can enhance the financial stability by easing the monitoring of the banking system by

regulators (Allen and Gale, 2000).

III. Data and Methodology

A. Data

Banking sector concentration and lending risk

Main variables

To investigate the relationship between the concentration of the banking sector and banks' lending risk, I use non-performing loans as a proxy of the lending risk. The level of non-performing loans shows the quality of loans which can be alleviated largely by the appropriate risk management approaches by banks. I obtain the data for countries' non-performing loans from the World Bank Development Indicator (WDI) dataset. The 23 European countries in the sample are: Austria, Belgium, Bulgaria, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, the United Kingdom, Greece, Hungary, Croatia, Ireland, Italy, Lithuania, Luxembourg , Latvia, Netherlands, Portugal, Romania, and Sweden. Table 1 reports the level of non-performing loans across all of these countries during the years 2004 to 2011. According to this table, non-performing loans more than doubled in this period, a result perhaps largely owing to the global financial crisis of 2008-09. Bulgaria, Denmark, Spain, Greece, Hungary, Ireland, Lithuania, Latvia, and Portugal are among those countries whose non-performing loans more than doubled between 2004 and 2011. Non-performing loans increased dramatically in many countries in 2008, when the crisis began. Nevertheless, this increase was not dramatic for several countries, including Austria, Germany, Finland, Luxembourg, and Sweden. The next variables I obtained from WDI is the C5 (asset

share of the five largest banks in each country) as a measure of banking sector concentration, that is the main explanatory variable. There are other proxies for concentration, such as HHI (Herfindahl-Hirschman Index), C3(asset share of the three largest banks) and C4 (asset share of the four largest banks). I use C5 as the main measure for concentration in countries, however there are concerns that C5 does not use the market shares of all the firms in the industry, and does not provide the distribution of firm size. It also does not provide full details about the competitiveness of the industry. In order to address this concern, I also check for the robustness of my analysis using HHI (Herfindahl-Hirschman Index) as an indicator for the level of concentration.

$C5 = \Sigma^{5}_{i=1} S_i$ Where S_i is the share of the assets of bank i relative to the total assets of the whole banking system in each country. Table 2 shows the level of banking sector concentration (C5) in the 23 countries across years 2004 to 2011. In several countries such as Belgium, Czech Republic, Estonia, Germany, Hungary, Finland, Lithuania, Netherlands and Sweden the concentration level is high and remains high over the period 2004 to 2011. This is not the case for all the countries in the sample.

Country level controls

While examining the impact of banking concentration on banks' non-performing loans across different countries, there are regional and macroeconomic factors that affect the level of banks' lending risk. Therefore, I add some country characteristics from the World Bank dataset to my data list. To capture the business cycle effect of each country, I include the growth of GDP in the regression. According to Leaven and Majoni (2003), bank investment opportunities may be correlated

with business cycles. In times of greater GDP growth, borrowers may have better financial abilities to repay their loans. This may improve the lending quality. Hence, I expect a negative impact from GDP growth on non-performing loans. Legal right is the next country-level variable that I add to capture the status of the institutions in these countries. It is the degree to which collateral and bankruptcy laws protect the rights of creditors and, thus, facilitate lending. The strength of legal rights in countries may improve the flow of liquidity by protecting the rights of both lenders and borrowers. On the other hand, since it facilitates lending, it can also be positively associated with the level of non-performing loans. I also add the regulatory capital to the controls. This is a ratio of total regulatory capital to the assets held by deposit takers in the country. The regulatory capital is weighted according to the risk of the assets of the institutions. By using this indicator, I aim to capture the country level of capital regulation. I expect the higher capital regulation to be negatively related to the non-performing loans. I add the ratio of foreign banks to total banks, to control for the presence of cross-border banking. This can partially offset the limitations of C5 to fully capture the effect of multinational banks.

Role of the banks' size and support on their lending risk

Main variables

In the next set of analyses, I test whether larger banks with higher potential support are also those with greater risk level in their lending. To do that, I choose the ratio of impaired loans to gross loans as the main dependent variable. I obtain the annual balance sheet data of all active banks in the corresponding 23 European countries from Bureau van Dijk's Bankscope during the years 2004 to

2011. The sample of banks includes commercial banks, saving banks, cooperative banks, real estate, and mortgage banks. The geographic coverage of banks and the average number of banks per each year in each country is as follows: Austria (23), Belgium (21), Bulgaria(7), Czech Republic(3), Germany(335), Denmark (31), Estonia (4), Spain (87), Finland (11), France (219), UK (66), Greece (18), Croatia (6), Hungary (7), Ireland (13), Italy (265), Lithuania (10), Luxembourg (22), Latvia (9), Netherlands (53), Portugal (15), Romania (6), and Sweden (27). The number of banks in each country, naturally, changes slightly in some years. The analysis focuses on the impact of the size and the potential support of the banks on the ratio of banks' impaired loans. Size is the natural logarithm of the banks' total assets. In addition to the data mentioned earlier, I use Bankscope to retrieve Fitch support rating as a measure of the expected support to the banks in distress, where a lower value captures greater-than-expected support from a higher rates supporter. Thus, these ratings deem the relative strength of both the bank and also the potential supporter. A higher potential support may be a banks' incentive to take higher risk. I use this rating to capture the possible higher risk-taking by highly supported banks. Table 3 provides the definitions for Fitch support ratings which classify each bank with either a high or low possibility of being bailed out in the future. Using this rating and the size of the bank, I can recognize the effect of the size and support on the lending risk of the banks. I use the ratio of 1/Fitch support rating to be the index for support. Incorporating the reverse ratio of Fitch makes the interpretation simpler.

Bank level controls

In this regression, I need to control for bank specific characteristics that also affect banks' lending. I choose Tier1, which is the ratio of Tier 1 regulatory capital to risk-weighted assets for determining the capital adequacy of the banks. I expect banks with the higher Tier1 ratio to operate with less risk. Thus, the effect from Tier 1 on the impaired loans should be negative. To explore the impact on liquidity risk, I follow Bonfim and Kim (2014) and include the ratio of liquid assets to deposits and short-term borrowings as a measure of maturity mismatch. Liquid assets are trading assets and loans and advances with a maturity of less than three months. I expect a negative impact of liquidity ratio on banksâĂŹ lending risk. The next bank-specific factor that I add as a control variable is the leverage, which is the ratio of total assets to equity. A relatively high ratio (indicating lots of assets and tiny equity) may indicate the bank has taken on substantial debt merely to remain in business, but a high asset/equity ratio can also mean the return on borrowed capital exceeds the cost of that capital. At some higher levels, however, the ratio can reach unsustainable levels. A highly leveraged bank may be known as a risky bank. Therefore, I expect the leverage to be positively related to the lending risk of the bank. I also include bank income and profitability to controls. Both of these characteristics can include both positive and negative risk-taking by banks. In general, there is a long-term positive effect of risk on return, but the large ratio of non-performing loans may be the effect of some particular losses at any point in time. Also, the impact of income and profitability of banks on their lending risk might be affected by the type of activity at the bank. Since greater lending may imply a deterioration in the quality of loans, I add the total lending (growth of gross loans) to the list

of bank control variables. I expect a positive effect from the level of lending on impaired loans.

IV. Empirical Analysis and results

The empirical analysis in this paper consists of two parts. The first part investigates whether and how the banking sector concentration affects the lending risk of banks. I regress the ratio of non-performing loans of banking sector on the concentration level, employing different methodologies. However, using macroeconomic data, we cannot recognize which are the banks that drive the results of this part, nor assess the potentially heterogeneous effects of banks' characteristics. Therefore, in the second part using bank level data I examine the impact of the banks' size and their potential public support on the individual banks' ratio of non-performing loans.

Impact of banking sector concentration on non-performing loans

Here I present empirical evidence on the role of banking concentration on non-performing loans. I analyze this with the regression of the non-performing loans on the level of banking sector concentration and adding all the controls.

$$(NPL)_{jt} = a + \beta_1 BSC_{jt-1} + \Sigma \kappa_j X_{jt-1} + \varphi_j + \tau_t + s_{jt}$$

Where $(NPL)_{jt}$ is the level of non-performing loans of country j at time t. BSC_{jt} is the level of banking sector concentration in country j at time t-1. β_1 which is the main coefficient of interest is that of banking sector concentration. X_{jt-1} is the vector of control time varying variables: GDP growth; legal right; regulatory capital and foreign banks. φ_j is the country fixed effect, which captures

all unobserved country characteristics which are almost unchanged over time. τ_t represents the time dummies. Standard errors are clustered in country level. The choice of using fixed effect instead of random effect is done by Hausman test, which suggest the better fit of fixed effect.

Table 6 reports the results of the analysis of the impact of banking concentration on the non-performing loans. According to this table, banking industry concentration enters our regression, significantly positive. Columns (1) and (2) show the results of the OLS regressions, where the coefficient of concentration is positive, and it increases in the second column after adding country controls. Columns (3) to (4) show the results for e fixed-effects (within) regression estimator, after adding the country and time dummies. These results also show a positive and significant link between banking sector concentration and the level of non-performing loans.

Instrumental Variable

The reverse causality and endogeneity in the analysis of the effect of banking concentration and non-performing loans are matters of concern. The level of concentration in the banking industry may be affected by the scale of non-performing loans. Moreover there may be unobserved variables which affect both banking concentration and lending risk. To precisely identify the role of banking sector on banks' lending risk we need an exogenous variable which affects the level of concentration independent of the level of lending risk. I address the issue of reverse causality by analyzing the impact of banking concentration on lending risk using the weighted index of political preferences as the instrumental

variable. Market-regulation is the specific political preference which I use as the instrument for banking concentration. This is the Support for policies designed to create a fair and open economic market, which may include: calls for increased consumer protection; increasing economic competition by preventing monopolies and other actions disrupting the functioning of the market; defense of small businesses against disruptive powers of big businesses; social market economy. More details on the market-regulation variable is presented in the appendix. I obtain the data for the political parties manifestos from Manifesto Project dataset[1]. *How can the index of market-regulation affect the level of banking concentration?* Indirectly, larger banks are known to offer loans with higher interest rates. Studies such as Berger and Hannan (1989, 1997) and Hennan (1991) found that banks in more concentrated markets charge higher rates on small business loans and pay lower rates on retail deposits. The pro âĂIJâĂİmarket- regulationâĂİ preferences affect the concentration negatively to protect costumers from high interest rates. In addition, the attempt to increase competition by preventing monopolies can directly lead to the drafting of anti-concentration laws.

$$(\text{BSC})_{jt} = \alpha + \beta_1\ (\text{Market-regulation})_{jt} + \Sigma\kappa_j X_{jt-1} + \varphi_j + \tau_t + \varepsilon_{jt}$$

Where $(\text{BSC})_{jt}$ is the level of banking sector concentration in country j at time t. and $(\text{Market-regulation})_{jt}$ is the market-regulation index I use from the manifesto dataset. X_{jt-1} is the set of country control variables; GDP growth, legal right, regulatory capital and the ratio of foreign banks. φ_j is the country fixed effect. τ_t shows time dummies. Finally, ε_{jt} is the error term.

and the second stage:

$$(\text{NPL})_{jt} = \alpha + \beta_1\ \hat{BSC}_{jt} + \Sigma\kappa_j X_{jt-1} + \varphi_j + \tau_t + \varepsilon_{jt}$$

[1]Please consult: https://manifesto-project.wzb.eu/information/documents/information for more information

Where $(NPL)_{jt}$ is the level of non-performing loans of country j at time t. $\hat{BSC}_{jt}$ is the estimated banking sector concentration from the first stage regression in country j at time t. β_1 which is the main coefficient of interest is that of banking sector concentration.

In Table 6 columns (5) and (6) report the results for the instrumental variables method. The coefficient of concentration in columns (3) and (6) are between 0.14 to 0.39, with the significance level of one percent. Thus also using the instrumental variables approach, I see a positive impact from banking concentration on non-performing loans. Banking sector concentration coefficients in this table imply that an increase in banking market concentration has a positive impact on the ratio of non-performing loans. The results from the two last columns confirm the positive effect of banking concentration on non-performing loans. This is in line with the ”concentration-fragility” view in the literature. Thus, the more concentrated the banking industry, the higher is the lending risk of banks. Among the control variables GDP growth has a negative sign in all the regressions. This is in line with our expectation, which shows that the ratio of non-performing loans decreases when the growth is higher, and the country experiences an output growth. Legal right has a positive impact on lending risk, this may be due to the fact that this variables show the ease of lending. Higher level of capital regulatory leads to lower level of non-performing loans, which is also in line with our expectations. A higher ratio of foreign banks in the country increases the level of non-performing loans.

Impact of the size and the support on banks' lending risk

In the previous section, the analysis shows that there is a positive and significant effect of banking concentration on the aggregate lending risk of the banks. One might suspect that this result is driven by the larger and potentially more supported banks. In the second set of analysis I investigate the effect of size on the lending risk. I use the following fixed effect approach in this part:

$$(IL)_{ijt}=\alpha + \beta_1 (size)_{ijt-1} + \lambda_1 (support)_{ijt-1} + \gamma_1 size_{ijt-1}*support_{ijt-1}+ \Sigma\kappa_i X_{ijt-1} + \varphi_j + \eta_i + \tau_t + s_{it}$$

Where $(IL)_{ijt}$ is the ratio of impaired loans to gross loans of bank i at time t; $(size)_{ijt}$ is the natural log of the total assets of bank i in country j at time t; $(support)_{ijt}$ is the potential support of bank i in country j at time t; X_{ijt-1} is the vector of bank controls; φ_j is the country fixed effect; η_i is the bank fixed effects and τ_t are the time dummies.

7 reports the results of the regressions of banks' impaired loans on their size and support. The main dependent variables is the ratio of impaired loans on gross loans on the bank level. The first four columns are the results of the OLS regressions without the fixed effects. Columns (5) to (8) of this table include the country fixed effects, bank fixed effects and the time dummies. Note that the number of observations change once I incorporate the support in the equations. This is because the data for the Fitch support rating is not reported for all the banks in the Bankscope dataset. We are interested in the effect of size on the ratio of impaired loans: $\partial\ IL_{ijt}/\ \partial size_{\ ijt} = \beta_1 + \gamma_1 support_{\ ijt}$

which for the last column of the table is:

$\partial\ IL_{ijt}/\ \partial size_{\ ijt} = -2.1 - 0.19 support_{ijt}$ Which is always negative regardless

of the value of support (Note that support take a value between 0.5 and 1). The results are the same if we take replace the coefficients of any other column. This implies that size has always a negative impact on the ratio of impaired loans.

The effect of support on the lending risk is may be more important for the policy makers.

∂ IL_{ijt} / $\partial support_{ijt} = \lambda_1 + \gamma_1 size_{ijt}$

Which is:

∂ IL_{ijt}/ $\partial support_{ijt} = 1.03 - 0.22\ size_{ijt}$. This ratio is negative for size larger than 4.68 in this case. This condition changes depending on the method. However, one general result is that, for larger banks if the support is higher, the level of impaired loans decreases. Since this result may be driven by reverse causality between the impaired loans and the support, I check the robustness by using GMM (Generalized Method of Moments) estimator. The signs of the coefficients still hold after robustness checks. I report the tables and the models of the robustness checks in the next section.

Among the control variables, income has an adverse impact on banks' lending risk, which indicates that banks with higher income to equity ratio have less non-performing loans in their balance sheet. These banks with higher income may be able to invest more in monitoring and negotiating their lending conditions. Liquidity enters the regressions most of the time negative. Coefficient of liquidity is significant only in the last two columns of the table. This result implies that more liquid banks are less risky in their lending; this is in line with our primary expectations. Leverage has a positive and always significant effect on the lending risk. Finally, more lending leads to a higher level of impaired loans, this is shown by the coefficients of Lending.

Table 8 reports the results of the analysis on the size and the concentration. We are interested in the effect of size on the lending risk:

∂ IL_{ijt} / $\partial size_{ijt} = \beta_1 + \beta_2 BSC_{ijt}$

For the second column it is: ∂ IL_{ijt} / $\partial size_{ijt}$ = -3.53 + 4.02 *BSC_{ijt} Which is negative for BSC larger than 0.87. This implies that, in highly concentrated banking sector (higher than 0.87), the smaller banks have larger ratio of impaired loans, compared to other banks.

Robustness checks

As following:

Generalized method of moments

In addition to the reverse causality issues which I addressed above, there is the concern of endogeneity and the fact that in a dynamic context in a dynamic context the lagged dependent variable may depend on the panel-level effects and lead to an inconsistent estimator when the time dimension is limited (Nickell, 1981). To get around this potential inconsistency problem I also report the GMM estimators which have as additional advantages that they require no distributional assumptions and allow for heteroscedasticity of unknown form which was developed for dynamic panel models. Using this approach I combine the lagged levels of non-performing loans and BSC with first differences of the instrument to estimate the coefficient of BSC. In addition to that I test also the impact of HHI instead of BSC. 8. The first two columns report the results of the GMM estimation. The coefficient of concentration (C5) is positive between 0.41 to 0.44 and significant at one percent level. This coefficient is positive and significant also for HHI. This table confirms that the result of the paper about the impact of

concentration on non-performing loans holds also after sensitivity checks. shows the result of robustness checks. I am aware that the GMM estimator is the best for the large sample size, and in this case my sample size is too small. However as a robustness check we can trust the results. This is the dynamic version of the regression: $(NPL)_{jt} = a + a_1 (NPL)_{jt-1} + \Sigma\beta^{n}_{c=1} (BSC)_{jt-c} + \Sigma\kappa_j X_{jt-1} + \varphi_j + \tau_t + s_{jt}$

Where, $(NPL)_{jt}$ is the ratio of non-performing loans in country j at time t. $(BSC)_{jt-1}$ is the level of concentration of the banking industry in country j. The explanatory variable enters the regression with one time lag. X_{jt-1} is the vector of country controls. φ_j is the country fixed effect and τ_t is the symbol for the time dummies. The main coefficient of interest is the β_1.

V. Conclusion

This paper estimates the impact of banking sector concentration on the lending risk of banks in 23 European countries during the years 2004 to 2011. The outcome of this paper provides empirical evidence that there is a positive relationship between banking sector concentration and banks' lending risk. To address the concern about the moral hazard of large banks in the highly-concentrated banking industry, I estimate the impact of the size and potential public support of the banks. I show that larger banks, independent of the level of their support, have a smaller ratio of impaired loans. The effect of potential support on lending depends on the size of the banks. Higher support leads to fewer problematic loans if the bank is large enough. This result rolls out the moral hazard of "too-big-to-fails" which comes from the public support of very large banks. The higher lending risk within a more highly concentrated banking sector is therefore not because of the

higher risk of larger banks, but, instead, is driven by medium and smaller banks. This paper shows empirical evidence that small banks in the highly concentrated banking sector have more impaired loans than either large banks or small banks in the lower concentrated banking industry. One explanation may be the idea that larger banks provide loans and services to larger and less risky borrowers, while smaller banks pick up smaller and, possibly more risky, borrowers, leading to higher numbers of bad loans. This can be especially problematic during times of economic distress. Another possibility to explain this result is that larger banks are more efficient and enjoy better risk management than their smaller counterparts.

VI. Tables

Table 1— **Non-Performing Loans Across Countries and Years**

This table shows the non performing laans across 23 European countries and during years 2004 to 2011. The level of non-perfomring laons is the depnedent variable in the main analyisis. It is the ratio of defaulting loans (payments of interest and principal past due by 90 days or more) to total gross loans (total value of loan portfolio)

Year	2004	2005	2006	2007	2008	2009	2010	2011
Austria	2.7	2.6	2.7	2.2	1.9	2.3	2.8	2.7
Belgium	2.3	2	1.7	1.4	1.7	2.7	2.8	2.8
Bulgaria	2	2.2	2.2	2.1	2.5	6.4	11.0	14.9
Czech Republic	4	3.9	3.6	2.7	2.8	4.6	5.4	5.5
Germany	4.9	4.1	3.4	2.7	2.9	3.2	3.7	3.3
Denmark	0.7	0.2	0.6	0.6	1.2	3.3	4.1	3.5
Estonia	0.3	0.2	0.2	0.5	1.9	5.2	5.4	4
Spain	0.8	0.8	0.7	0.9	2.8	4.1	4.7	5.3
Finland	0.4	0.3	0.2	0.4	0.6	0.6	0.6	0.5
France	4.2	3.5	3	2.7	2.8	4	3.8	3.7
United Kingdom	1.9	1	0.9	0.9	1.6	3.5	4	3.9
Greece	7	6.3	5.4	4.5	5	7.7	10.4	14.7
Hungary	1.8	2.3	2.6	2.3	3	6.7	9.8	13.3
Croatia	7.5	6.2	5.2	4.8	4.9	7.7	11.1	12.3
Ireland	0.8	0.7	0.7	0.8	2.6	9	8.6	14.7
Italy	6.6	5.3	6.6	5.8	6.3	9.4	10	11
Lithuania	2.2	0.6	1	1	4.6	19.3	19.7	16.4
Luxembourg	0.3	0.2	0.1	0.4	0.6	0.7	0.2	0.4
Latvia	1.1	0.7	0.5	0.8	3.6	16.4	19	17.5
Netherlands	1.5	1.2	1.3	1.6	1.7	3.2	2.8	2.7
Portugal	2	1.5	2	2.8	3.6	4.8	5.2	6.9
Romania	8.1	1.4	1.8	2.6	2.8	7.9	11.9	14.1
Sweden	1.1	0.8	0.8	0.6	1	2	1.5	1.8

Source: World Development Indicator, World Bank

Table 2— **Banking Sector Concentration Across Countries and Years**.

This table reports the variation of the banking sector concentration for the countries during years 2004 through 2011 in the sample. The banking sector concentration is the main explanatory variable in the analysis of this paper. The data for the banking concentration is from the World Development Indicator (WDI) dataset from the World Bank. This variable is the asset share of the five largest banks in the each country.

Year	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Austria	74.1	76.3	72.4	68.5	73.9	65	71.2	73.2
Belgium	95.3	95.7	95.9	96.4	96.1	93.6	91.8	93.2
Bulgaria	74.7	68.4	66.5	78.5	74.3	78	71.7	69.5
Czech Republic	75.4	80.2	78.3	79.9	81.9	76.6	77.5	78.9
Germany	85.7	85.5	83.8	84.3	84.8	84.7	85.8	85.6
Denmark	90.4	88.7	87.3	87.7	89	88.6	90	91.1
Estonia	100	100	100	98.8	100	100	100	98
Spain	96.3	82.2	81.1	83.9	85.3	83.2	83.4	77
Finland	100	100	100	100	98.1	97.6	98	98.5
France	71.6	73.9	74.8	76.3	74	78.7	79.9	76.2
United Kingdom	78.4	65.3	66.8	73.9	78	75.2	75.5	76.6
Greece	94.0	89.7	81.1	85.5	85	83.6	83.7	94.4
Croatia	78.4	77.8	77	72.5	77	75.8	75.6	76.2
Hungary	83.4	84.9	85.6	90.4	89.2	93.4	92.9	93.6
Ireland	100	82.7	82.3	84.3	90.2	90.7	88.6	87.6
Italy	94	47.8	49.6	56.8	63.1	65.1	68.7	71.2
Lithuania	89	91.9	88.2	87.6	87.4	86.8	85.5	91.51
Luxembourg	44.5	46.4	46.4	37.5	39	41.3	46.1	45.5
Latvia	66.3	72.4	75	70.8	72.7	70.2	63.5	65.6
Netherlands	91.3	94	93.7	95.1	94.5	94.4	92.5	93
Portugal	100	96.7	93.4	91.3	90.8	92.2	92.6	96
Romania	80.2	80.9	87.1	85.5	84	84	76.7	73.4
Sweden	98.1	98.2	97.6	97.6	97.6	96.4	96.2	96.6

Source: World Development Indicator, World Bank

Table 3— **Fitch Support Rating**

This table shows the definition of different Fitch support ratings.

Fitch support rating	Definitions
1	A bank for which there is an extremely high probability of external support. The potential provider of support is very highly rated in its own right and has a very high propensity to support the bank in question. This probability of support indicates a minimum Long-Term Rating floor of 'A-'.
2	A bank for which there is a high probability of external support. The potential provider of support is highly rated in its own right and has a high propensity to provide support to the bank in question. This probability of support indicates a minimum Long-Term Rating floor of 'BBB-'.
3	A bank for which there is a moderate probability of support because of uncertainties about the ability or propensity of the potential provider of support to do so. This probability of support indicates a minimum Long-Term Rating floor of 'BB-'.
4	A bank for which there is a limited probability of support because of significant uncertainties about the ability or propensity of any possible provider of support to do so. This probability of support indicates a minimum Long-Term Rating floor of 'B'.
5	A bank for which there is a possibility of external support, but it cannot be relied upon. This may be due to a lack of propensity to provide support or to very weak financial ability to do so. This probability of support indicates a Long-Term Rating floor no higher than 'B-' and in many cases, no floor at all

Table 4— **Descriptions of the variables and their sources**

Variable	**Description**	**Source**
Country level variables		
Non-performing loan (NPL)s	Ratio of defaulting loans (Payment of interest and principal past due 90 days or more)	World Bank
Banking sector concentration (BSC)	Ratio of a country's total banking system's assets held by 5 largest banks of each country assets held by 5 largest banks of each country	World Bank
GDP growth	Growth of GDP	World Bank
Legal rights	Degree of which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending	World Bank
Regulatory capital	The capital adequacy of deposit takers. It is a ratio of total regulatory capital to its assets held, weighted according to risk of those assets.	World Bank
Foreign bank to total banks	Percentage of the number of foreign owned banks to the number of the total banks in an Economy. A foreign bank is a bank where 50 percent or more of its shares are owned by foreigners.	World Bank
Market regulation	Support for policies designed to create a fair and open economic market. May include: Calls for increased consumer protection; Increasing economic competition by preventing monopolies and other actions disrupting the functioning of the market; Defence of small businesses against disruptive powers of big businesses; Social market economy.	
Bank level variables		
Impaired loans	Impaired loans to gross loans	Bankscope
Herfindahl Hirschman Index		Bankscope
Support	1/(Fitch support rating)	Bankscope
Profitability	Return on average equity	Bankscope
Lending	log(Gross Loans)	Bankscope
Size	Log of total assets	BankScope
Leverage	1/equity ratio	BankScope
Liquidity	Ratio of liquid assets to total deposits and borrowings	BankScope
Income	Net Income to Equity	BankScope
Tier 1	Tier 1 ratio	BankScope

Table 5— **Summary Statistics**

Variable	**Mean**	**Sd**	**N**
NPL	3.619	2.157	184
BSC	83.625	5.446	184
Herfindahl Hirschman Index	0.12	.08	184
GDP growth	1.29	2.63	184
Legal rights	7.2	1.06	184
Regulatory capital	10.33	5.38	184
Ratio of Foreign banks	42.09	30.6	184
Market regulation	6.55	3.07	184
Market regulation*relative seats	92.42	37.62	184
All the banks Impaired loans	4.97	4.86	6600
Profitability	4.37	5.54	6600
Lending	20.37	1.96	6600
Size	20.94	1.95	6600
Leverage	0.18	2.58	6600
Liquidity	16.76	11.18	6600
Income	3.80	13.11	6600
Tier 1	12.12	4.03	6600
Banks with available data for FSR Impaired loans	5.72	7.13	3608
Support	0.69	0.319	3608
Profitability	1.81	4.07	3608
Lending	24.09	1.95	3608
Size	22.67	1.88	3608
Leverage	0.46	5.23	3608
Liquidity	21.48	16.38	3608
Income	2.65	20.13	3608
Tier 1	12.17	23.94	3608

Table 6— **Impact of banking sector concentration on banks' non-performing loans.** The dependent variables is the level of non-performing loans. The first column is the OLS regression of NPL on concentration Columns () and () show the result for the following fixed effect model. $(NPL)_{jt} = \alpha + \beta_1 (BSC)_{jt-1} + \Sigma \kappa_j X_{jt-1} + \varphi_j + \tau_t + \varsigma_{jt}$

	(1) OLS	(2) OLS	(3) FE	(4) FE	(5) IV	(6) IV
BSC	0.04***	0.06***	0.14***	0.16***	0.21***	0.39***
	(0.00)	(0.00)	(0.02)	(0.01)	(0.03)	(0.02)
GDP growth		-0.19***		-0.17***		-0.77***
		(0.00)		(0.00)		(0.03)
Legal right		0.23***		0.14***		0.82***
		(0.01)		(0.02)		(0.17)
Regulatory capital		-0.10***		-0.33***		-0.10***
		(0.01)		(0.01)		(0.03)
Ratio of foreign banks		1.03**		1.01**		0.93**
		(0.54)		(0.53)		(0.02)
Country fixed effects	No	No	Yes	Yes	Yes	Yes
Time dummies	No	No	Yes	Yes	Yes	Yes
Observations	184	184	184	184	184	184
R^2	0.02	0.15	0.04	0.27		
F-statistics of first stage					13.75	16.98

Standard errors in parentheses

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

Table 7— **The impact of size and support on the banks' lending risk**

	(1)	(2) IL	(3) IL	(4) IL	(5) IL	(6) IL	(7) IL	(8) IL
Size	-0.08***	-0.31***	-1.36***	-1.26***	-1.21***	-1.27***	-2.07***	-2.10*** (0.03)
		(0.10)	(0.29)	(0.29)	(0.28)	(0.43)	(0.58)	(0.58)
Support		0.39**	0.22	1.03***		1.28**	-1.15	-1.16
		(0.2)	(0.26)	(0.33)		(0.22)	(1.24)	(1.40)
Income			-0.04***	-0.03***			-0.02***	-0.02***
			(0.01)	(0.01)			(0.01)	(0.01)
Liquidity			-0.03**	-0.03***			-0.05***	-0.05***
			(0.01)	(0.01)			(0.02)	(0.02)
Profitability			-0.02***	-0.02***			-0.01**	-0.01**
			(0.01)	(0.01)			(0.00)	(0.00)
Tier 1			-0.06	-0.04			-0.10***	-0.10**
			(0.04)	(0.04)			(0.04)	(0.04)
Leverage			0.66***	0.62***			0.24***	0.22***
			(0.06)	(0.06)			(0.08)	(0.08)
Lending			1.48***	1.63***			0.80***	0.92***
			(0.27)	(0.27)			(0.24)	(0.24)
Size*Support				-0.22***				-0.19***
				(0.05)				(0.06)
Country Fixed Effect	No	No	No	No	Yes	Yes	Yes	Yes
Bank Fixed Effect	No	No	No	No	Yes	Yes	Yes	Yes
Time dummies	No	No	No	No	Yes	Yes	Yes	Yes
Observations	8865	3608	3608	3608	8865	3608	3608	3608
R^2	0.00	0.02	0.39	0.01	0.38	0.46	0.46	0.48

Standard errors in parentheses

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

Table 8— **The impact of banks' size and concentration on the lending risk**

The corresponding regression is: (IL) $_{ijt} = \alpha + \beta_1$ Size$_{ijt-1} + \beta_2$ Size*BSC$_{ijt-1} + \Sigma\kappa_i X_{it-1} + \varphi_j + \tau_t + s_{jt}$

where (concentration)$_{it-c}$ can be either BSC and HHI in country j at time t.

	(1) OLS	(2) FE	(3) IV
Size	-1.6**	-3.02***	-3.53***
	(0.53)	(0.36)	(0.9)
BSC*Size	1.95***	3.5***	4.02***
	(0.00)	(0.00)	(0.01)
Income	0.04***	0.02***	-0.08**
	(0.01)	(0.01)	(0.04)
Liquidity	0.03**	-0.04*	-0.03
	(0.01)	(0.02)	(0.06)
Profitability	-0.18***	-0.12***	-0.05
	(0.01)	(0.01)	(0.05)
Tier 1	-0.08	-0.05	-0.34*
	(0.05)	(0.07)	(0.18)
Leverage	0.54***	0.57***	1.34***
	(0.07)	(0.12)	(0.26)
Lending	1.17**	0.72**	1.39**
	(0.49)	(0.23)	(0.99)
Bank fixed effect	No	Yes	Yes
Country fixed effects	No	Yes	Yes
Time dummies	No	Yes	Yes
Observations	8865	8865	8865
R^2	0.33	0.52	
F-test			24.32

Standard errors in parentheses

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

Table 9— **The impact of concentration on non-performing loans (GMM style regressions)**

corresponding regression is: $(NPL)_{jt} = \alpha + \alpha_1 (NPL)_{jt-1} + \Sigma\beta^n_{c=1} (concentration)_{jt-c} + \Sigma\kappa_j X_{jt-1} + \varphi_j + \tau_t + s_{jt}$

where $(concentration)_{jt-c}$ can be either BSC and HHI in country j at time t.

	(1) GMM	(2) GMM	(3) GMM	(4) GMM
NPL(lagged)	0.02***	0.04***	0.21***	0.29***
	(0.01)	(0.01)	(0.07)	(0.08)
BSC	0.41***	0.44***		
	(0.01)	(0.16)		
HHI			3.23***	6.50***
			(0.3)	(0.2)
GDP growth		-4.36***		-7.7***
		(0.02)		(0.03)
Legal right		1.00***		2.28***
		(0.11)		(0.2)
Regulatory capital		-0.36***		-0.36***
		0.02		(0.04)
Ratio of foreign banks		0.93***		2.05***
		(0.48)		(0.06)
Observations	106	97	106	97
P value of Sargan	0.25	0.31	0.23	0.29
P value of AR(1)	0.00	0.00	0.00	0.00
P value of AR(2)	0. 00	0.102	0.19	0.00

Standard errors in parentheses

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

Table 10— **The impact of banks' size and support on the ratio of impaired loans (GMM style)**

	(1) GMM	(2) GMM
IL (lagged)	0.72***	0.57***
	(0.04)	(0.06)
Size	-1.62	-3.07**
	(1.13)	(1.39)
Fitch Support Rating	-0.41	-1.01
	(1.04)	(1.10)
size*support	-0.24**	-0.14
	(0.12)	(0.15)
Income		-0.01
		(0.01)
Liquidity		-0.23***
		(0.04)
Profitability		-0.01
		(0.01)
Tier 1		0.22***
		(0.09)
leverage		-0.60***
		(0.21)
Lending		0.70
		(2.79)
Observations	1953	1813
P value of Sargan	0.39	0.48
P value of AR(1)	0.00	0.00
P value of AR(2)	0.06	0.04

Standard errors in parentheses

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

VII. Appendix

Instrumental variables

The numbers in the dataset for variables constitute the relative share of statements for each category to all statements in the manifesto. Number "0.35" means that 0.35 percent of the manifesto were devoted to that category. Since this is a relative share, the scale can run between zero (no statement at all) and 100 (the whole manifesto is about this category). As the first step to identify the instruments, I obtain the data for most relevant economic approaches from the Manifesto dataset for the 23 countries in the sample for all the years between 2003 to 2011. The reason this data goes further back to 2003 is that I expect any impact from the politics on concentration to be with time lags. The primary variables are all those which fit the general economic statements that can affect the financial and economic decisions in the countries. There are more than 15 variables in the Manifesto project dataset that show relevant economic concepts. To see the relative share of the preferences of the indicator of the variable in the manifesto, I multiply the corresponding number of the preference by the percentage of seats (The ratio of the absolute number of the seats of each party to the total seat numbers of the parliament in specific years). The numbers in the dataset are limited to the times of local elections. For the years when there is no election, I assume that the preferences and the relative seat numbers remain the same as the last previous elections' date.

$$Manifestoz_{jt} = \zeta_{zjt} * seats_{zjt} \quad M$$

$$Manifesto_{jt} = \mu(Manifesto_{zjt})$$

Where ζ_{zjt} is the relative share of the statements about a preference of choice in

the manifesto of party Z in country j at time t. μ is the mean of the interaction of the preferences and the seat numbers of each party, in each country for each existing year. Thus, $Manifesto_{jt}$ is the index of the political preferences in countries over years weighted by their decision power (seat numbers)). After analyzing the impact of different political preferences on the banking concentration, I find $Manifesto_{jt}$ to be negatively related to concentration more than other statements, with no evidence for its impact on non-performing loans. The manifesto project defines the Market regulation as the support for poli- cies designed to create a fair and open economic market, which may include: (i) calls for increased consumer protection; (ii) increasing economic competition by preventing monopolies and other actions disrupting the functioning of the market; (iii) defense of small businesses against the disruptive powers of big businesses; and (iv) the social market economy.

In order to be an appropriate instrument, the $Manifesto_{jt}$ should not directly affect non-performing loans. I show the correlation matrix between the instrument, concentration and level of non-performing loans in the table below. According to this matrix: there is a high correlation between the instruments

	BSC	NPL	Market regulation
BSC	1.00		
NPL	0.12***	1.00	
Market regulation	-0.47***	0.04	1.00

and the concentration. The correlation between non-performing loans and the instruments, meanwhile, is not significant.

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