Guilherme Solino Evelin Oliveira

What was the bank ownership lending behavior after the financial crisis? New evidence from an emerging market

Brasília

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Dissertação apresentada como requisito parcial para obtenção do título de Mestre pelo Programa de Pós-Graduação em Economia do Departamento de Economia da FACE/Unb

Universidade de Brasília – Unb

Faculdade de Economia, Administração e Contabilidade

Departamento de Economia

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Aos amores da minha vida: Valessa, Daniel, Lucas e Gabriela.

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Resumo

Analisamos o comportamento de crédito dos bancos comerciais para o mercado de crédito por localidades no Brasil para o período de 2005 a 2013. Utilizamos uma base de dados de alta freqüência do Banco Central do Brasil dos principais itens de balanço de bancos comerciais e bancos múltiplos com carteira comercial, com informações a nível municipal. Mostramos evidências de má alocação de crédito pelos bancos públicos após a crise financeira de 2008-2009 para o segmento de mercado de crédito livre. Isso ocorreu devido a uma grande expansão do crédito, deterioração da qualidade dos empréstimos e por evidência de que os empréstimos bancários foram politicamente direcionados. Utilizamos um painel de efeitos fixos e painel quantílico de efeito-fixos com termo não aditivo para um universo de 2.601 localidades.

Palavras-chave: Regressão quantílica. Crédito. Crise financeira. Painel Quantílico com efeitos-fixos.

Abstract

We analyze the lending behavior of the commercial banks in the credit market at the local level by localities in Brazil for the period from 2005 to 2013. We use a high-frequency database from Brazil Central Bank of the main items of balance sheets of commercial banks and multiple banks with commercial portfolio. We used fixed-effects panel and non-additive fixed-effect quantile panel for a universe of 2,601 localities. We find evidence of poor credit allocation by state-owned banks after the 2008-2009 financial crisis for the non-earmarked credit market segment. The larger credit expansion, the deteriorating loan quality and the political targeted bank lending seem to be main determinants of such poor allocation.

Keywords: Quantile regression. Credit. Financial crisis. State-owned banks. Quantile panel data.

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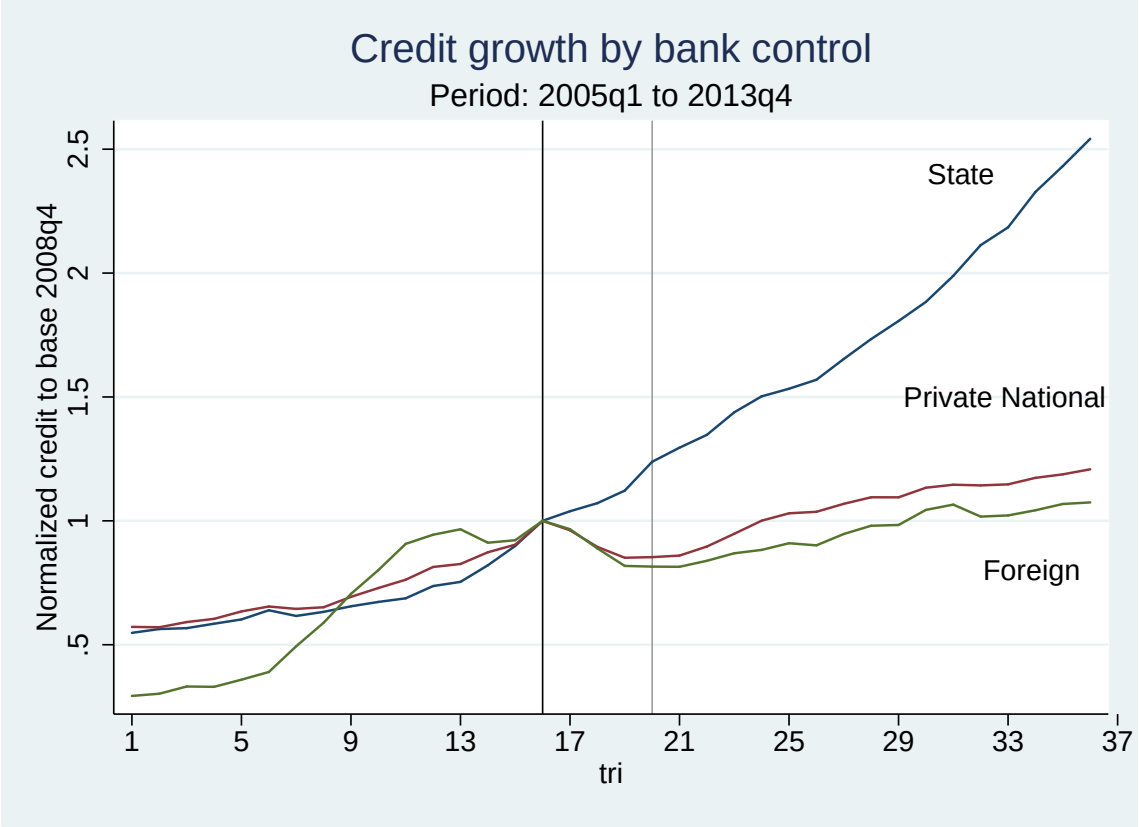
ESTBAN	Estatísticas Bancárias

Sumário

1 Introduction

Partial or complete state-ownership in the banking sector is pervasive all over the world, especially in developing countries (PORTA; SILANES; SHLEIFER, 2002). Figure 1 shows banks lending in Brazil from 2005 to 2013. About four years before the 2008–2009 financial crisis, state and domestic-owned banks presented similar trends in lending. After the collapse of Lehman Brothers by September 2008, though, lending had grown almost 150% and 25% in state and domestic-owned banks, respectively. The central concern is to find what had driven this expansion by state-owned banks. The main contribution of this paper consists of showing new evidence on the misallocation of banks lending in the non-earmarked segment after the financial crisis in Brazil possibly caused by the large credit expansion, deteriorating loan quality and politically targeted lending.

Figura 1: Lending deflated to Brazilian reais of January 2000 and normalized to have value 1 for all banks at quarter of Lehman Brother‘s collapse.



Accordingly, we address the local response in the credit market during the 2008–2009 financial crisis and the local response in the credit market following one year after the bankruptcy of Lehman Brothers bank. The novelty of our contribution lies in the evidence that the greater the intensity of state-owned banks in the localities, the greater is lending expansion and the worsening of loan quality. Also, the largest credit expansions after the begining of financial crisis are associated with the political alignment of localities with the federal government. Thus it brings further evidence to the political view of state-owned bank misallocating lending.

We estimate a panel fixed-effects models as well as quantile regression models with a non-additive fixed-effect estimator. Our quantile regression results bring new insightful information on the

relationship between lending, bank ownership, and political alignment.

There are two strands of the relevant literature about the government intervention in the banking sector. The social view is aligned with the strand of the literature that supports the state ownership of banks as a way to overcome market failures and ensure credit supply to small and medium-sized enterprises, increase home ownership through mortgage lending, fight poverty and promote agricultural development (BEHR; FOOS; NORDEN, 2017). Also, they support that state-owned banks should be willing to increase lending in bad times for the sake of stabilizing the economy, even if doing so does not maximize profits (CHEN et al., 2016; BREI; SCHCLAREK, 2013).

The other strand of literature emphasizes the negative side of the state ownership of banks. The agency theory supports this strand of literature and argues that state-owned banks managers will face weaker and/or more adverse incentives compared to privately owned firms managers, and thus will be less diligent in maximizing revenues and (especially) minimizing costs (MEGGINSON, 2005; ZHU; YANG, 2016).

The political view is also aligned with the strand of literature that emphasizes the negative side of the state ownership of banks. This view holds that state control over financial institutions leads to resources misallocation and other forms of inefficiency. State ownership of banks is associated with low bank efficiency and lower levels of financial development (KRUEGER, 1974; SHEN; HASAN; LIN, 2014; PORTA; SILANES; SHLEIFER, 2002). Country level studies also show that politicians use government bank lending to provide political patronage leading to significant credit misallocation (DINÇ, 2005; CARVALHO, 2014; SHEN; HASAN; LIN, 2014). They generally do not serve the more credit constrained segments of the population, such as small and medium enterprises (BERGER et al., 2008). Megginson (2005) argues that government control of banks will be inefficient by design since they are created specifically so that politicians can use them to benefit their own supporters at the expense of another group in society. Chen et al. (2015) shows evidence that during the global financial crisis political connections of government banks deteriorate their quality lending that leads to a decline in their operating performance.

Our paper links directly to the political view literature of state ownership of banks. Our results complement this literature as we assess the influence of bank ownership the on quantiles of lending growth to evaluate whether localities that had the greatest loan expansion did so by the performance of state-owned banks. Furthermore, we show that the increased lending by state-owned banks in the crisis period is related to worsening loan quality compared to private banks. This result suggests that state-owned banks provide more loans to less efficient borrowers (CHEN et al., 2015).

Also, we complement the literature of state-owned banks lending behavior during financial crisis (BERTAY; DEMIRGÜÇ-KUNT; HUIZINGA, 2015; BREI; SCHCLAREK, 2013). We show that state-owned banks have lent counter-cyclically, while privately-owned banks have lent pro-cyclically during the 2008-2009 financial crisis. However, state-owned banks continued to expand the credit counter-cyclically after 2009, and this behavior is associated with a worse loan quality and with federal political connections. This evidence brings evidence for a poor credit allocation of state-owned banks as a short-term countercyclical tool.

Besides, our findings are related to relevant recents events in the political and economic field in Brazil. For instance, in 2017, two major federal state-owned banks in Brazil are taking steps to improve their efficiency and reduce costs. The closing of bank branches and voluntary resignation plans are announced to avoid banks capitalization.[1]

[1] Report on O ESTADO DE S. PAULO - SP, 04 January 2017 – The Federal Savings and Loan Bank (CEF) plans to save R$ 1.5 billion per year with voluntary retirement plan

Also, economic factors in Brazil were decisive for the discharge of the elected president Dilma Rousseff in 2016, despite the political debate of the impeachment. From the beginning of 2015, the severe recession and the rising unemployment can be seen, at least in part, as consequences of economic policies decisions. Among the critical actions in the economic field, misallocation of bank loans is a determining factor for increased lending write-offs, worsening loan quality and reducing the profitability of state-owned banks.

Our paper has important implication and policy insights. First, the estimator of panel quantile regression with non-additive term disturbance can help supervisor investigate if over-stimulus on lending behavior is associated with worsening lend quality. Second, state-owned banks could have lent countercyclically during financial crisis. But the performance of these banks in countries with high corruption and weak institutional characteristic, such as Brazil (CARSON; PRADO, 2016), demands a sound bank governance in order to attenuate the political influence on bank lending. Recent papers relate that institutional ownership and better design of board composition could improve the performance of state-owned banks (CHEN et al., 2015; ZHU; YANG, 2016).

The remainder of the paper is structured as follows: In Section 2 we describe data, variables and the empirical strategy. In section 3 we discuss the empirical results and the robustness checks. Section 4 we concludes the paper.

2 Methodology

This section discuss the data and the empirical strategy used to identify the effects of bank ownership on lending behavior.

2.1 Data

We assess the impact of bank ownership on lending behavior during and post the global financial crisis in Brazil. We use data from the Monthly Banking Statistics, ESTBAN, provided by the Brazilian Central Bank. It consists of the monthly position of the main items of balance sheets of commercial banks and multiple banks with commercial portfolio, with information at the municipal level. We obtained information of annually local GDP and social-demographic data[1] from the Institute of Applied Economic Research (IPEA).

Table 1 presents the averages values of education, lending, population, wage and GDP for each locality over low, medium and high lending quantiles. Lending and GDP are year averages values through 2005 to 2013. Education, population and wage came from census data of the year 2000. We can see that localities that expanded more the lending were the ones with lower education, wage and economic development.

Tabela 1: Descriptive statistics

quantiles	education	lending	population	wage	gdp
5 to 25	4.390	0.600	67	21	495
40 to 60	4.400	1.010	54	17	415
75 to 95	4.340	1.920	61	16	396

The variables correspond to the averages of the quantiles referenced in each row. All variables have the reference values for the year 2000, except loans, which corresponds to the mean value during the data sample (2005 to 2013). Population, wage and gdp are in thousands

We analyze aggregate loans and the two more relevant segments of it. The first one is non-earmarked lending, where banks can choose freely where allocate credit. The second one is earmarked lending, where lending is target to a specific economy sector.

As stated before, we are motived to find what had driven the lending expansion by state-owned banks after the global financial crisis. Government intervenes in credit market in Brazil targeting basically three economy segments. The first one is headed to industry and infrastructure projects. BNDES, a state-owned development bank, is the major channel for this earmarked lending. BNDES lending could be by direct credit operations to enterprises or indirect credit operations channeled by commercial banks to the real economy. The second one is direct to housing loan market, and the third one is driven to rural credit, a segment destined to promote agricultural development.

It is important to highlight that the BNDES, the larger and more relevant state-owned investment bank in Brazil, is not in our sample since it is not a bank with a commercial portfolio and it does not have bank branches. Therefore, it is not within the scope of this study to evaluate lending from BNDES.

We construct our proxies variables for credit segments from ESTBAN as follows. Non-earmarked

[1] The social-demographic include census data from 2000 of education, wage, export level and population.

loans are the sum of: loans and discounted securities ; and fundings[2]. Earmarked loans are the sum of agricultural financing and real estate financing[3].

Figure 2 shows the average of earmarked lending before, during and after the global financial crisis. We can see that state-owned banks have most of the market share for this credit segment in all periods. Besides, we see a massive expansion of earmarked lending by state-owned banks after the financial crisis (the average values goes from R$ 68,39 billions during the financial crisis to R$ 131.70 billions after the financial crisis).

Figure 3 shows the average of non-earmarked lending before, during and after the global financial crisis. Private-owned banks have the most of the market share for this credit segment in all periods. However, we can see an expressive expansion of non-earmarked lending by state-owned banks after the bankruptcy of Leman's Brothers (the average values goes from R$ 94.12 billions during the financial crisis to R$ 162.56 billions after the financial crisis).

We also aim to evaluate whether there is a political connection on local banking lending with the federal government. We obtained two proxies variables of political alignment from municipalities and presidential elections. We collect this data from Superior Electoral Court, TSE. The first one consists of an indicator variable that assumes the value of one if the mayor of the locality was from the Workers' Party in either 2004, 2008 or 2012 municipal elections. The other proxy variable consists of a continuous variable reflecting the highest vote margin for Workers' Party presidential candidates in 2006 and 2010 elections in each locality.

Also, we construct the variable of a credit quality index as the ratio of loan loss provision to the credit operation. Note that there is a lag of time between the actual loss determination with accuracy and certainty and the fact that loans can be written off. So we lag one period the credit operation on the ratio to loan loss provision.

We are interested in assessing lending regionally. Brazil had 5565 municipalities in 2013. We combined all municipalities into 3659 spatially constant units that we call "localities." These 3659 localities reflect the 1970 municipal borders and are roughly equivalent in size to U.S. counties. Collapsing municipalities into 3659 comparable minimal areas serve two central purposes: first, the 1970 borders more closely reflect geographic units corresponding to common area labor markets. Second, considering larger geographic units reduces the possibility that firms obtain loans from outside their own locality (COLEMAN; FELER, 2015)[4]. Localities that have no bank branch were excluded from the analysis, as they tend to be sparsely and remotely populated. The resulting sample has 2,601 locations with at least one bank branch.

In 2013, the Brazilian banking system had 120 banks with commercial portfolio, 11 state-owned banks, and 109 domestic and foreign-owned banks, totaling 22,791 bank branches. Our sample include all domestic and foreign-owned commercial banks with at least one branch in any locality. Among state-owned banks, our sample include the four national state-owned banks and three state level-owned banks.[5]

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[2] Loans and discounted securities correspond to the account 161 - Empréstimos e títulos descontados of ESTBAN. Fundings correspond to the account 162 - Financiamentos of ESTBAN.

[3] Agricultural financing correspond to the sum of the accounts 163 financiamentos rurais e agrícolas de custos e investimentos, 164 financiamentos rurais pecuários de custos e investimentos, 165 financiamentos rurais e agrícolas comercializáveis, 166 financiamentos rurais pecuários comercializáveis and 167 financiamentos agroindustriais. Real estate financing correspond to the account 169 financiamentos imobiliários of ESTBAN

[4] Note that it is possible that loans be taken in places where they are not its accounting records, due ESTBAN database methodology.

[5] The four federal national banks are: Banco do Brasil, Caixa Economica Federal (CEF), Banco do Nordeste and Banco da Amazonia. The state level banks are: BRB, Banco Estadual de Sergipe and Banco Estadual do Pará.

For each locality, we aggregate data by bank ownership. To avoid problems with missing data for a relevant variable in a specific month, we average the balance sheet data for each quarter. Subscript ”i”represents the locality and the ”t”denotes time, measured in quarters.

For all specifications, we normalize all the dependent variables on 2008q4 to the value of 1 (one), as banks and localities have different sizes. We include time fixed effects, and thus each bank or locality must experience the same relative change in time.

Figura 2: Average of earmarked lending in three periods: before the crisis (2005 to 2008), during the crisis (2009) and after the crisis (2010 to 2013). Values in R$ billions.

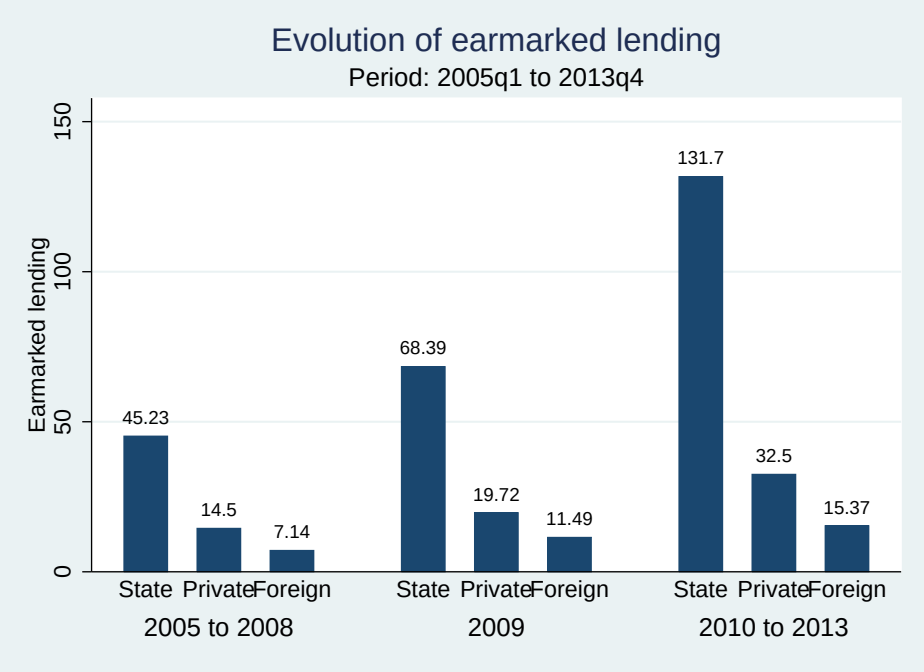


Figura 3: Average of non-earmarked lending in three periods: before the crisis (2005 to 2008), during the crisis (2009) and after the crisis (2010 to 2013). Values in R$ billions.

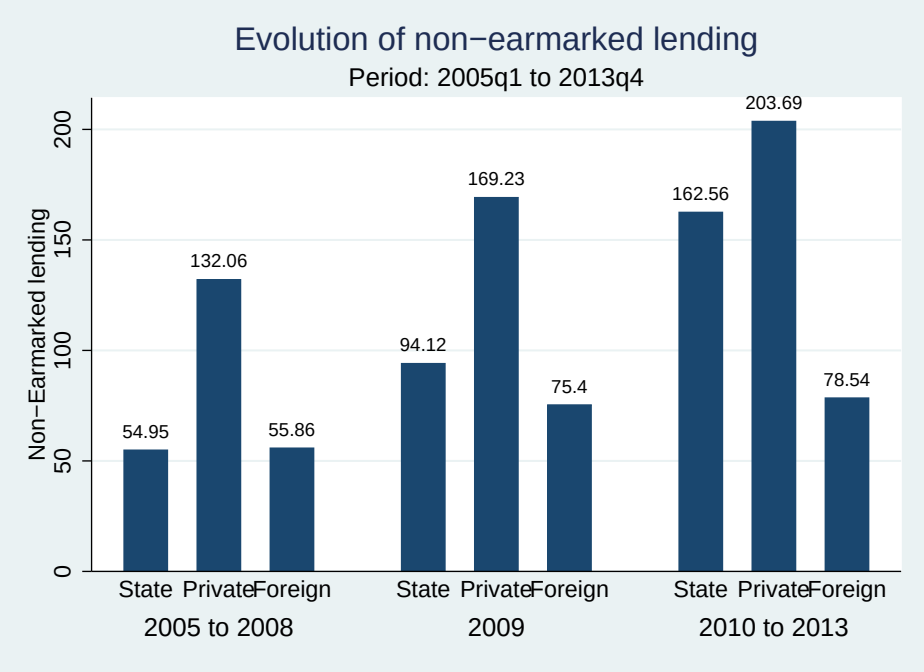


Tabela 2: Variables description

Type	Variable	Description	Source
dep. var	Lending	Aggregate lending normalized to the value 1 in 2008q4. The data frequency is monthly and we average the values for each quarter	ESTBAN
	Non-earmarked ending	Proxy for normalized non-earmarked lending to the value 1 in 2008q4. We sum the values of: loans and discounted securities; and fundings. The data frequency is monthly and we average the values for each quarter	ESTBAN
	Earmarked lending	Proxy for normalized earmarked lending to the value 1 in 2008q4. We sum the values of agricultural financing and real estate financing. The data frequency is monthly and we average the values for each quarter	ESTBAN
	Quality lending indicator	Normalized value of $\frac{provision_t}{lending_{t-1}}$ to the value 1 in 2008q4. The data frequency is monthly and we average the values for each quarter	ESTBAN
indep. var	state . during	state is the share of state-owned bank branches in 2007q3. During is an indicative variable equal to one during the quarters 2008q4 to 2009q3. and equal to zero in the others cases	ESTBAN
	state . Post	State is the share of state-owned bank branches in 2007q3. Post is an indicative variable equal to one following the quarters 2009q4 to 2013q4 and equal to zero in the others cases	ESTBAN
	domestic . during	Domestic is the share of domestic-owned bank branches in 2007q3. During is an indicative variable equal to one during the quarters 2008q4 to 2009q3 and equal to zero in the others cases	ESTBAN
	domestic . post	domestic is the share of domestic-owned bank branches in 2007q3. Post is a indicative variable equal to one following the quarters 2009q4 to 2013q4 and equal to zero in the others cases	ESTBAN
	foreign . during	Foreign is the share of foreign-owned bank branches in 2007q3. During is a indicative variable equal to one during the quarters 2008q4 to 2009q3 and equal to zero in the others cases	ESTBAN
	foreign . post	Foreign is the share of foreign-owned bank branches in 2007q3. Post is a indicative variable equal to one following the quarters 2009q4 to 2013q4 and equal to zero in the others cases	ESTBAN
	state . during . dpt	state is the share of state-owned bank branches in 2007q3. During is an indicative variable equal to one during the quarters 2008q4 to 2009q3 and equal to zero in the others cases. Dpt is an indicative variable if the mayor of some locality is of the same of the presidential of the Republic	ESTBAN TSE
	state . post . dpt	State is the share of state-owned bank branches in 2007q3. Post is an indicative variable equal to one following the quarters 2009q4 to 2013q4 and equal to zero in the others cases. Dpt is an indicative variable if the mayor of some locality is of the same of the presidential of the Republic	ESTBAN TSE
	state . during . mv	state is the share of state-owned bank branches in 2007q3. During is an indicative variable equal to one during the quarters 2008q4 to 2009q3. and equal to zero in the others cases. Mv is a continuous variable of the margin of votes of the last presidential election for Workers Party	ESTBAN TSE
	state . post . mv	State is the share of state-owned bank branches in 2007q3. Post is an indicative variable equal to one following the quarters 2009q4 to 2013q4 and equal to zero in the others cases. Mv is a continuous variable of the margin of votes of the last presidential election for Workers Party	ESTBAN TSE
	gdp	Normalized GDP of the localities in the quarter 2008q4. The data frequency is monthly and we average the values for each quarter	IPEA

2.2 Empirical strategy

To establish a causal relationship between bank ownership and lending, we use disaggregated data at regional level to evaluate lending for each locality.

Our empirical strategy is related to Coleman e Feler (2015), as we use the same municipalities aggregation and database for lending. Besides, his main estimation equation is similar to ours. However, our paper has a significant distinction between the estimation and the researcher's questions then Coleman Coleman e Feler (2015). We use the quantile fixed-effects panel estimator to evaluate the effect of banking ownership on lending behavior in localities that had the most credit expansion. Besides, we assess the earmarked and non-earmarked loan, and we use a different loan quality index than Coleman e Feler (2015).

We can evaluate the causal link between lending and bank ownership using a fixed-effect panel data and the fixed-effect quantile panel regression. The traditional regression techniques focus on the conditional mean and ignore relevant relationships coefficients (BINDER; COAD, 2011). The quantile regression technique was introduced by the seminal article Koenker e Jr (1978). This method extends the regression analysis to the quantile distribution of the dependent variable. The quantile regression is robust to outliers and asymmetric distributions. The quantile regression may be formulated as a minimization problem (KOENKER; JR, 1978):

$$\begin{aligned}\hat{Q}_y(\tau) &= argmin_a\{\sum_{i:y_i\geq a}\tau \mid y_i - a \mid + \sum_{i:y_i<a}(1-\tau) \mid y_i - a \mid\} \\ &= argmin_a \sum_i \rho_\tau(y_i - a)\end{aligned} \tag{2.1}$$

with the check function

$$\rho_\tau(z) = \begin{cases}\tau z : z \geq 0 \\ (\tau - 1)z : z < 0\end{cases}$$

Considering that y is linearly dependent on a vector of exogenous variables x, the linear conditional quantile function can be written as

$$Q_y(\tau \mid x) = inf\{a \mid F_y(a \mid x) \geq \tau\} = \sum_k \beta_k(\tau)x_k = x^{`}\beta(\tau) \tag{2.2}$$

In analogy to equation (2.1), the quantile regression coefficients are obtained by solving with respect to $\beta(\tau)$:

$$\begin{aligned}\hat{\beta}(\tau) &= argmin_{\beta(\tau)\in\mathbb{R}^k}\{\sum_{i:y_i\geq x^{`}\beta(\tau)}\tau \mid y_i - x^{`}\beta(\tau) \mid + \sum_{i:y_i<x^{`}\beta(\tau)}(1-\tau) \mid y_i - x^{`}\beta(\tau) \mid\} \\ &= argmin_{\beta(\tau)} \sum_i \rho_\tau(y_i - x^{`}\beta(\tau))\end{aligned} \tag{2.3}$$

Many quantile panel estimators regression use a similar method including fixed and additive effects. However, the additive fixed effects change the original model. We use a quantile panel fixed-effects model estimation with non-additive disturbance term proposed by Powell (2014). This estimator does not separate α_i and is the first that allows the coefficients be interpreted in the same way as the coefficients of the traditional cross-section quantile regression, allowing an arbitrary correlation between the fixed effects and the independent variables.

Equation (2.4) describes the effect of bank ownership on lending. We estimate the bank ownership influence on lending through the traditional within panel data estimator and also through a quantile fixed-effects estimator with a non-additive disturbance term. All the models include time and fixed-effects, as well as the local GDP.

$$y_{it} = \beta_1 \cdot ownership_i \cdot During + \beta_2 \cdot ownership_i \cdot Post + \alpha_i + \beta_3 \cdot gdp_{it} + \lambda_t + \epsilon_{it} \quad (2.4)$$

The dependent variables are lending, proxies for non-earmarked and earmarked lending segments, and an indicator of a quality lending. All variables are described and detailed in table 2. Subscript ”i”represents the locality and the ”t”denotes time, mesured in quarters. The variables of interest are $ownership_i \cdot During$ and $ownership_i \cdot Post$. $During$ is a dummy variable that equals one for the 2008q4–2009q3 period, and $Post$ is a dummy variable for quarters after 2009q3. α_i and λ_t capture cross-section and time fixed-effects, respectively.

We also investigate whether there is a political motivation in the lending process according to banks ownership. We use two variables as proxies for political alignment, Int. The first one consists of an indicator variable that assumes the value of one if the locality was ruled by any major from the Workers' Party in either 2004, 2008 or 2012 municipal elections. The other proxy consists of a continuous variable reflecting the highest vote margin for Workers' Party presidential candidates in 2006 and 2010 elections. We aim at investigate whether there is political capture of loans provided by state-owned banks by those localities that are politically aligned with the federal government. Therefore, besides the state ownership of banks, we interact the political alignment with our main independent variables:

$$y_{it} = \beta_1 \cdot state_i \cdot During \cdot Int + \beta_1 \cdot state_i \cdot Post \cdot Int + \beta_3 \cdot gdp_{it} + \alpha_i + \lambda_t + \epsilon_{it} \quad (2.5)$$

3 Empirical results

3.1 Q1: What was the local response in the credit market during the 2008–2009 financial crisis?

First, we assess the local lending behavior during the financial crisis of 2008-2009. We use the share of bank branches in each locality interacted with the dummy for the period between 2008q4 and 2009q3 to evaluate the impact of ownership type on lending. We use the panel and quantile fixed-effects estimator from equation (2.4). Table 3 shows panel fixed-effects estimations for lending at locality level from 2005 to 2013. Localities with higher shares of state-owned bank branches had a statistically and positive marginal effect on lending during 2008q4 to 2009q3 (coefficient on variable $state \cdot during$ equal to 0.1883). Locations with higher shares of private bank branches (domestic and foreign) supplied less credit (coefficient on variables $domestic \cdot during$ and $foreign \cdot during$ equal to -0.0925 and -0.3451, respectively). Tables 4 and 5 show fixed-effects estimates for an earmarked and non-earmarked loan proxy, respectively. The estimations are statistically insignificant for earmarked loan proxy independent variables and statistically significant for non-marked loan proxy independent variables. The results suggest that during the financial crisis, localities with a larger share of state-owned banks had a positive response in both credit segments (coefficient on variables $state \cdot during$ equal to 2.7801, earmarked, and 0.2387, non-earmarked), while regions with intensity larger share of domestic banks had a negative marginal effect on both segments (coefficient on variable $domestic \cdot during$ equal to -4.0803 to earmarked, and -0.1973 to non-earmarked). Regions with larger share intensity of foreign banks had a positive (negative) marginal effect on earmarked (non-earmarked) segments (coefficient on variable $foreign \cdot during$ equal to 0.4750 and -0.2262, respectively). Figure 4 show the fixed-effects quantile estimates for the period between 2005 and 2013. Looking at the results, we can conclude that quantile regression estimates are, qualitatively the same as those of conditional mean.

State-owned banks have lent countercyclical and private-owned banks procyclical during the financial crisis. This lending behavior are expected (COLEMAN; FELER, 2015; BERTAY; DEMIRGÜÇ-KUNT; HUIZINGA, 2015; BREI; SCHCLAREK, 2013).

Second, we evaluate the quality of the loans and the lending capture by political interests. Table 6 shows fixed-effects estimates regarding the index of lending quality. All estimations are statistically significant, except for the coefficients of the variables $foreign \cdot during$. We observe an improvement in the index among localities with larger shares of state-owned banks (coefficient on variable $state \cdot during$ equal to -0.5552) and the worsening of the index in areas with higher presence of private banks (coefficient on variable $domestic \cdot during$ equal to 0.6208 and variable $foreign \cdot during$ equal to 0.1698).

Table 7 shows fixed-effects estimates of political influence on lending, where the main explanatory variables are interacted with variables that reflect political alignment with the federal government. The estimation for the column (1) shows that the political alignment increases the amount of credit target at the locality (coefficient on variable $state \cdot during \cdot mv$ equal to 0.1940), and the estimation of the column (2) shows no effects of political alignment on credit (coefficient on variable $state \cdot during \cdot dpt$ equal to 0.0112 but statistically insignificant).

In conclusion, we can interpret the banks's lending behavior during the global financial crisis as follows. State-owned banks acted counter-cyclically during the crisis (2008q4 to 2009q3). The credit shock has hit the segment of private banks harder, especially foreign banks. One year after the collapse

Tabela 3: Lending at local level, from 2005 to 2013

	(1) lending	(2) lending	(3) lending
state.during	.1883452***		
	(.0172992)		
state.post	.1508039***		
	(.052462)		
domestic.during		-.092562***	
		(.0203651)	
domestic.post		.1266548**	
		(.0613815)	
foreign.during			-.3451763***
			(.046663)
foreign.post			-.8027742***
			(.0740335)
N	94507	94507	94507
r2	.4191327	.4188477	.4296057
F	265.4034	196.6757	239.8149

Standard errors, clustered at the locality level, are reported in parentheses. The dependent variable is lending normalized to 2008q4. It is is an average of monthly lending in each quarter. The period range from 2005q1 through 2013q4. Lending is deflated to Brazilian reais of January 2000. State, domestic, and Foreign is the share of locality branches banks that are owned by the state, domestic and foreign banks in 2007q3, respectively. During is an indicator variable for the four quarter from 2008q4 through 2009q3 and Post is an indicator variable for the quarters following 2009q4. All regressions include locality fixed-effects, time fixed-effects. We used as covariates the GDP of each locality and omitted it coefficients.
** p < 0.05
*** p < 0.01

of the Leman Brothers, there was an improvement in the index of credit quality of the state-owned banks' and a worsening in this index of private banks (domestic and foreign). We found no evidence of credit misallocation for the period during the financial crisis (2008q4 to 2009q3).

3.2 Q2: What was the local response in the credit market one year after the bankruptcy of Lehman Brothers bank?

To evaluate the local lending behavior after the financial crisis of 2008-2009, we assess the share of bank branches in each locality interacted with the dummy for the period after 2009q3 as the regressor of interest. We estimate fixed effects within estimator as well as quantile fixed-effects estimator from equation (2.4). The estimations are statistically insignificant for earmarked loan proxy independent variables and statistically significant for non-marked loan proxy independent variables. Table 3 shows panel fixed-effects estimates for the local level lending. Localities with a larger share of state-owned banks branches had increased the lending following the quarters 2009q4 to 2013q4 (coefficient on variable $state \cdot post$ equal to 0.1508). Localities with a larger share of private domestic-owned banks had increased the lending one year after the financial crisis (coefficient on variable $domestic \cdot post$ equal to 0.1266). Localities with a larger share of foreign banks reduced lending more intensely than in the period during the financial crisis (coefficient on variable $foreign \cdot post$ equal to -0.8027).Figure 5 shows the fixed effects quantile estimates with non-additive disturbance term for lending from 2005 to 2013. Figure suggests that the marginal effect of a larger share of state-owned bank on lending is greater than that of localities with a larger share of domestic-owned banks for all quantiles of the dependent variable, except

Tabela 4: Earmarked Lending at local level, from 2005 to 2013

	(1) earmarked	(2) earmarked	(3) earmarked
state.during	2.780143		
	(2.369306)		
state.post	2.300491		
	(2.364304)		
domestic.during		-4.080304	
		(3.943211)	
domestic.post		-2.794901	
		(3.956974)	
foreign.during			.4750127
			(1.386812)
foreign.post			-.7858814
			(1.82461)
N	86019	86019	86019
r2	.0008309	.0008456	.0007696
F	22.9102	22.60173	24.23718

Standard errors, clustered at the locality level, are reported in parentheses. The dependent variable is earmarked lending normalized to 2008q4. It is is an average of monthly earmarked lending in each quarter. The period range from 2005q1 through 2013q4. Lending is deflated to Brazilian reais of January 2000. State, domestic, and Foreign is the share of locality branches banks that are owned by the state, domestic and foreign banks in 2007q3, respectively. During is an indicator variable for the four quarter from 2008q4 through 2009q3 and Post is an indicator variable for the quarters following 2009q4. All regressions include locality fixed-effects, time fixed-effects. We used as covariates the GDP of each locality and omitted it coefficients.

the 80th and 85th quantiles.

Table 5 shows fixed-effects estimations of the lending proxy for non-earmarked loans at the local level. The results suggest that credit is higher in localities with larger shares of state-owned banks branches (coefficient on variable $state \cdot post$ equal to 0.4504). There was a procyclical behavior to this modality of credit by private banks (domestic and foreign), specially among foreign banks, which reduced lending three times more than domestic-owned banks. Moreover, localities with a larger share of state-owned branches increased non-earmarked credit following the financial crisis, according to the figure 5. That is, localities where non-earmarked credit substantially increased, it did so through state-owned banks.

We evaluate the quality of the loans and the political capture of the lending after the financial crisis. Table 6 shows fixed-effects estimates of the index of lending quality from 2005 to 2013. All estimations are statistically significant, except for the coefficients of the variables $foreign \cdot post$. In this case, a positive (negative) marginal effect on the loan quality index should be interpreted as the worsening (improvement) of the credit, since the indicator is given by the ratio of loss lending provision to lending (lagged over one period). After 2009q3, localities with a larger share of state-owned banks presented a more pronounced deterioration in the quality of the lending (coefficient on variable $state \cdot post$ equal to 0.6208). Areas with a higher presence of domestic-owned banks had improved their lending quality, the opposite of what happened between 2008q4 and 2009q3. Locations with a larger shares of foreign-owned banks branches presented an worsening on their loan quality index (coefficient on variable $foreign \cdot post$ equal to 0.4004).

Tabela 5: Non-Earmarked Lending at local level, from 2005 to 2013

	(1) non-earmarked	(2) non-earmarked	(3) non-earmarked
state.during	.2384709***		
	(.0146956)		
state.post	.450412***		
	(.0371472)		
domestic.during		-.1973816***	
		(.0182459)	
domestic.post		-.2569065***	
		(.0454828)	
foreign.during			-.226279***
			(.0376996)
foreign.post			-.7304047***
			(.0602717)
N	94507	94507	94507
r2	.5470844	.5362143	.5449942
F	606.9452	427.0499	455.9859

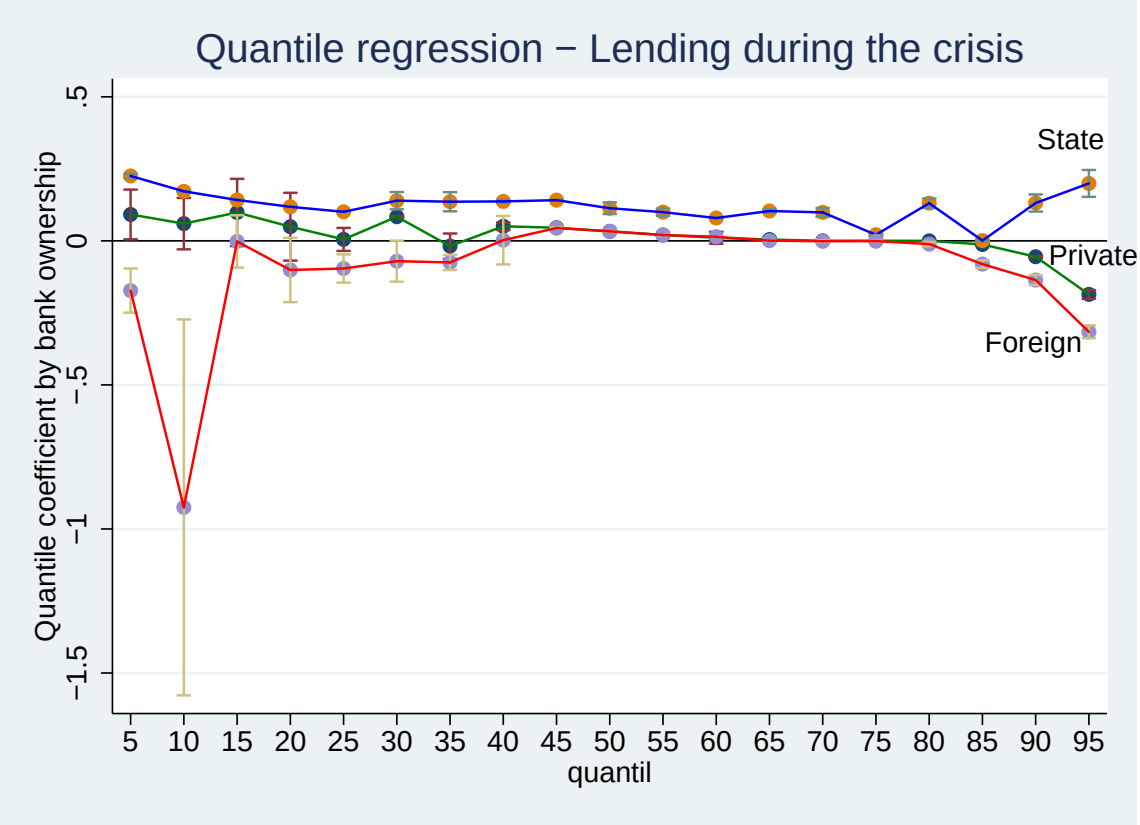
Standard errors, clustered at the locality level, are reported in parentheses. The dependent variable is non-earmarked lending normalized to 2008q4. It is is an average of monthly non-earmarked lending in each quarter. The period range from 2005q1 through 2013q4. Lending is deflated to Brazilian reais of January 2000. State, domestic, and Foreign is the share of locality branches banks that are owned by the state, domestic and foreign banks in 2007q3, respectively. During is an indicator variable for the four quarter from 2008q4 through 2009q3 and Post is an indicator variable for the quarters following 2009q4. All regressions include locality fixed-effects, time fixed-effects. We used as covariates the GDP of each locality and omitted it coefficients.
*** p < 0.01

Tabela 6: quality lending index at local level, from 2005 to 2013

	(1) quality lending index	(2) quality lending index	(3) quality lending index
state.during	-.5552731***		
	(.1413081)		
state.post	.6208337***		
	(.1885595)		
domestic.during		.4126475**	
		(.2056283)	
domestic.post		-.8368102**	
		(.3751034)	
foreign.during			.1698292
			(.1570674)
foreing.post			.4004867
			(.3914602)
N	57784	57784	57784
r2	.0089342	.0094717	.0079863
F	21.55703	21.47659	18.29824

Standard errors, clustered at the locality level, are reported in parentheses. The dependent variable is a quality lending index, the fraction of loan loss provision and lending lagged by one-quarter. The period range from 2005q1 through 2013q4. Lending is deflated to Brazilian reais of January 2000. State, domestic, and Foreign is the share of locality branches banks that are owned by the state, domestic and foreign banks in 2007q3, respectively. During is an indicator variable for the four quarter from 2008q4 through 2009q3 and Post is an indicator variable for the quarters following 2009q4. All regressions include locality fixed-effects, time fixed-effects. We used as covariates the GDP of each locality and omitted it coefficients.
** p < 0.05
*** p < 0.01

Figura 4: This figure shows the quantile regression coefficient for localities during the financial crisis



In each quantile there is a coefficient estimation of $ownership \cdot during$ on lending, where the confidence interval is 5%. Estimates followed the equation (2.4) . The dependent variable is lending normalized to 2008q4. It is is an average of monthly lending in each quarter. The period range from 2005q1 through 2013q4. Lending is deflated to Brazilian reais of January 2000. State, domestic, and Foreign is the share of locality branches banks that are owned by the state, domestic and foreign banks in 2007q3, respectively. During is an indicator variable for the four quarter from 2008q4 through 2009q3. All regressions include locality fixed-effects, time fixed-effects. We used as covariates the GDP of each locality and omitted it coefficients.

Table 7 shows fixed-effects estimates of political alignment on credit . The explanatory variable $state \cdot post$ reflects the marginal effect on lending of localities with a larger share of state-owned branches. The estimation of political alignment, measure as either a continuous variable (margin vote) or indicator variable (dummy of mayor alignment with the federal government) indicate that lending was politically targeted because the marginal effect was positive and statistically significant (coefficient on variable $state \cdot post \cdot mv$ equal to 0.3025 and variable $state \cdot post \cdot dpt$ equal to 0.1709).

Finally, we can conclude that the behavior of local lending after the financial crisis is as follows. Locations with a higher performance by state-owned banks had over-promotion of non-earmarked credit. We also find evidence that there was an worsening in the loan quality and evidence of the lending being politically targeted. This results suggest a possibility of lending misallocation by state-owned banks after the financial crisis.

3.3 Robustness

We proceed with a robustness check that consists of estimating the same models of Section 2.2 for previous periods from our estimations. We aim to verify whether there was a previous trend of a counter-cyclical lending behavior of state-owned banks and a pro-cyclical lending behavior by private-owned banks.

Tabela 7: Lending being political targeted at local level, from 2005 to 2013

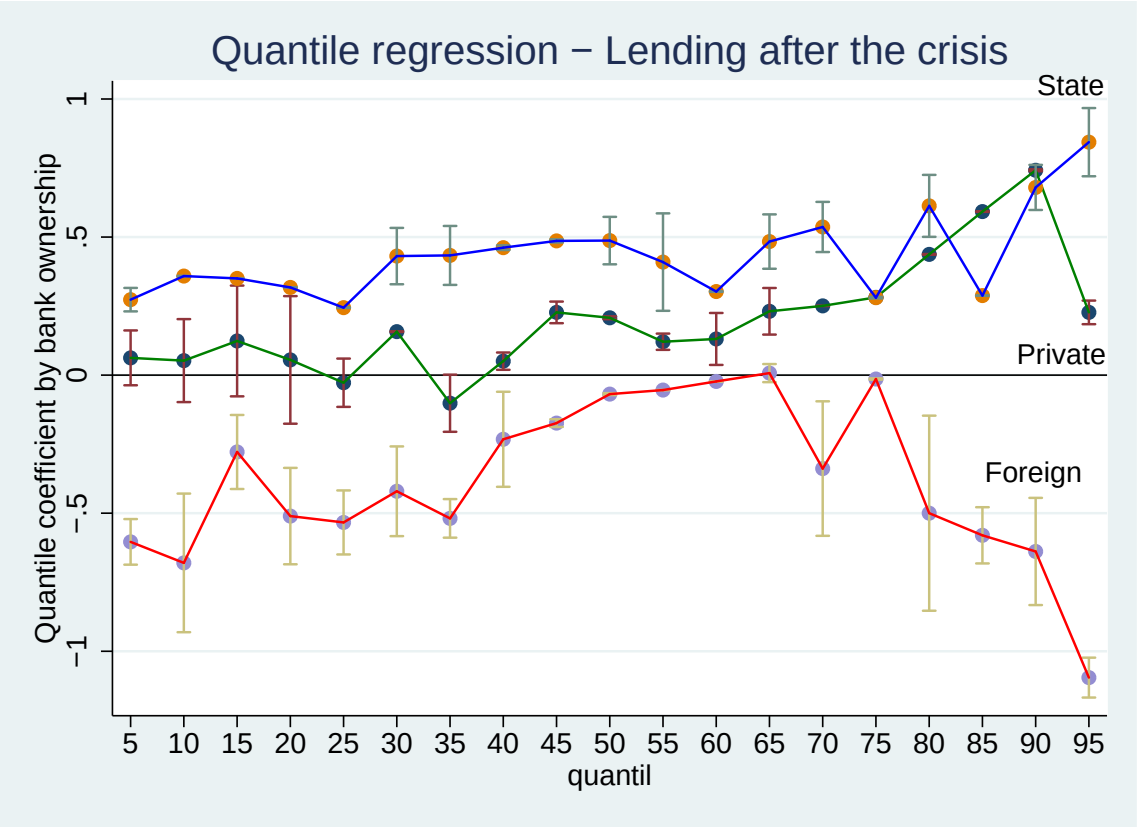
	(1) lending	(2) lending
state.during.mv	.1940743***	
	(.0317988)	
state.post.mv	.3025498***	
	(.0449801)	
state.during.dpt		.0112437
		(.0437819)
state.post.dpt		.1709275**
		(.0851161)
N	93003	93003
r2	.4139475	.4121134
F	200.1463	182.3979

Standard errors, clustered at the locality level, are reported in parentheses. The dependent variable is lending normalized to 2008q4. It is is an average of monthly lending in each quarter. The period range from 2005q1 through 2013q4. Lending is deflated to Brazilian reais of January 2000. State, domestic, and Foreign is the share of locality branches banks that are owned by the state, domestic and foreign banks in 2007q3, respectively. During is an indicator variable for the four quarter from 2008q4 through 2009q3 and Post is an indicator variable for the quarters following 2009q4. mv is a continuous variable of the margin of votes of the last presidential election for the Workers Party, for each quarter. dpt is an indicative variable that is equal to one if some mayor of the locality is of the same party of the president of the republic, and dpt is equal to zero if the opposite. All regressions include locality fixed-effects, time fixed-effects. We used as covariates the GDP of each locality and omitted it coefficients.
** p < 0.05
*** p < 0.01

Table 8 shows fixed-effects panel estimation for lending at the local level from 2001 to 2008. In this placebo test, $during$ assume the value of one from 2004q4 to quarter 2005q4 and $post$ assume the value one from 2005q4 to 2008q4. The results suggest that state-owned banks have not lent countercyclical before the 2008–2009 financial crisis.

However, the results suggest that localities with a higher share of foreign-owned banks had a negative effect on lending from 2005q4 to 2008q4 (coefficient on variable foreign post equal to -0.7084). This could indicate a past trend in lending behavior for foreign-owned banks. But these banks started from 2007Q2 suffering a setback on lending because of the beginning collapse of the mortgage securitization market and several mortgage financing firms in developed countries.

Figura 5: This figure shows the quantile regression coefficient for localities following the financial crisis (after 2009q4)



In each quantile there is a coefficient estimation of $owership \cdot post$ on lending, where the confidence interval is 5%. Estimates followed the equation (2.4) . The dependent variable is lending normalized to 2008q4. It is is an average of monthly lending in each quarter. The period range from 2005q1 through 2013q4. Lending is deflated to Brazilian reais of January 2000. State, domestic, and Foreign is the share of locality branches banks that are owned by the state, domestic and foreign banks in 2007q3, respectively. Post is an indicator variable for the quarteres following 2009q4. All regressions include locality fixed-effects, time fixed-effects. We used as covariates the GDP of each locality and omitted it coefficients.

Tabela 8: Lending at local level, from 2001 to 2008

	(1) lending	(2) lending	(3) lending
state.during	.0529915		
	(.0527485)		
state.post	.0981234		
	(.0720769)		
domestic.during		-.0693723	
		(.0750192)	
domestic.post		.1721026*	
		(.0904455)	
foreign.during			.0568083
			(.0533834)
foreing.post			-.7084571***
			(.1006441)
N	80808	80808	80808
r2	.0733168	.0735911	.0752635
F	84.76996	86.63743	88.97238

Standard errors, clustered at the locality level, are reported in parentheses. The dependent variable is lending normalized to 2004q3. It is is an average of monthly lending in each quarter. The period range from 2001q1 through 2018q4. Lending is deflated to Brazilian reais of January 2000. State, domestic, and Foreign is the share of locality branches banks that are owned by the state, domestic and foreign banks in 2007q3, respectively. During is an indicator variable for the four quarter from 2004q4 through 2005q3 and Post is an indicator variable for the quarters following 2005q4. All regressions include locality fixed-effects, time fixed-effects. We used as covariates the GDP of each locality and omitted it coefficients.

* $p < 0.1$
** $p < 0.05$
*** $p < 0.01$

4 Conclusions

In this paper, we explore the lending behavior of bank ownership during and after the global financial crisis in Brazilian credit market. We found evidence of state-owned banks had a countercyclical lending behavior that could be aligned with the policy of economy stabilization during a financial crisis, while private-owned banks have shown a pro-cyclical lending behavior.

However, the greater the presence of state-owned banks in the localities, the greater the overstimulation of loans and the worsening of loan quality. This show explicit evidence of the negative effect and inefficient of state-owned banks, accordingly to Coleman e Feler (2015), Dinç (2005), Porta, Silanes e Shleifer (2002).

We also find that state-owned banks lending could be associated with a political patronage from politicians in this banks to stimulate credit in localities political alignment with the federal government. But the lendings was of low quality, corroborating the political viewpoint according to which state-owned bank misallocate loans (PORTA; SILANES; SHLEIFER, 2002; DINÇ, 2005; CARVALHO, 2014).

We propose implications and policy insights from our paper. The estimator of panel quantile regression with non-additive term disturbance can help banks shareholders and others stakeholders to examine the association between over-stimulus on lending behavior and worsening of loan quality.

Besides, in countries like Brazil, where there are weak institutional characteristic and high corruption, as stated by (CARSON; PRADO, 2016), state-owned banks demand a sound bank governance to minimize the political patronage over managerial lending decisions (CHEN et al., 2015; ZHU; YANG, 2016; ČIHÁK; DEMIRGÜÇ-KUNT, 2013; JOHN; MASI; PACI, 2016)

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