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# Effects of State-Owned Banks' Programs to Stimulate Credit: evidence from Brazil

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Non-Technical Summary

This paper examines the effects of two programs aimed at ameliorating credit conditions and expanding access to credit to individuals and financially constrained firms in Brazil ("credit programs"). These initiatives are carried out by Brazilian federal government-owned banks ("federal banks") and start in April 2012. Both programs include the reduction of lending rates, as an attempt of the Brazilian government at the time to trigger the pass-through of a previous monetary policy easing starting in 2011, the extension of loans terms and the raise of credit limits to the targeted borrowers. I focus on the impact of these credit policies on the corporate credit market and evaluate the effectiveness of this socially motivated credit policy conducted by state-owned banks. Moreover, I investigate the impact of this stimulus to credit on the decisions of profit-oriented private domestic and foreign banks.

The paper documents that federal banks manifest their social motivation by expanding their credit operations with smaller firms in Brazilian states with lower GDP at a relatively higher growth rate. Nevertheless, federal banks accomplish this by increasing their credit relationships with riskier firms. In response to federal banks' credit programs, foreign banks follow this competitive pressure, but expand credit operations in Brazilian states with higher GDP and focus on less risky small firms, consistently with the "cherry-picking" behavior described in the literature.

Concurrently, private domestic banks are affected twice, not only by the competitive threat introduced by federal banks but also by the subsequent competitive move of foreign banks. However, I find that private domestic banks still expand their credit operations at a higher rate than foreign banks, especially by focusing on safer and profitable credit operations, such as less risky SMEs in Brazilian states with lower GDP and larger firms all over the country. These outcomes lead to an indirect increase in private domestic banks' market share in the large firms' segment.

Sumário Não-Técnico

Este artigo examina os efeitos de dois programas realizados com o objetivo de melhorar as condições e expandir o acesso a crédito para indivíduos e empresas com restrições financeiras no Brasil ("programas de crédito"). Tais iniciativas são realizadas por bancos brasileiros de propriedade do governo federal a partir de abril de 2012. Ambos os programas incluem a redução das taxas de juros, como uma tentativa do governo brasileiro, à época, de estimular o repasse de política monetária expansionista iniciada em 2011, a extensão dos prazos de empréstimos e o aumento dos limites de crédito para tomadores de crédito específicos. Eu foco no impacto dessas políticas no mercado corporativo de crédito e avalio a eficácia dessa política de crédito com motivações sociais conduzida por bancos estatais. Ademais, eu investigo o impacto desse estímulo ao crédito nas decisões de bancos nacionais e estrangeiros privados com fins lucrativos.

O artigo documenta que os bancos federais exercem sua motivação social ao expandir suas operações de crédito relativamente mais com empresas menores em estados com PIB mais baixo. No entanto, os bancos federais atingem este objetivo aumentando as relações de crédito com empresas mais arriscadas. Como resposta aos programas de crédito dos bancos federais, os bancos estrangeiros reagem a essa pressão competitiva concentrando-se em operações de crédito menos arriscadas em estados brasileiros com PIB mais alto, o que resulta numa escolha seletiva de tomadores de empréstimo, conforme descrito na literatura.

Em paralelo, os bancos domésticos privados são afetados duas vezes, não apenas pela ameaça competitiva introduzida pelos bancos federais, mas também pelo movimento competitivo subsequente dos bancos estrangeiros. No entanto, os bancos domésticos privados ainda expandem suas operações de crédito a uma taxa mais alta do que os bancos estrangeiros, principalmente concentrando-se em operações de crédito mais seguras e lucrativas, como pequenas e médias empresas menos arriscadas nos estados brasileiros com menor PIB e empresas maiores em todo o país. Esses resultados levam a um aumento indireto da participação de mercado dos bancos domésticos privados no segmento de grandes empresas.

Effects of State-Owned Banks' Programs to Stimulate Credit: evidence from Brazil[1,2]

Emerson Erik Schmitz[3]

Abstract

This paper examines the impact of two programs carried out by Brazilian federal banks aimed at ameliorating credit conditions and expanding access to credit to individuals and SMEs. These initiatives involve the raise of credit limits, extension of loan terms and the reduction of lending rates to targeted borrowers. I study the consequences of these credit policies on banks' risk-taking behavior and credit allocation in the corporate credit market. I document that federal banks increase credit operations relatively more with small firms all over the country, especially in Brazilian states with lower economic output, although loading more risky firms to their portfolios. In response to federal banks' programs, foreign banks enlarge the provision of credit to less risky small firms in Brazilian states with higher economic output, consistently with a "cherry-picking" behavior, while private domestic banks focus on keeping safer and profitable credit operations, increasing their market share in the large firms' segment. Overall, my findings suggest that federal banks' initiatives to expand the access to credit in Brazil have a significant impact on the credit allocation to SMEs and indirect effects on the credit allocation to larger firms.

1. Introduction

High costs of funding may be especially harmful for small and medium enterprises (SMEs). The literature on this subject shows that these firms face more difficulties in obtaining credit than larger firms do (Schiffer and Weder, 2001; Beck and Demirgüç-Kunt, 2006), which might prevent them from flourishing, thereby retarding economic development. Governments, aware of this, may act in several ways in order to overcome market failures and promote the growth of SMEs, for instance by granting subsidized credit to this subset of firms. In addition, government-owned institutions may curtail profit margins by reducing interest rate spreads, one of the main components of the cost of credit[4].

This paper examines the effects of two programs aimed at ameliorating credit conditions and expanding access to credit to individuals and financially constrained firms in Brazil ("credit programs"). These initiatives are carried out by Brazilian federal government-owned banks ("federal banks") and start in April 2012. Both programs include the reduction of lending rates, as an attempt of the Brazilian government at the time to trigger the pass-through of a previous monetary policy easing starting in 2011, the extension of loans terms and the raise of credit limits to the targeted borrowers. I focus on the impact of these credit policies on the corporate credit market and evaluate the effectiveness of this socially motivated credit policy conducted by state-owned banks. Moreover, I investigate the impact of this stimulus to credit on the decisions of profit-oriented private domestic and foreign banks.

I study banks' risk-taking behavior and credit allocation after the launching of state-owned banks' initiatives to increase the supply of credit through the lens of the ownership of banks. I choose this standpoint for several reasons, which I relate to their respective literature. First, I address the role of government ownership of banks in order to ascertain whether federal banks' credit policies are consistent not only with the social view of these institutions (Atkinson and Stiglitz, 1980; Stiglitz and Weiss, 1981; Greenwald and Stiglitz, 1986; Stiglitz, 1993), but also with the agency (Tirole, 1994) and political interpretations (Shleifer and Vishny, 1994, 1998; Sapienza, 2004).

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[4] The other main components of credit are the following: administrative costs, default rates, compulsory deposit with the Central Bank, and taxes.

Second, my research refers to differences in the screening and monitoring of credit operations depending on the ownership of banks. In this regard, most of the literature supports the idea that state-owned banks in emerging markets are less efficient than private domestic or foreign banks (La Porta, Lopez-de-Silanes, and Shleifer 2002; Barth, Caprio, and Levine 2004; Lin and Zhang, 2009; Micco et al., 2007). Third, I am also concerned with the impact of foreign banks on domestic banking systems. The literature on this topic suggests that acquiring information may be more difficult to foreign banks, which usually rely on "hard information", while domestic banks typically have long-standing relationship with borrowers, which enables them to absorb borrowers' "soft information" (Detragiache et al., 2008). Consequently, the higher cost of acquiring information for foreign banks may incentivize them to cherry-pick" or "cream-skim" more profitable borrowers (Dell'Ariccia and Marquez, 2004, Gormley 2010), especially in countries with weaker public institutions and where these banks have a small portion of the market (Claessens and Van Horen, 2013, 2014), which is especially the case of Brazil.

Unlike earlier research, which has generally relied on cross-country analyses to examine the role of government banks, I address this subject using data from one single country. Particularly, Brazil offers an interesting setting in which to conduct this research. It is among the economies with the highest interest rate spreads in the world (Gelos, 2006), in which the risk level of firms plays a substantial role. The country has also a well-developed banking system, with the presence of large nationwide state-owned banks, several and important private groups, while foreign financial institutions also hold a significant market share. Still, Brazil has an uneven spatial distribution of credit allocation, which allows us to observe the discrepancies in credit distribution across its regions.

Even though I address this issue using data from one specific economy, my findings may contribute to the overall understanding of the consequences of the use of state-owned banks to reduce overall lending rates, stimulate bank competition, and increase the supply of credit. Consequently, other emerging countries with a significance presence of state-owned banks, developed countries whose government-owned financial institutions increased their market share in the wake of the 2008 financial crisis, and countries with large economic imbalances may also benefit from this analysis.

To empirically investigate the effects of the credit programs carried out by federal banks on the Brazilian corporate credit market, I rely initially on an event study. I compare the growth in the outstanding credit granted by federal, private domestic and foreign banks after the launching of state-owned banks' credit programs. I use federal banks and private domestic banks as my groups of interest, which I relate to the base group, mainly composed of foreign banks. Then, I exploit the heterogeneity of banks' credit behavior across different standpoints, by splitting the sample according to firm size, regional economic output, and firms' credit risk rating. These comparisons between subsamples allow me to document the social motivation of federal banks in broadening their customers' base and to test the subsequent risk-taking behavior of these governmental institutions. Additionally, I assess the effects of this induced boost in bank competition on the decisions of other players to either follow state-owned banks' credit policy or to sacrifice market share.

Next, I use two different treatment intensity analyses to complement the first model. First, I test the impact of the state-owned banks' credit stimulus on bank concentration, measured by the Herfindahl-Hirschman index (HHI). I use the median of the credit market share of federal banks in 2011, before the changes in federal banks' credit policies, to capture the intensity of the treatment. The underlying idea of this methodology is to test whether localities with larger share of federal banks experience higher bank concentration after the launching of state-owned banks' initiatives to stimulate credit, depending on the behavior of other banks. Second, I relate the credit growth of banks operating in Brazil in the aftermath of the credit programs, by ownership, to the share of Brazilian states in the national GDP in 2011. With this strategy, I intend to examine whether each set of banks, in absolute terms, experiences changes on its credit evolution throughout the country. I execute both approaches with the whole sample, and then separately using the SME and large firms' subsamples.

I perform my study using a unique aggregated dataset extracted from the Brazilian Credit Risk Bureau (SCR), administered by the Central Bank of Brazil (BCB). My results are in accordance with the overall literature on the ownership of banks. First, I document, as expected, that federal banks manifest their social motivation by expanding their credit operations with smaller firms in Brazilian states with lower GDP at a relatively higher growth rate. Nevertheless, federal banks accomplish this by increasing their credit relationships with riskier firms. In response to federal banks' credit programs, I find that foreign banks follow

this competitive pressure, but expand credit operations in Brazilian states with higher GDP and focus on less risky small firms, consistently with the "cherry-picking" behavior described in the literature.

Concurrently, private domestic banks are affected twice, not only by the competitive threat introduced by federal banks but also by the subsequent competitive move of foreign banks. However, I find that private domestic banks still expand their credit operations at a higher rate than foreign banks, especially by focusing on safer and profitable credit operations, such as less risky SMEs in Brazilian states with lower GDP and larger firms all over the country. These outcomes lead to an indirect increase in private domestic banks' market share in the large firms' segment.

Concerning the effects on bank concentration, my findings partially corroborate the hypothesis that localities with larger share of federal banks experience higher bank concentration after the credit programs. This pattern is more prominent in the SME segment within Brazilian states with lower GDP, where the presence of those banks is already higher. However, in Brazilian states with higher GDP, I do not find significant results in the SME segment, as long as foreign banks respond to the competitive pressure exerted by federal banks in these regions. In contrast, the concentration index drops in the large firms' segment, since private domestic banks focus on safer credit operations all over the country.

Finally, when it comes to the behavior of each set of banks, in absolute terms, throughout the country after the introduction of federal banks' credit programs, my results confirm that the impact of these initiatives is significant for the credit allocation in the SME segment, and only indirect for the larger firms' segment. While all three sets of banks expand their credit operations to larger firms in the aftermath of the credit programs the higher the Brazilian state share in the national GDP, the coefficients for smaller firms show a different pattern. Both federal and private domestic banks increase their outstanding credit at higher rates the lower the regional economic output. Hence, federal banks behave consistently with their social motivation, whereas private banks results are in accordance with the higher competitive pressure experienced in higher GDP states.

Overall, my findings suggest that the credit programs conducted by government-owned banks have important effects on the corporate credit market. This public policy seems to particularly affect the credit allocation in the SME segment, whose firms display a greater

range of credit ratings. This special feature of smaller firms leads to different banks' reactions, according to their intrinsic characteristics, which influence credit allocation across a country with significant imbalances. On the other hand, the impact on larger firms' segment is limited and indirect, potentially because of the lower interest rates margins usually observed in this segment.

The remainder of this paper is organized as follows. Section 2 introduces the institutional and economic background of the Brazilian corporate credit market. Section 3 describes the data sources, provides descriptive statistics and a data preview. Section 4 presents the methodology and reports empirical results. Section 5 discusses robustness checks, and Section 6 concludes.

2. Institutional and Economic Background

2.1. The Brazilian corporate credit market

The credit market in Brazil is characterized by the existence of two distinct segments, each of them with its own dynamics: the earmarked credit market, with interest rates and sources of funding defined by law, whose credit must be granted to the real estate, agribusiness, and infrastructure sectors; and the non-earmarked credit market (hereafter "free corporate credit market"), in which funding sources and interest rates are freely established by banks. Additionally, one institution plays a special role in the Brazilian banking system: *Banco Nacional de Desenvolvimento Econômico e Social* (BNDES), a federal government-owned developing bank, which finances its operations mainly with a subsidized source of funding[5]. All credit granted by the BNDES is counted as earmarked credit, although other banks, including private ones, may act as intermediaries in the provision of credit to final borrowers. Given the significant influence of the BNDES on the earmarked credit market, and my interest in the risk-taking behavior of banks, my research is focused on the free corporate credit market.

Besides the BNDES, Brazil has four other federal banks: *Banco do Brasil* (BB), a multiple bank with stocks publicly traded; *Caixa Econômica Federal* (CEF), a savings bank

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[5] Funding is provided by the Brazilian Treasury, which is compensated with a subsidized interest rate given by the TLP - *Taxa de Longo Prazo*.

entirely controlled by the Brazilian treasury; *Banco do Nordeste*, a regional development bank focused on the northeast region; and *Banco da Amazônia*, a commercial bank which aims to promote the development of the Amazon region. Since *Banco da Amazônia* and *Banco do Nordeste* are regional banks that operate mainly two specific constitutional funds[6] to finance projects at their respective areas of activity, I also exclude both institutions from my sample.

Concerning banks controlled by Brazilian state governments (hereafter "state banks"), there are still five financial institutions in operation (*Banrisul*, *BRB*, *Banese*, *Banpará*, and *Banestes*), which have survived a privatization program aimed at restructuring and reducing the presence of these banks during the 1990s. Brazil has an important private banking sector as well. Taking December 2011 as a baseline, this segment included 94 private domestic banks, 68 foreign banks, and three private banks partially owned by foreign shareholders (hereafter "foreign-share banks").

2.2. Federal banks' credit programs

To trigger the pass-through of the concurrent monetary policy easing starting in 2011 and induce bank competition, Brazilian federal banks, almost concomitantly, present two programs aiming at stimulating and expand the access to credit in April 2012. These initiatives consist of reducing rates, extending loan terms, and increasing credit limits to targeted borrowers (individuals and SMEs). First, BB launches the "*BOMPRATODOS*" program ("Good for Everyone") and, subsequently, CEF releases the "*Caixa Melhor Crédito*" program ("Caixa Best Credit").

Both programs[7] involve broaden initiatives to increase the supply of credit to individuals and SMEs, including the reduction of lending rates, as an attempt of the Brazilian

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[6] *Fundo Constitucional de Financiamento do Norte* (FNO) and *Fundo Constitucional de Financiamento do Nordeste* (FNE). The credit provided with these sources of funding are classified as earmarked credit.

[7] BB and CEF are two different legal entities, with distinct purposes, advertising and credit policies. For this reason, each bank launches a unique credit program developed specifically to their respective target-audiences. Information about both credit programs is obtained from the following banks' annual reports: BB 2012 Annual Report (available at www.bb.com.br/docs/pub/siteEsp/ri/eng/dce/dwn/annualreport2012.pdf) and Caixa 2012 Managerial Report (available at http://www.caixa.gov.br/Downloads/caixa-demonstrativo-financeiro/ManagementReport_2012.pdf). Additional and more detailed information about "BOMPRATODOS" program can also be found in BB quarterly Management Discussion and Analysis (MD&A) reports published as from 2012:Q2, available at https://ri.bb.com.br/en/financial-information/results-center/. Concerning "*Caixa Melhor Crédito*" program, additional information can also be obtained from CEF

government[8] at the time to trigger the pass-through of a previous monetary policy easing starting in 2011, the extension of loans terms and the raise of credit limits to the targeted borrowers. In regard specifically to SMEs, these initiatives result in lower interest rates for working capital credit lines and investment loans, varying in accordance to credit recipients' risk and relationship profile. Combined with the measures to attract additional borrowers, BB and CEF programs also involve the provision of financial education to support new customers.

After the introduction of these programs, the average interest rate spread[9] in the free corporate credit market drops from approximately 15 p.p. before April 2012 to around 12 p.p. at the end of 2012, as shows Figure 1. In order to verify whether private domestic and foreign banks follow the reduction in interest rate spread carried out by federal banks, I proxy banks' lending rates by the average return of banks' credit operations using balance sheet information[10], calculated as follows:

$$Ret_{i,t} = Rev_{i,t}/(Credit_{i,t-1} + \Delta LLP_{i,t}), \tag{1}$$

where $Ret_{i,t}$ is the return of credit operations of bank i in quarter t; $Rev_{i,t}$ are the revenues obtained from credit operations by bank i in quarter t; $Credit_{i,t-1}$ is the outstanding credit position of bank i in quarter $t-1$; and $\Delta LLP_{i,t}$ is the difference in bank i loan loss provisions (LLP) between quarters t an $t-1$.

Figure 2 shows the average return of banks' credit operations from 2011 to 2014 to the three main bank ownership types: federal banks, private domestic banks, and foreign controlled banks. Interestingly, the average return of federal banks' credit operations drops significantly more in 2012 and 2013, while the average returns of private and foreign banks' credit operations decline less vigorously during these years. These numbers indicate that lending rates drop in the aftermath of the introduction of federal banks' credit programs for

all banks. However, it suggests that federal banks' lending rate cuts are not completely followed, in magnitude, by other banks, on average.

I also investigate whether the decision of federal banks to increase the supply of credit and reduce lending rates is anticipated by market agents. Then, I look at the behavior of BB stock prices[11] during the months surrounding the announcement of the "*BOMPRATODOS*" program. Figure 3 compares BB stock prices (BBAS3) with the *Ibovespa* index, both equalized to 100 at the beginning of 2012. BB stock prices experience almost a perfect correlation to the *Ibovespa* index until the end of March, which implies that investors are not aware of the initiatives to reduce lending rates. However, from April onwards, BB shares start to underperform in comparison to the market index, reflecting the realization among BB shareholders that lower lending rates and a more comprehensive customer base could bring lower returns and higher risk to BB credit operations.

3. Data

3.1. Data sources

I address the impact of the federal banks' credit programs on corporate credit market using quarterly information extracted from the Brazilian Credit Risk Bureau (SCR[12]), a comprehensive proprietary dataset administrated by the BCB. For confidentiality reasons, I use aggregated data in several dimensions. First, the credit information is separated by the two informal segments of credit in Brazil - earmarked and free corporate credit markets. Then, for each segment the data is divided by the 26 Brazilian states and the Federal District. Next, the data is split-up into bank ownership types, according to the following categories[13]:

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[11] CEF is 100% owned by the Brazilian Treasury and does not have publicly traded stocks.

[12] The SCR gathers information on all outstanding loans above a threshold of 1,000 Brazilian Real (BRL) for all banks operating in the country. 1,000 BLR was worth approximately 600 USD at the beginning of 2011, and 375 USD at the end of 2014.

[13] The dataset comprising bank ownership is public available at the BCB's website and takes into consideration all changes in bank control over the sample period, which are not substantial enough to affect the results. The classification of banks as foreign controlled follows the related literature (De Haas and van Lelyveld, 2010; Claessens and van Horen, 2013).

federal banks, state banks[14], private domestic banks, foreign-controlled banks[15], and foreign-share banks[16].

Beyond this, the data is allocated into four sets of firms ordered by annual gross revenues and assets[17]: micro, small, medium, and large firms. Finally, using the rating categories defined in Resolution 2,682/1999, which determines that financial institutions should classify their credit operations on their own discretion into progressive levels of risk[18], the dataset is divided into credit operations with "lower risk" (ratings from AA to C) and "higher risk" (ratings from D to H).

I select a sample period that runs from 2011:Q1 to 2014:Q4. This period takes into account the time in which the lower lending rates are in effect as part of federal banks' credit programs and rules out the potential effects of the 2008 global financial crisis. Additionally, this time frame considers the introduction of the new credit registry in Brazil in 2011, which establishes as mandatory information such as funding sources and firms' sizes. I end up with an unbalanced panel data. The final sample excludes lines with less than 15 operations for privacy concerns, and contains 12,177 observations, representing a significant share of the Brazilian corporate free credit market.

I merge this dataset with banks' balance sheets, which I aggregate by bank ownership in order to fit the characteristics of the credit data. To perform this merging, I use bank ownership information, comprising all changes in ownership during the sample period[19]. Local GDP information is gathered from the Brazilian Institute of Geography and Statistics (IBGE) regional accounts. Finally, I take the 2010 presidential poll's outcomes from the Brazilian Supreme Electoral Court (TSE).

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[14] Banks controlled by a Brazilian state.
[15] Financial institutions with greater than or equal to 50% voting capital share held by foreigners.
[16] Financial institutions with foreigners holding greater than 10% and lower than 50% of voting capital share.
[17] According to Complementary Law 123, 2006, firms' sizes are attributed by their annual gross revenues and assets: *i*. micro firms, equal to or less than 360,000 BRL; *ii*. small firms, between 360,000 BRL and 3,600,000 BRL; *iii*. medium firms: between 3,600,000 BRL and 300,000,000 BRL, provided that total assets do not exceed 240,000,000 BRL; and *iv*. large firms, above 300,000,000 BRL, provided that total assets exceed 240,000,000 BRL (Ordinary Law 11,638, 2007).
[18] These ratings are limited by the days of arrears of each credit operation. AA or A – 0 or less than 15 days; B - between 15 and 30 days; C - between 31 and 60 days; D - between 61 and 90 days; E - between 91 and 120 days; F - between 121 and 150 days; G - between 151 and 180 days; and H – above 180 days.
[19] Banks' balance sheet and ownership information are publicly available on the BCB's website.

3.2. Descriptive statistics

I first provide the summary statistics of banks' balance sheet information in Table 1. For each type of bank ownership in Brazil[20], I present the statistics of the total assets[21], liquidity[22], capital ratio[23] and retail funding[24] for the whole sample period. Concerning total assets, both federal banks are relatively large financial institutions, whose sizes are comparable to the largest private domestic and foreign controlled banks. We also observe that there is a substantial number of smaller financial institutions within private domestic and foreign banks groups, given the small total assets' means of the respective samples. Lastly, state banks and banks with foreign shareholders are few and less representative, in aggregated terms.

Concerning other banks' balance sheet information, there is no significant variation in liquidity between bank ownership types. However, there are substantial differences in retail funding and capital ratio indices. First, while federal, foreign share, and state banks are usually commercial banks that rely relatively more on deposits to fund their credit operations, there are several investment banks, who do not receive deposits, within the group of private and foreign banks. Second, smaller financial institutions in Brazil are typically more capitalized than larger banks as a signaling of solvency, which move upwards the capital ratio means for private, foreign controlled and foreign share banks.

The dispersion of the descriptive statistics for some groups of banks may harm the interpretation of figures. This is because some very large banks might have very different characteristic from the remaining banks within the same bank ownership type. To overcome this setback, I provide in Tables 2A to 2C the weighted average, by the share of each banks' assets in total assets, of the liquidity, retail funding, and capital ratio indices, and show how they evolve over the sample period.

For instance, the average level of capitalization (capital ratio) of private banks is much closer to the observed for federal banks when we take into account the respective weighted averages. When it comes to the time variation, we observe that federal and foreign banks

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[20] Except BNDES, *Banco da Amazônia*, and *Banco do Nordeste*.
[21] I subtract from each bank total assets' account the value of off-balance operations.
[22] Liquidity is defined as (cash + Interbank liquidity operations + securities and derivatives)/total assets.
[23] Capital ratio is defined as equity/assets.
[24] Retail funding is defined as (cash deposits + savings + term deposits)/total deposits.

amplify their capital leverages[25], while private domestic banks maintain their capital ratio figures relatively stable.

Finally, I provide in Tables 3A and 3B the evolution of total credit and total assets information over the sample period, by bank ownership type. First, it is noticeable that federal, private domestic and foreign banks account for more than 95% of the total credit provided in the Brazilian corporate credit market. Second, the relationship between total credit and total assets is relatively low for all classes of banks, for three reasons: the dataset concerns only the free corporate credit market and does not takes into account earmarked credit operations; the data is aggregated, which leads to some degree of missing information; and the persistence of a long standing low depth of intermediation of Brazilian banks in comparison to the US and Europe (Belaisch, 2003).

3.3. Data preview

In this section, I provide an overview of the evolution of banks' lending behavior in the Brazilian corporate credit market. I focus my analysis on the non-earmarked (free) segment, as mentioned above. Starting with bank ownership type, Figure 4 shows the progress of banks' market share given this segmentation. Interestingly, federal banks increase their market share from around 28% before the credit programs to more than 35% at the end of 2014. This surge in the presence of federal banks is followed by an almost symmetric decline in the presence of private domestic banks, whose market share drops from 49.0% to 41.7% in the same period. Foreign banks, however, do not show any significant variation after the initiatives to increase the supply of credit carried out by federal banks.

The symmetrical movement of federal banks and private domestic banks may indicate a difference in these banks' credit policies. In order to come to a more accurate assessment of this possibility, Figure 5 illustrates banks' market share in the SME segment of the free

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[25] Although we observe an increasing leverage for federal banks, measured by equity/assets, these institutions manage to maintain reasonable capital requirement indices for the sake of complying with Basel rules over the sample period. This is possible mainly through federal banks' issuance of convertible financial instruments, which are liabilities with characteristics of capital that could be classified as Tier 1 complimentary capital. Additionally, the issuance of these hybrid bonds contributes to relatively stable risk classification given by international rating companies, in accordance with information obtained from BB investors' relation website (https://ri.bb.com.br/en/).

corporate credit market, since these firms are targeted by federal banks' credit programs. The graphical analysis confirms the different behavior of banks towards SMEs. While the SMEs' credit market share for private banks decline from 55.1% in 2012:Q1 to 44.8% in 2014:Q4, federal banks increase their participation from 22.0 to 32.7% in the same period. The market share of foreign banks remains flat through all the sample period.

Now, I turn to the analysis of banks' credit policies according to the size of Brazilian states' economies. I divide Brazilian states into levels of economic output: "higher GDP" and "lower GDP" states[26]. Figure 6A presents the graph for the market share in Brazilian states with lower economic output, and Figure 6B presents the graph for the subsample of Brazilian states with higher economic output, irrespectively of firm size. The market share of federal banks increases substantially in lower GDP states after the launching of their credit programs, private domestic banks' participation declines almost as much, while foreign banks slightly lose market share. We observe similar movements in the sample cut of higher GDP states.

Next, in order to explore the potentially different risk-taking behavior of banks, Figure 7 presents the graph of credit operations classified with ratings from D to H (higher risk). Federal banks increase their share in this risky credit segment, rising from 16.5% in 2012:Q1 to 33.4% in 2014:Q4. Foreign banks also present a slight growth in the market share of riskier firms. On the other hand, private domestic banks reduce their share in risky operations from 63.6% in 2012:Q1 to 43.7% in 2014:Q4.

4. Methodology and results

4.1. Banks' credit growth – relative behavior

4.1.1. Empirical strategy

This paper aims to evaluate the lending behavior of banks operating in Brazil in the corporate credit market after the introduction of federal banks' programs to stimulate credit in April 2012. This unique event allows me to empirically test the consequences to credit allocation of a governmental directive carried out by means of state-owned banks. To address this, I first rely on an event study in which I compare the credit growth granted by federal,

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[26] I present the reasoning to divide the sample into lower and higher GDP states in the methodological section.

private domestic and foreign banks after the launching of the programs to increase the supply of credit in Brazil.

My basic model is the following:

$$Ln\ credit_{b,l,s,r,t} = \beta_0 + \beta_1 Post_t + \beta_2 Fedbanks_b + \beta_3 Privbanks_b + \beta_4 Post_t * Fedbanks_b + \beta_5 Post_t * Privbanks_b + \varphi Bank_{b,t} + \delta_{t,s,r,l} + \varepsilon_{b,l,s,r,t}\ , \tag{2}$$

where $Ln\ credit_{b,l,s,r,t}$ is the natural logarithm of the outstanding credit granted by bank ownership type b, in the locality (Brazilian state) l, to the set of firms of size s, classified with credit risk r, at time (quarter) t. $Post_t$ is a dummy variable that takes the value one from 2012:Q2, when firms began to have access to reduced lending rates, extended loan terms, and higher credit limits as a consequence of the federal government banks' programs to increase the supply of credit in April 2012, and zero otherwise.

Although the source of exogenous variation that I take into account is endogenous to federal banks, I am particularly interested in analyzing their conduct in relation to the theoretical view of government ownership of banks. Then, I use the dummy $Fedbanks_b$, which takes the value one for federal banks and zero otherwise, to specify this set of banks as one of my groups of interest. Nevertheless, the use of federal banks as my unique "treatment group" does not allow me to make inferences about the lending behavior of other banks operating in the Brazilian corporate credit market. It could be the case that private domestic banks or foreign banks react differently to the new credit policy introduced by federal banks, either following it or responding somehow differently to the new competitive threat. To account for this possibility, I use the dummy $Privbanks_b$, which takes the value one for private domestic banks and zero otherwise.

I bring both $Fedbanks_b$ and $Privbanks_b$ into interaction terms with $Post_t$, whose respective coefficients[27] provide an estimate of the difference between the outstanding credit growth of federal banks and private domestic banks and other banks operating in Brazil in the period subsequent to the introduction of federal banks' credit programs. In this setup, I run an event study with two groups of interest (federal banks and private domestic banks)

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[27] The Log-Linear model is used to capture the outstanding credit growth rates after the introduction of federal banks' credit programs. The difference between the natural logarithms of a variable Y in times t and t-1, for instance, is approximately the percentage variation of Y, which is given by the coefficient of $Post_t$ in specification (2). Then, the interactions of $Post_t$ with dummies for bank ownership provide the differences in credit growth, in percentage points, between these categories and the control group.

while my base group is the set of banks under foreign control, banks with a significant foreign share or banks owned by a Brazilian state. Given that the market shares in the Brazilian corporate credit market of the last two banks are negligible, I henceforth refer to my control group as "foreign banks".

Since I explore differences in the lending behavior between classes of bank ownership, I also control for the aggregated and specific characteristics of these set of banks. To fit these variables to the aggregated feature of my bank ownership-firm size credit information, I combine banks' balance sheets by bank ownership type and produce unique measures of log of total assets[28], liquidity, retail funding and capital ratio ($Bank_{b,t}$)[29,30].

I use the log of total assets to control for the size of banks, because larger banks account for most of the outstanding credit in the corporate credit market. I control for liquidity because banks in Brazil usually maintain significant government bond portfolios, of which the short-term and post-fixed income bonds are especially liquid and can be used to expand credit operations. Variations in credit supply could also have been caused by an increase in retail funding operations, due to changes in bank competition on the liability side. Lastly, I consider the capital ratio because well capitalized banks have more autonomy to increase credit operations without hampering their solvency indicators.

I use different approaches of group fixed effects to account for unobserved variations in my sample, which I introduce one by one. I start by controlling for time fixed effects (δ_t) to take into consideration any time variation, such as macroeconomic factors that could affect banks and firms. This control also captures the effect of the unexpected monetary inflection that took place in August 2011, which preceded the launching of credit programs.

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[28] The log of total assets refer to the logarithm of the total banks' assets.

[29] Given the significant variation of liquidity, retail funding, and capital ratio indicators within bank ownership types, I use as control the weighted average, by the share of each banks' assets in total assets, of these indices, as discussed in section 3.2.

[30] These variables mainly capture the differences in banks' outstanding credit levels and are also important to the correct comparison of credit growth rates between different types of bank ownership after the programs to stimulate credit, given that all classes of banks are balanced by their main characteristics. I do not interact the vector $Bank_{b,t}$ with $Post_t$ because it would add endogeneity to my model. These new interaction terms would capture most of the variation in banks' credit growth. The objective of the model is to identify differences in banks' credit allocation and risk-taking behavior, whose changes intrinsically depend on the decision of banks to raise funds and manage capital requirements. Therefore, I do not intend to rule out the variation of these variables before and after federal banks' credit programs and identify only the residual differences, as long as they are part of the explanation.

As it is crucial to prevent the classical endogeneity problem caused by simultaneity in specifications involving supply and demand for credit, I need to disentangle "firms' borrowing channel" from the "banks' lending channel", which I intend to isolate. To account for this, I add grouped fixed effects, initially by considering firms based on their size, which takes into consideration the unobserved differences in credit demand by firms of different sizes. However, as credit demand by firm sizes could have varied over time – for instance, because of public policies to promote small businesses during a specific period – I test the interaction between time and grouped fixed effects based on firm size ($\delta_{t,s}$).

It is also reasonable to argue that differing credit demand by firm size could also have varied according to firms' credit risk ratings. Then, I go one step further and use the interaction of time and grouped fixed effects based on firm size and credit risk ($\delta_{t,s,r}$). Lastly, the credit demand may still have been different throughout the country, which brings me to my preferred fixed effect approach: the interactions among time and grouped fixed effects based on firm size, credit risk and locality ($\delta_{t,s,r,l}$).

My time-firm size-credit risk-locality fixed effects' strategy resembles the identification strategy introduced by Khwaja and Mian (2008), but it differs from their model because I use aggregated data. Instead of unique firms that have credit relationships with at least two banks, I consider groups of firms (by size) with different credit risk ratings in each locality who have credit relationships with at least two bank ownership types at a given time. My strategy is also related to the methodology developed by Degryse et al. (2019), who construct and test a more comprehensive version of the Khwaja and Mian (2008) model, relying on a broadened sample of firms of the same size, from the same industry, and with headquarters at the same locality, that borrow from at least two different classes of banks.

Although the aggregated feature of my dataset carries potential disadvantage of not accounting for individualized bank-firm relationships, my results are still very informative. This is because the Brazilian corporate credit market is highly concentrated, such that shocks initiated at large institutions may reverberate into the whole market (Blank, Buch, and Neugebauer, 2009). This hypothesis is consistent with the concept of granular origins of aggregated fluctuations, developed by Gabaix (2011), in which individual firms are responsible for a significant part of aggregated movements.

More specifically, my strategy is related to the methodology developed by Amiti and Weinstein (2013), who take into consideration market composition to match aggregated bank lending and firms' borrowing. These authors estimate granular bank-supply shocks, applying Gabaix's (2011) concept to the banking industry. Additionally, their method accounts for a potential drawback of Khwaja and Mian's (2008) methodology, which can be violated in samples with asymmetric lending (Degryse et al., 2019), as is the case in Brazil. Therefore, using individualized data, but applying Amiti and Weinstein`s (2013) weighting procedure, could lead me to results close to those that I find with aggregated data, giving the characteristics of the Brazilian corporate credit market.

Finally, I cluster the errors by bank ownership, locality, firm size and time, because the Brazilian corporate credit market presents some degree of bank specialization (by firm size and region), and these characteristics are persistent over time. Therefore, banks operating at a given locality with a specific firm size niche will be exposed to the same sort of unobservable characteristics.

4.1.2. Results

Banks' credit growth

I start this empirical section by investigating the impact of federal banks' credit programs introduced in April 2012 on the overall lending behavior of banks in the corporate credit market. The time frame of the analysis runs from January 2011 to December 2014, which rules out the potential effects of the 2008 financial crisis and encompasses the period in which the state-owned banks' credit policies are in effect. I focus the analysis on the free corporate credit market, in which interest rates and sources of funding are freely established by banks.

To gather initial inferences concerning the potential changes in banks' credit allocation, I run the basic specification for the whole sample. I present the results in Table 4 first without any control variables (column 1), subsequently adding bank controls (column 2), and then introducing each of the time and group fixed effect approaches I take into account in this study – δ_t (column 3), $\delta_{t,s}$ (column 4), $\delta_{t,s,r}$ (column 5), and $\delta_{t,s,r,l}$ (column 6). Later, I perform several analyses using different cuts of the sample to draw conclusions regarding banks' risk-taking and credit allocation throughout the country.

I begin with the regression without any controls, which is basically a comparison among different ownership types of banks of their outstanding credit and their respective mean growth rates over time. Overall, as expected, federal banks expand their credit operations at a higher rate after their programs to stimulate credit in comparison to other banks operating in Brazil. When we move to the regression with aggregated bank controls, the coefficient for the interaction between the dummies for federal banks and the credit programs decreases, while the interaction between the credit programs' and private banks' dummies are still statistically insignificant.

Next, I introduce the aforementioned fixed effect approaches, one by one. Using time fixed effects, the results do not change significantly, since macroeconomic or other time-variant factors impact all the banks in the same way. However, as from the use of time interacting with group fixed effects by firm size, there is a better fit of the regression model. Then, adding the credit risk dimension, the coefficients of interest varies considerably, and explanatory power increases, indicating that firms with different credit risk profiles have distinct and unobserved credit demand, varying over time, that should be considered. Finally, we come to the last set of fixed effects, which takes into consideration the specific credit demand of firms, by size, credit risk, and across different localities. Notably, the Adjusted R^2 reaches 76%, and the coefficients of the interaction between the dummies for federal banks and private domestic banks with the dummy for the credit programs become more precise.

Using the time-firm size-credit risk-locality fixed effects, I show in Table 4, column 6, that the growth rate of the outstanding credit granted by federal banks is 25.6 percentage points (p.p.) higher than that of foreign banks after the initiatives of state-owned banks to increase the supply of credit[31], while private banks expand their credit operations at a rate 14.3 p.p. higher than the control group. In next sections, I exploit the heterogeneity of this pattern among firm size, regional economic output (Brazilian states' GDP) and firm credit risk rating.

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[31] These results consider the whole period between 2012:Q2 and 2014:Q4, which corresponds to the quarters in which state-owned banks' credit policies to increase the supply of credit are in effect.

By firm size

To observe the heterogeneity of banks' credit allocation, I first examine whether the programs to stimulate credit that take place in Brazil differently affect the supply of credit provided by banks to SME and large firms. Smaller firms are usually more credit constrained than larger firms, and governments, consistently with their social motivation, may use their banks to overcome these restrictions, as the case I address in this paper.

To perform this analysis, I consider the firm size classification described in Section 3. Firms' data is divided into four groups: micro, small, medium, and large. I combine the first three classes into a single group (SMEs). Next, I split the sample into the outstanding credit granted to SMEs and large firms, and rerun specification (2) for both subsamples. Additionally, to draw conclusions regarding the subsamples' results, I add a SME_s dummy to the specification (2), which I interact with all regressors to test the statistical difference between the coefficients for the SME and larger firms' subsamples.

The results are reported in Table 5. To facilitate the comparison, I repeat the results for the whole sample in column 1. Then, I present the coefficients for the SME subsample in column 2, for the large firms subsample in column 3, and for the regression with the SME_s dummy ("difference") in column 4. Interestingly, banks behave differently according to firm size segmentation. Considering only the SME subsample, the credit growth rate is 27.5 p.p. higher for federal banks and statistically insignificant for private banks after the introduction of credit programs, compared to the control group. When it comes to the large firms' subsample, I do not find statistically significant coefficients for federal banks. However, private domestic banks increase their credit to this niche at a rate strikingly 70.4 p.p. higher than foreign banks.

To correctly interpret these results, it is necessary to observe the "checking" regression which tests the difference between coefficients of both subsamples. I do not find significant statistical difference between the SME and large firm subsamples for federal banks[32]. This implies that the lending behavior of federal banks is not significantly different from the foreign banks' conduct. A possible and reasonable interpretation for these results is that foreign banks could have decided to follow, at least partially, the credit policy carried out by

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[32] The coefficient of the interaction $Post_t * Fedbanks_b * SME_s$ is positive, but insignificant (0.188).

state-owned banks. Therefore, we should not disregard the effectiveness of federal banks' policies targeting new credit operations at smaller firms.

Concerning the difference between the SME and large firm subsamples for private banks[33], the results are more conclusive. The difference between SME and large firms' coefficients is highly significant, which suggests that private banks may be more sensitive to risk than federal banks. Moreover, this result implies that these financial institutions could have decided to divert funds to provide credit to safer markets in the aftermath of the credit programs introduced by federal banks.

By firm size and Brazilian state GDP

The previous findings point to federal banks increasing their market share in the SME segment. Oppositely, private domestic banks seem to have focused on keeping safer and more profitable credit operations, switching the attention to the large firms' segment. However, these outcomes could have varied between Brazilian states, given the imbalances in the regional economic output across the country. Based on the potential cost economies of scale associated with the economic size of a given locality (Berger and Mester, 1997), I turn to an investigation of the behavior of banks operating in Brazil after federal banks' credit programs according to differences in regional economic output measured by Brazilian states' GDP. Additionally, this segmentation allows me to make further inferences about banks' behavior concerning their respective theoretical predictions.

Information on Brazilian states' GDP comes from 2011 regional accounts of produced by the IBGE, presented in Table 6. It provides the share of each Brazilian state in national GDP, which I use to divide my sample into lower and higher GDP states. I classify as "higher GDP" five Brazilian states that account for almost 2/3 of the country's economy, and as "lower GDP" the remaining twenty-one states and the Federal District. Then, for each firms' size subsample, I split it into higher and lower GDP states and rerun specification (2). Subsequently, I also check the statistical difference between the states' coefficients using a dummy for "lower GDP" states.

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[33] The coefficient of the interaction $Post_t * Fedbanks_b * SME_s$ is negative (-0.704) and significant at the 1% level.

I report the outcomes in Table 7. Interestingly, I find that federal banks concentrate their credit expansion on smaller firms in lower GDP states, in accordance with the social view of state-owned banks. Federal banks increase their presence in the SME segment in these regions at a rate 40.4 p.p. higher than foreign banks do[34], whose difference from the respective coefficient for higher GDP states is highly statistically significant[35]. This implies that, from federal banks' perspective, credit policies to expand the access to credit in Brazil are effective. These outcomes may also suggest that foreign banks are more prone to adhere to the competitive boost driven by federal banks in the SME segment in higher GDP states, but do not follow their policy in the rest of the country[36].

Concerning the lending behavior of private domestic banks to SMEs across the country, these banks behave similarly to foreign banks in Brazilian states with lower GDP but not in Brazilian states with higher GDP. In these localities, private banks' credit growth rate to SME is 27.7 p.p. lower than that of foreign banks[37], whose difference from the coefficient for lower GDP states[38] is statistically significant. These outcomes give an additional indication of the possible competitive pressure exerted by foreign banks in higher GDP states in the wake of the introduction of federal banks' credit programs.

When it comes to the large firms' subsamples, there are no significant coefficients for federal banks neither in lower nor in higher GDP states, which implies that these banks do not present credit growth rates different from those of foreign banks in this segment[39]. However, the positive and highly significant results for private domestic banks in both regions suggest that these institutions may have switched their focus towards large companies all over the country[40]. Another plausible explanation for these results is that federal and foreign banks could have diverted credit allocation from large firms to the SME segment,

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[34] Column 2 (interaction $Post_t * Fedbanks_b$).
[35] The coefficient of the interaction $Post_t * Fedbanks_b * Lower\ GDP_l$ is positive (0.528) and significant at the 1% level.
[36] The coefficient for the interaction $Post_t * Fedbanks_b * Lower\ GDP_l$, in column 3, is negative, although insignificant, which gives an additional clue to the behavior of foreign banks.
[37] Column 3 (interaction $Post_t * Fedbanks_b$).
[38] The coefficient of the interaction $Post_t * Fedbanks_b * Lower\ GDP_l$ is positive (0.374) and significant at the 1% level.
[39] Columns 6 and 7 (interaction $Post_t * Fedbanks_b$), and column 8 ($Post_t * Fedbanks_b * Lower\ GDP_l$).
[40] The coefficients for the interaction $Post_t * Fedbanks_b$ (columns 6 and 7) are positive for both subsamples, but there is no statistical difference between them, as shown by the interaction $Post_t * Fedbanks_b * Lower\ GDP_l$ in column 8.

while private banks do not follow this pattern. Both interpretations indicate that the effects of the federal banks' credit programs are more pronounced in the SME segment and that the effects of these policies on large firms' segment are only indirect.

By firm size, Brazilian state GDP and firm credit risk rating

The results so far give us some insights about the credit allocation of banks after the introduction of initiatives to increase the supply of credit by means of state-owned banks but are still not conclusive concerning their risk-taking behavior. For a more accurate interpretation of these effects, I take into account the credit rating classification described in Section 3 and split the previous SME subsamples into firms with "low risk" credit ratings (AA to C), and firms with "high risk" credit ratings (D to H). I concentrate my analysis on the SME segment because the credit extended to these firms is more sensitive to interest rate movements. Then, I rerun specification (2) for all subsamples, controlling for the differences between risk coefficients using a higher risk dummy.

Importantly, two features of Resolution 2,682/1999, which defines the credit rating classifications in Brazil, must be considered. These two directives forestall any attempt by banks to reclassify riskier borrowers as non-risky in new or renewed credit operations, which could bias my coefficients. First, the rating of new credit operations of a previous borrower should be defined considering the one that presents the highest risk. Second, any credit operation subject to renegotiation must be maintained, at least, at the same level of risk at which it was classified before. Therefore, if we observe an increase in the volume of high-risk credit operations, this may be due to the deterioration of a given bank's credit portfolio, the result of the renegotiation of credit operations, or both effects.

Table 8 reports the results. I find that, in lower GDP states, federal banks register higher credit growth rates to SME firms than foreign banks[41], irrespective of their ratings. However, the difference between coefficients for federal banks towards riskier credit operations is positive and statistically significant, which implies that federal banks start or renovate relatively more credit operations with riskier SME firms in these regions. When it comes to

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[41] Columns 2 and 3 (interaction $Post_t * Fedbanks_b$), and 4 (interaction $Post_t * Fedbanks_b * higher\ risk_r$).

private domestic banks, we notice that these financial institutions grant relatively more credit operations to less risky SME in lower GDP states.

Both previous outcomes might be explained by foreign banks' movement toward lower risk firms in higher GDP states. To verify this, I look at the coefficients for federal banks in these regions, which show that state-owned banks' credit growth rate to lower risk firms is significantly lower than foreign banks'[42]. These results imply that foreign banks not only focus their credit relationships on SME in higher GDP states but also "cherry-pick" less risky firms that could still offer reasonable profitability in these regions. Concerning the results for private banks in higher GDP states, although the coefficient for the SME subsample is negative and slightly statistically significant, the coefficients for the SME sample cuts into higher and lower risk firms are negative, but not informative.

4.2. Bank concentration

In this second part of my empirical methodology, I test the impact of federal banks' credit programs on bank concentration. In order to measure the degree of concentration of banks in Brazil, I use the Herfindahl-Hirschman index (HHI) for the Brazilian corporate credit market[43]. First, I measure the HHI for each Brazilian state, irrespective of firm size, considering the credit market share of the different types of bank ownership, as follows:

$$HHI_{l,t} = Federal_{l,t}^2 + Private_{l,t}^2 + For\_control_{l,t}^2 + For\_share_{l,t}^2 + States_{l,t}^2, \qquad (3)$$

where $HHI_{l,t}$ is the HHI for locality (Brazilian state) l at time t, and $Federal_{l,t}$, $Private_{l,t}$, $For\_control_{l,t}$, $For\_share_{l,t}$ and $States_{l,t}$ are the credit market share of the respective types of bank ownership in each locality.

Since the results in the previous section show that the initiatives to expand the supply of credit carried out by federal banks affects banks' credit policies differently according to firm size, I also calculate a specific HHI for SME and large firms in each locality. Therefore, I consider the credit market share of the different types of bank ownership in each firm size segment, given by the following equations:

$$HHI_{l,SME,t} = Federal^2_{l,SME,t} + Private^2_{l,SME,t} + For\_control^2_{l,SME,t} + For\_share^2_{l,SME,t} +$$
$$States^2_{l,SME,t} \tag{3A}$$

$$HHI_{l,Large,t} = Federal^2_{l,Large,t} + Private^2_{l,Large,t} + For\_control^2_{l,Large,t} + For\_share^2_{l,Large,t} +$$
$$States^2_{l,Large,t}. \tag{3B}$$

4.2.1. Empirical strategy

To empirically test the impact of federal banks' credit programs on bank concentration, I apply a treatment intensity strategy, which relates the median of the credit market share of federal banks in 2011 for each Brazilian state (*Treat$_{l,2011}$*), before the initiatives to increase the supply of credit and boost banks competition, to the respective concentration index. I choose this variable because the higher the market share of federal banks, the higher the probability of a given locality receiving the "treatment" or experiencing the expected effects of the credit programs. Therefore, the basic idea of this methodology is to test whether localities with a higher share of federal banks would experience higher bank concentration (higher HHI) with the introduction of credit programs, which depends on the behavior of other banks. To test this hypothesis, I first run the following model, without considering different firms' size segments:

$$HHI_{l,t} = \beta_0 + \beta_1 Treat_{l,2011} + \beta_2 Post_t * Treat_{l,2011} + \gamma_t + \delta_l + \varepsilon_{l,t}, \tag{4}$$

where γ_t controls for time fixed effects, δ_l controls for locality fixed effects, and β_2 is my coefficient of interest.

To capture the effect of federal banks' credit programs on bank concentration in each firms' size segment, I run the following two regressions:

$$HHI_{l,SME,t} = \beta_0 + \beta_1 Treat_{l,SME,2011} + \beta_2 Post_t * Treat_{l,SME,2011} + \gamma_t + \delta_l + \varepsilon_{l,SME,t} \tag{5A}$$

$$HHI_{l,Large,t} = \beta_0 + \beta_1 Treat_{l,Large,2011} + \beta_2 Post_t * Treat_{l,Large,2011} + \gamma_t + \delta_l + \varepsilon_{l,Large,t} \tag{5B}$$

4.2.2. Results

I start with the results for the whole sample, regardless of firms' size segmentation. Table 9 reports the coefficients. I present the results first using time fixed effects, and then with time and locality fixed effects, which is my preferred model. Interestingly, I find that, for each 1% higher credit share of federal banks in 2011, the HHI increases by 37.51, on average, after the credit programs. These results confirm the hypothesis that localities in which federal

banks already provided a significant share of the supply of credit experience higher bank concentration after the credit programs.

However, since the impact on bank concentration could have been different according to firm size segmentation, I run regressions for each of these subsamples separately, taking into consideration their respective HHIs, and present the respective outcomes in Table 10. Interestingly, I find contrasting results. While the HHI rises by 64.34 for each additional 1% federal bank credit share in the SME subsample, the concentration indicator drops by 34.58 in the large firms' segment. It implies that the credit programs carried out by federal banks increase the concentration in the SME segment, but it indirectly leads to less concentration in the large firms' niche, as we observed that private domestic banks retrench their credit operations to this market.

4.3. Banks' credit growth – absolute behavior

Finally, in order to provide additional evidence to the previous findings, I analyze the absolute behavior of banks operating in Brazil, by ownership, in the aftermath of federal banks' credit programs. Once more, I apply a treatment intensity approach, relying on the prior results that show different strategic behavior of banks across the country depending on regional economic output. I create a treatment variable *gdp_share$_{l,2011}$* based on the contribution of each Brazilian state to the national output in 2011, presented in Table 6. Since the results so far point to relative growth rate differences, the underlying reason for the use of this variable is to capture whether each set of banks, in absolute terms, experiences changes on its credit evolution throughout the country after the federal banks initiatives to expand the access to credit in Brazil.

To test this proposition, I use the following specification for each type of bank ownership, which I run first for the whole sample and then taking into account firms' size segments:

$$Ln\ credit_{l,s,r,t} = \beta_0 + \beta_1 gdp\_share_{l,2011} + \beta_2 Post_t * gdp\_share_{l,2011} + \delta_{t,r} + \varepsilon_{l,s,r,t}, \qquad (6)$$

where *Ln credit$_{l,s,r,t}$* is the natural logarithm of the outstanding credit granted by federal, private domestic, and foreign banks, respectively, in the locality (Brazilian state) *l*, to the set of firms of size *s*, classified with credit risk *r*, at time (quarter) *t*. $\delta_{t,r}$ controls for time and

risk fixed effects. β_2 provides the credit growth after the introduction of credit programs for percentage increments in the share of Brazilian national GDP.

4.3.1. Results

I present the results in Table 11. Starting with the SME segment (columns 2, 5, and 8), I find that for every additional percentage point of Brazilian states' share of the national GDP, federal banks reduce their credit growth rate by 0.9 p.p. This result is consistent with the social view of state-owned banks, since federal banks increase credit operations at a higher rate the lower the economic output of a given region, and especially for more credit-constrained firms. Concerning the results for private domestic banks, we also verify that these institutions relatively reduce their rate of credit expansion to SME. Nevertheless, this pattern indicates a higher competitive pressure for the provision of credit to these firms in states with larger economies, as the previous analyses suggest. When it comes to foreign banks, although the coefficient for the SME is positive but statistically insignificant, it is in accordance with previous findings of a switch of these institutions to Brazilian states with higher GDP.

Finally, regarding large firms, we notice that the higher the state share in national GDP the more all three sets of banks expand their credit operations. This pattern is more prominent for private banks, whose coefficient presents higher statistically significance, consistently with their diversion to safer markets as an indirect response to federal banks' credit programs. Overall, these results imply that, except for the apparent flight of private banks to less risky credit operations, the impact of the credit programs on the large firms' segment is triggered by movements in banks' credit allocation in the SME segment.

5. Robustness check

To rule out other potential explanations for federal banks' credit allocation and risk-taking behavior after the introduction of federal banks' credit programs, I test the hypothesis of political interest to allocate credit to specific regions of the country. I follow Coleman and Feler (2015) and divide the sample using the 2010 Brazilian presidential poll results to examine this possibility. The election chose the president who ruled the country from 2011 to 2014, which comprises the period of my analysis. Table 12 presents the 2010 presidential voting outcomes by states, in percentages. I label Brazilian states "more aligned" if the

elected president was the most popular candidate in a given state, and "less aligned" otherwise. This gives 16 more aligned and 11 less aligned states with the former president. It might be the case that the credit granted by federal government banks was diverted to regions with more supporters of that federal government administration, which could validate a politicized use of state-owned banks.

Table 13 presents the regression outcomes. The results for the interaction $Post_t *$ $Fedbanks_b$ are very similar in both subsamples, and not statistically different from each other[44], which implies that political interest is not a factor in federal government banks' corporate credit policies, considering the non-earmarked credit segment. If that was the case, we should have observed a more pronounced and statistically significant coefficient for more aligned Brazilian states. In fact, the coefficients may just reflect the correlation between the spatial distribution of smaller firms across the country and the political alignment with the former president.

6. Conclusion

In this paper, I examine the impact of two initiatives carried out by federal government-owned banks to increase the supply of credit in Brazil. These programs to stimulate credit involve the reduction of lending rates, as an attempt to trigger the pass-through of a previous monetary policy easing starting in 2011, the extension of loans terms and the raise of credit limits to the targeted borrowers.

I use the bank ownership perspective in the study of banks' risk-taking behavior and credit allocation after the introduction of these credit programs, taking into account a developing country with an uneven distribution of credit. I rely on an event study in which I compare the growth in the outstanding corporate credit granted by federal, private domestic and foreign banks, and on two different treatment intensity approaches. I further examine the heterogeneity of banks' lending behavior across different standpoints, by splitting the sample according to firm size, differences in GDP among Brazilian states, and firm credit risk rating.

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[44] Column 4 (interaction $Post_t * Fedbanks_b * More\_aligned_l$).

I show that Federal government-owned banks, pursuing their social motivation, expand their credit operations with smaller firms, especially in lower GDP states, but accomplish this objective by increasing credit relationships with riskier firms. On the other hand, foreign banks follow this competitive pressure triggered by federal banks, but mainly in states with higher GDP and by focusing on lower risk firms, suggesting a "cherry-picking" behavior. Private domestic banks, although affected by the competitive threat introduced by federal banks and the new competitive force employed by foreign banks, focus on keeping safer and profitable operations all over the country, which results in a higher market for these banks in the larger firms' segment.

My findings partially corroborate the hypothesis that localities in which federal banks made up a larger share of the banking sector experience a higher degree of bank concentration after federal banks' credit programs. This pattern is most prominent in the SME segment within lower GDP states, where the presence of those banks is already relatively high. In contrast, private banks focus their credit operations on larger firms, indirectly reducing the concentration index in this segment.

Finally, the impact of federal banks' credit programs is more significant in the SME segment, which is characterized by wider range of firms' credit ratings. In contrast, the impact on larger firms' credit allocation is indirect, potentially because of the lower interest rates margins usually observed in this segment.

Future research could extend this analysis by investigating the effect of credit programs to stimulate credit by means of state-owned banks on the performance of firms benefiting from this policy, and, more broadly, on regional economic development.

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Figure 1 – Average of interest rate spreads in the Brazilian free corporate credit market
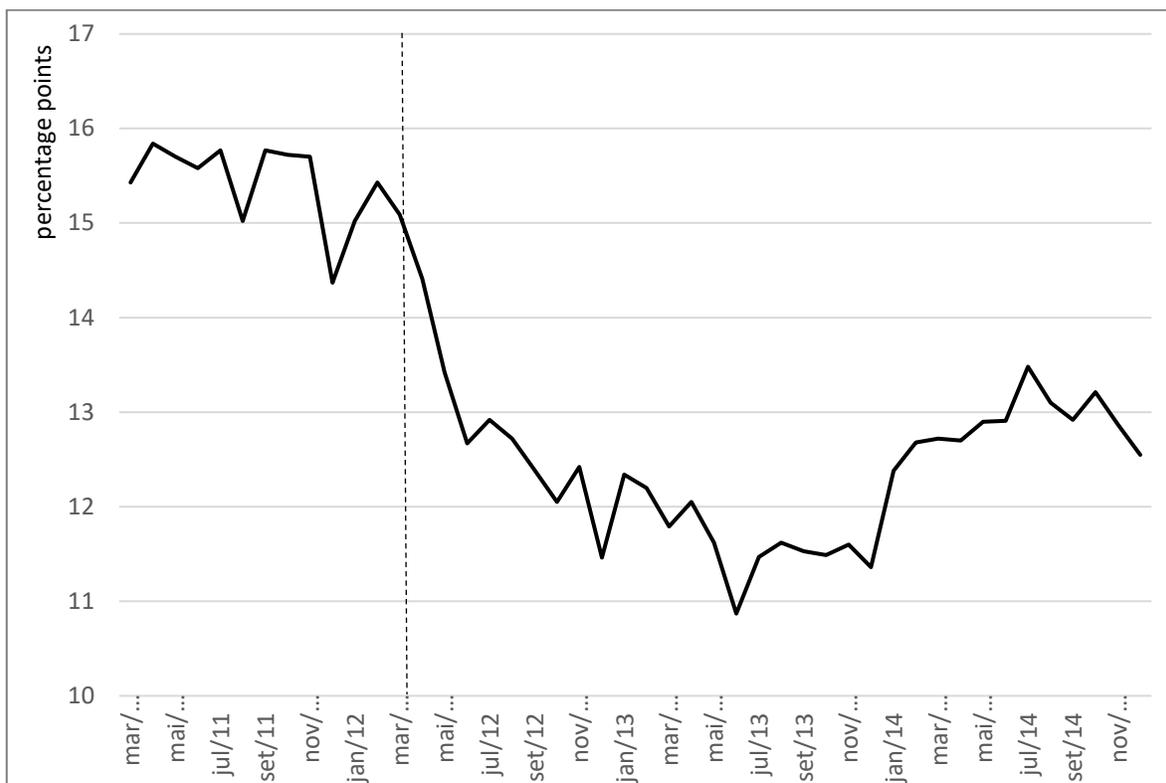
Notes: in Figure 1, I present the average of interest rate spreads (the difference between lending rates charged and deposit rates offered by banks) in the free corporate credit market, reported by the Central Bank of Brazil (BCB). Although the monetary policy easing starting in August 2011 brought the Selic rate to its lowest level in 2012, the interest rates charged by banks to firms in Brazil did not follow this tendency. In an attempt to trigger the pass-through of monetary policy easing and induce bank competition, Brazilian federal government-owned banks, almost simultaneously, presented two initiatives in April 2012 aimed at reducing rates and increasing loan terms to final borrowers. After the introduction of these programs, the average interest rate spread in the free corporate credit market dropped from approximately 15 p.p. before April 2012 to around 12 p.p. at the end of 2012. Then, it remained at this level during 2013 but rose to around 13 p.p. during 2014.

Figure 2 – Return of credit operations obtained from banks' balance sheet information as a proxy for banks' lending rates – by bank ownership (2011=1)
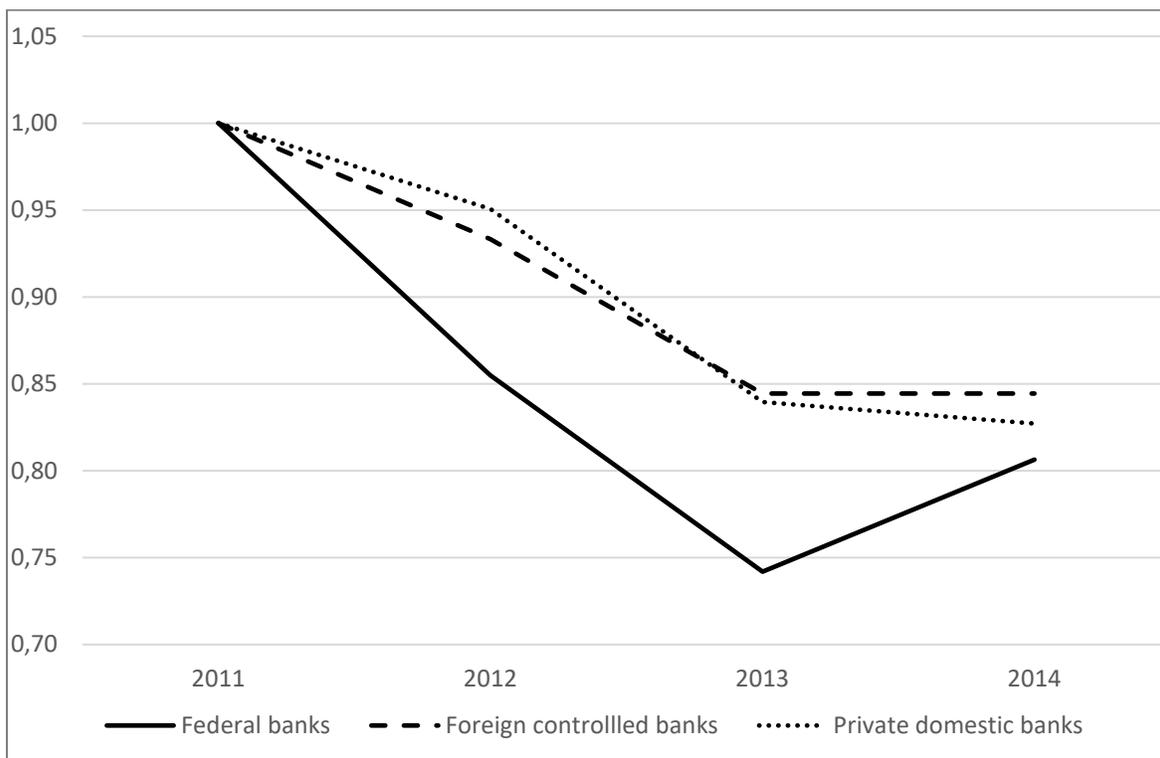
Notes: in Figure 2, I present the average return of credit operations obtained from balance sheet information as a proxy for banks' lending rates, calculated for the three main bank ownership types: federal banks, foreign controlled banks, and private domestic banks. The return of credit operations is measure on a quarterly basis by the following equation: revenues from credit operations in time *t* over total credit operations in time *t-1* adjusted by the variation in loan loss provisions from *t-1* to *t*. I calculate the average return for each year considered in the sample.

Figure 3 – *Banco do Brasil* **stock prices (BBAS3) vs.** *Ibovespa* **index (01/02/2012=100)**
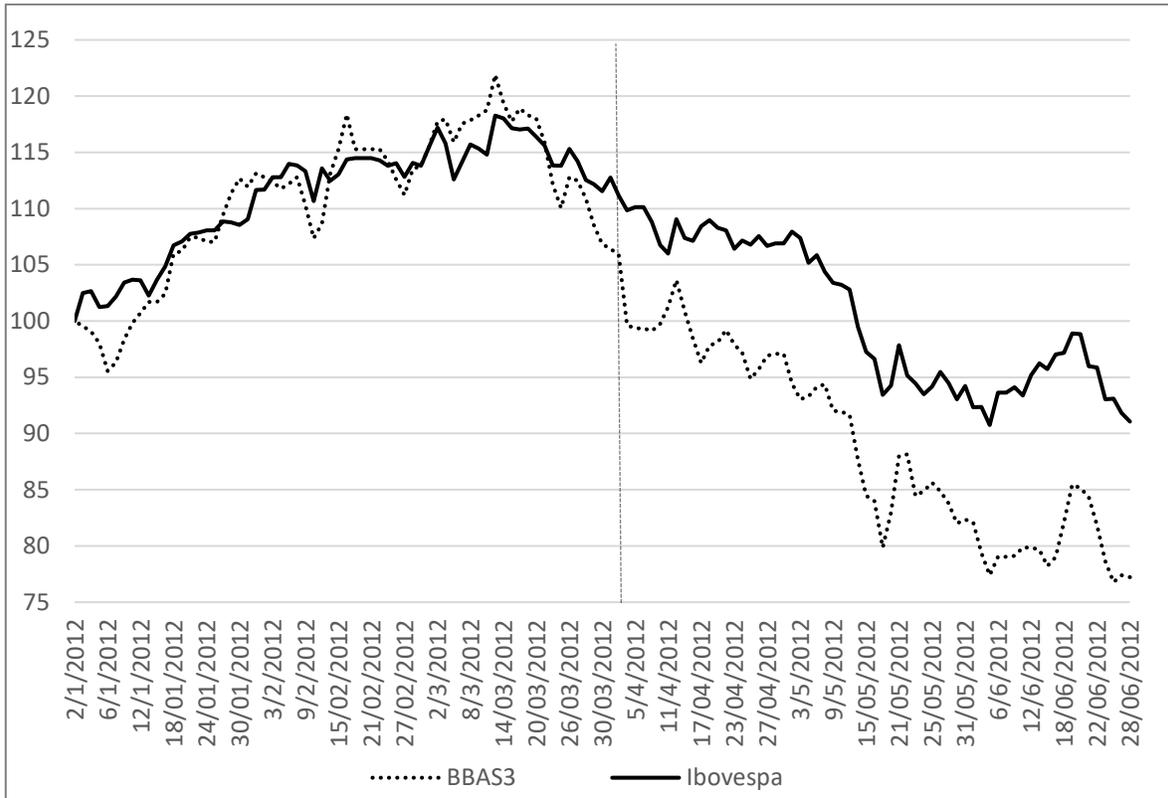
Notes: in Figure 3, I compare the performance of *Banco do Brasil* stock prices (BBAS3) with the Brazilian stock market index (*Ibovespa*). BB stock prices have an almost perfect correlation to the *Ibovespa* index until the end of March, which suggests that investors were not aware of upcoming initiatives to reduce interest rates. However, as from April, we observe that BB shares start to underperform comparing to the market index, as BB shareholders realized that the lending rate cuts could bring lower returns and higher risks to their portfolios.

Figure 4 – Free corporate credit market: banks' market share – by ownership
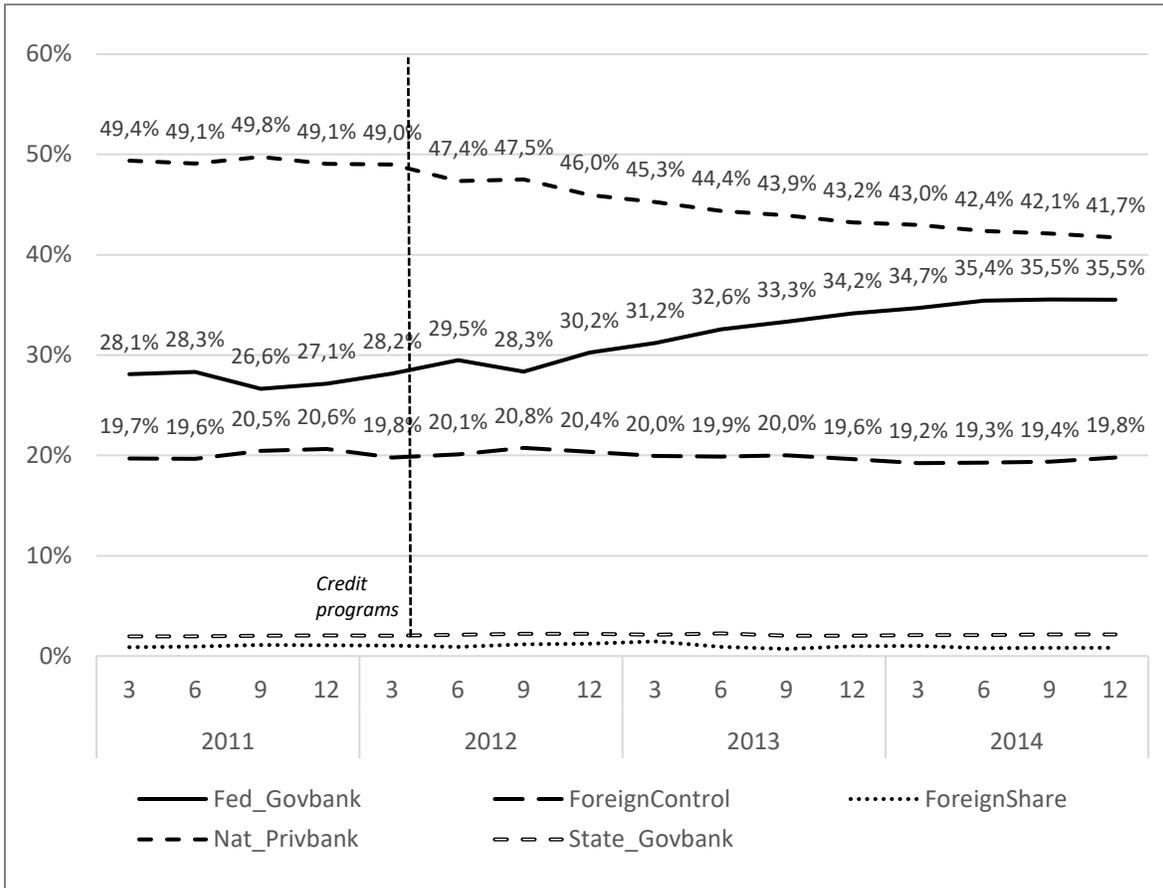
Notes: Figure 4 shows the evolution of banks' market share, by ownership, in the free corporate credit segment. The dashed line indicates the period in which federal banks' credit programs were in effect. We observe that federal banks increased their market share substantially, which was followed by an almost symmetrical decline in the share held by private domestic banks. Foreign banks, however, do not show any significant variation.

Figure 5 – Free corporate credit market: banks' market share in the SME segment – by bank ownership
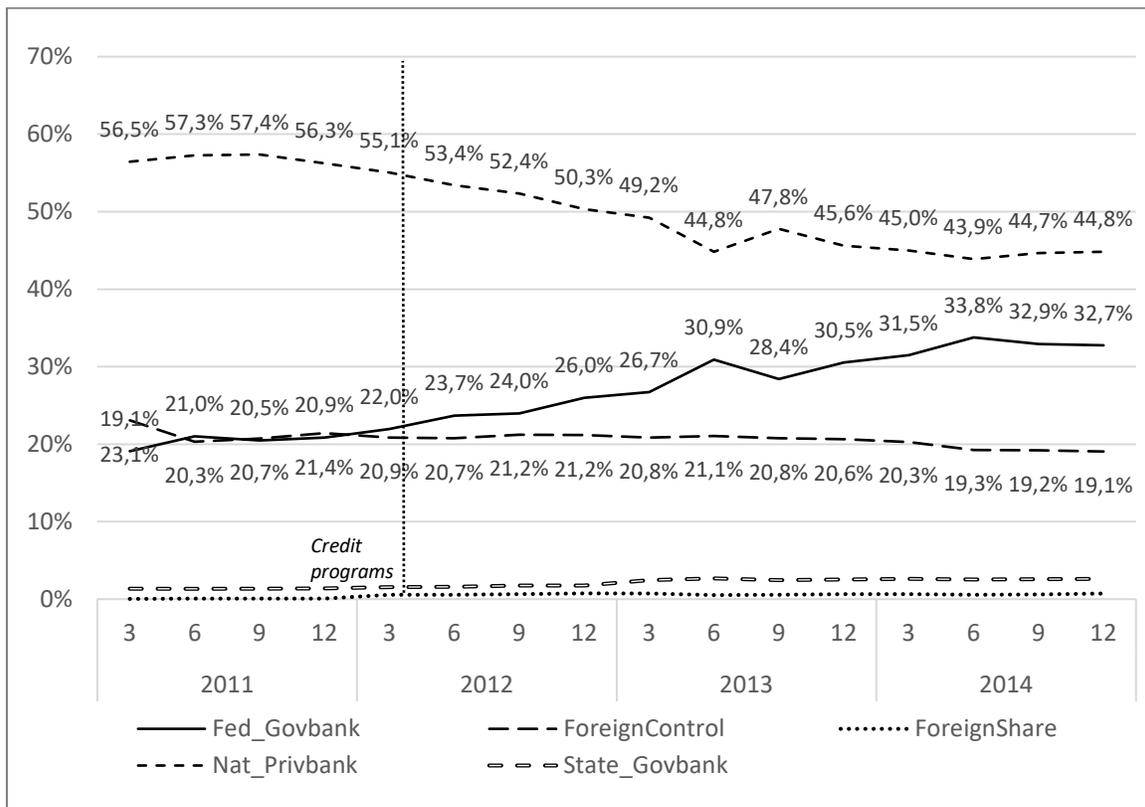
Notes: Figure 5 illustrates banks' market share in the SME segment of the free corporate credit market, as long as these firms were targeted by the credit programs carried out by federal banks. The graphical analysis confirms the different behavior of banks towards SME. We observe that while the SME's credit market share for private banks declined, federal banks increased their participation. The market share for foreign banks remains relatively flat throughout the sample.

Figure 6A – Free corporate credit market: banks' market share in lower GDP states – by bank ownership
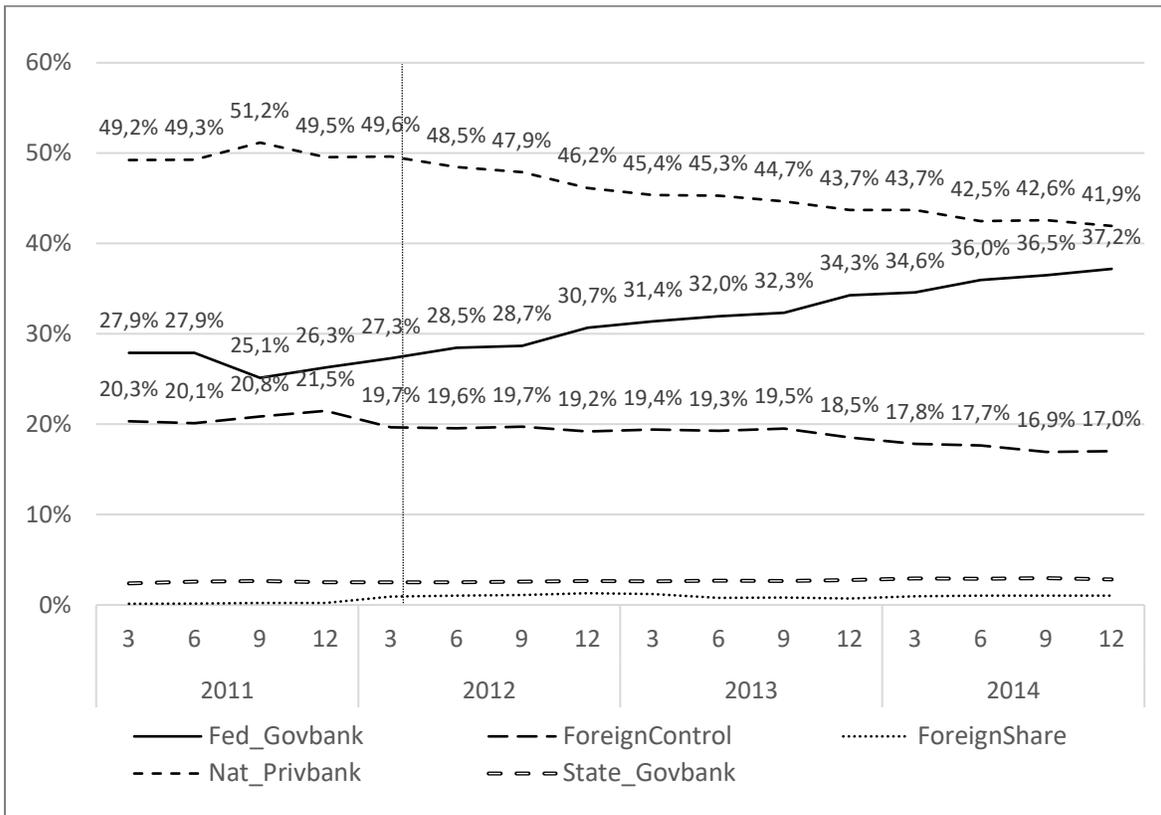
Notes: Figure 6A presents the graph for banks' market share in Brazilian states with lower GDP. We observe that the market share of federal banks shows substantial growth, while the participation of private domestic banks and foreign banks each decline in lower GDP states.
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Figure 6B – Free corporate credit market: banks' market share in higher GDP states – by bank ownership
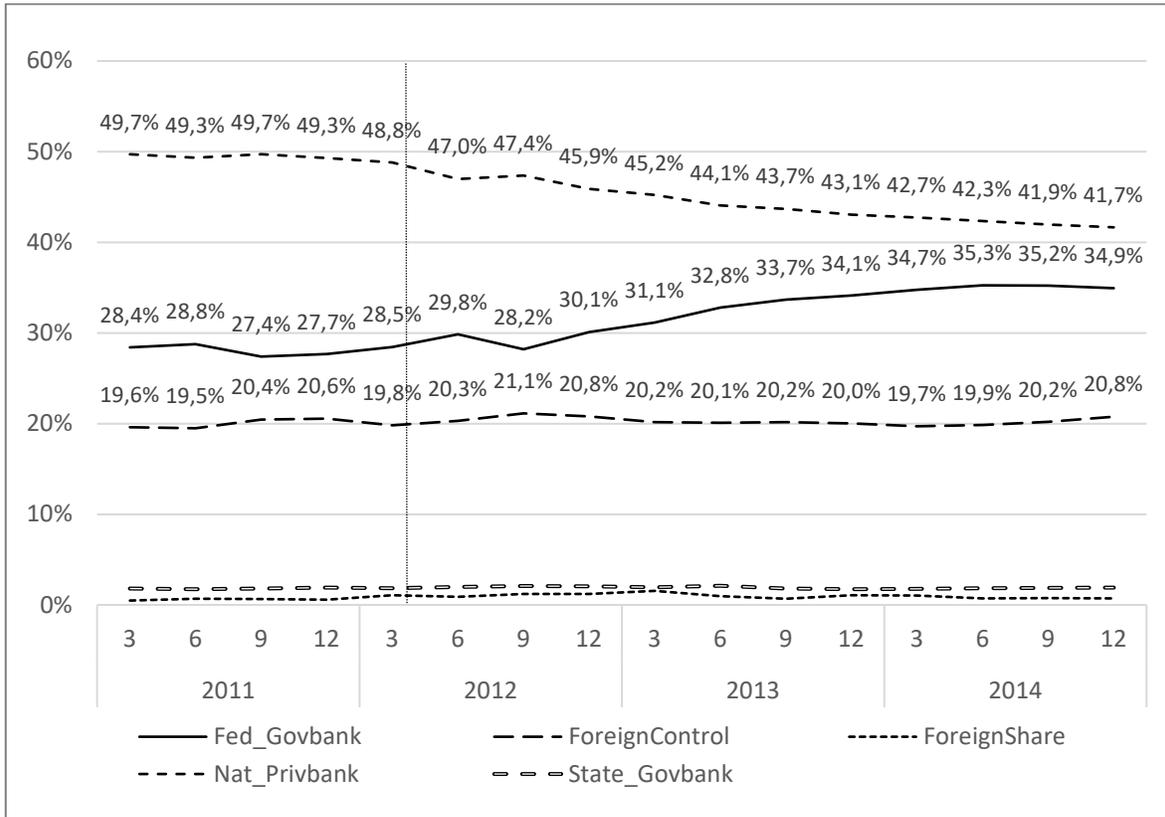
Notes: Figure 6B presents the graph of banks' market share in higher GDP states. We observe that the market share of federal banks increases, but less vigorously than in lower GDP states, while the participation of private domestic banks declines. Foreign banks' participation stays constant.

Figure 7 – Free corporate credit market: banks' market share for riskier firms – by ownership
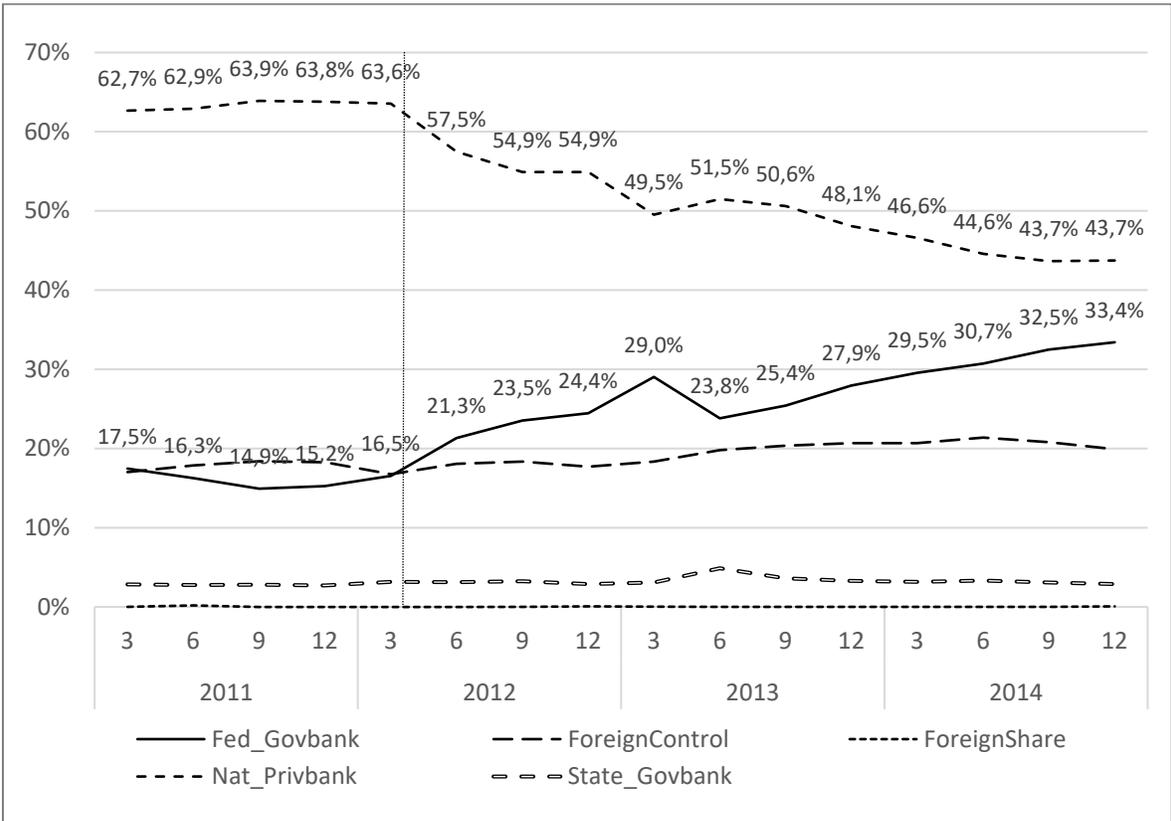
Notes: Figure 7 presents the graph of credit operations classified with ratings from D to H (higher risk), exploring the potential different risk-taking behavior of different types of banks in the aftermath of the launching of federal banks' credit programs. We notice that federal banks increased their presence in this risky credit segment. Foreign banks also presented a slight growth in their riskier credit market share. On the other hand, this figure shows that private domestic banks retrenched their credit operations towards less risky borrowers.

Table 1 – Descriptive statistics of banks' balance sheet information – by bank ownership

Bank Ownership	Statistics	Total assets (BRL trillion)	Liquidity	Retail funding	Capital ratio
Federal Banks	N	32	32	32	32
	Mean	0.866	0.313	0.959	0.049
	Median	0.859	0.319	0.964	0.049
	Sd	0.233	0.023	0.016	0.016
	Min	0.432	0.255	0.913	0.024
	max	1.260	0.349	0.975	0.071
Private Domestic Banks	N	916	916	916	916
	Mean	0.043	0.357	0.755	0.214
	Median	0.002	0.333	0.929	0.155
	Sd	0.015	0.210	0.339	0.179
	Min	0.000	0.000	0.000	0.006
	max	1.060	0.906	1.000	0.937
Foreign Controlled Banks	N	810	810	810	810
	Mean	0.019	0.325	0.662	0.205
	Median	0.003	0.276	0.835	0.157
	Sd	0.069	0.253	0.367	0.159
	Min	0.000	0.000	0.000	0.034
	max	0.610	0.959	1.000	0.952
Foreign Share Banks	N	45	45	45	45
	Mean	0.031	0.356	0.916	0.196
	Median	0.001	0.208	1.000	0.157
	Sd	0.040	0.277	0.154	0.139
	Min	0.000	0.024	0.388	0.037
	max	0.116	0.762	1.000	0.723
State Banks	N	80	80	80	80
	Mean	0.015	0.375	0.979	0.093
	Median	0.009	0.348	0.983	0.093
	Sd	0.017	0.115	0.014	0.016
	Min	0.002	0.185	0.948	0.058
	max	0.059	0.629	0.999	0.136

Notes: Table 1 presents the descriptive statistics concerning banks' balance sheet information. This table displays bank-level data, which is separated by type of bank ownership. The data comprises the total sample period (from 2011:Q1 to 2014:Q4) and shows the variability of banks' characteristics in Brazil. The definition of variables are the following: "total assets" is the sum of each banks' assets within a bank ownership type (banks' total assets minus off-balance operations, in BRL); "liquidity" is a ratio given by the expression (cash + Interbank liquidity operations + securities and derivatives)/total assets; "retail funding" is a ratio measured by (cash deposits + savings + term deposits)/total deposits, and "capital ratio" is the ratio of equity over total assets.

Table 2A – Liquidity ratio (weighted by the share of banks' assets in total assets)

Ownership	2011:Q4	2012:Q4	2013:Q4	2014:Q4
Federal Banks$_t$	0.309	0.318	0.282	0.317
Private Domestic Banks$_t$	0.456	0.501	0.475	0.511
Foreign Controlled Banks$_t$	0.391	0.377	0.382	0.412
Foreign Share Banks$_t$	0.708	0.724	0.631	0.561
State Banks$_t$	0.357	0.381	0.373	0.352

Notes: Table 2A presents the average of liquidity ((cash + Interbank liquidity operations + securities and derivatives)/total assets) for each type of bank ownership, weighted by the share of banks' assets in total assets, at the fourth quarter of each year *t*.

Table 2B – Retail Funding (weighted by the share of banks' assets in total assets)

Ownership	2011:Q4	2012:Q4	2013:Q4	2014:Q4
Federal Banks$_t$	0.951	0.959	0.968	0.971
Private Domestic Banks$_t$	0.523	0.488	0.490	0.552
Foreign Controlled Banks$_t$	0.733	0.788	0.841	0.833
Foreign Share Banks$_t$	0.909	0.899	0.892	0.662
State Banks$_t$	0.995	0.984	0.986	0.981

Notes: Table 2B presents the average of retail funding ((cash deposits + savings + term deposits)/total deposits) for each type of bank ownership, weighted by the share of banks' assets in total assets, at the fourth quarter of each year *t*.

Table 2C – Capital ratio (weighted by the share of banks' assets in total assets)

Ownership	2011:Q4	2012:Q4	2013:Q4	2014:Q4
Federal Banks$_t$	0.060	0.057	0.052	0.042
Private Domestic Banks$_t$	0.079	0.074	0.072	0.084
Foreign Controlled Banks$_t$	0.125	0.124	0.110	0.090
Foreign Share Banks$_t$	0.120	0.134	0.129	0.121
State Banks$_t$	0.110	0.100	0.094	0.092

Notes: Table 2C presents the average of a capital ratio (equity/assets) for each type of bank ownership, weighted by the share of banks' assets in total assets, at the fourth quarter of each year *t*.

Table 3A – Total Credit (Free Corporate Credit Market) – by bank ownership

Ownership	2011:Q4	2012:Q4	2013:Q4	2014:Q4
Federal Banks$_t$	0.164	0.213	0.260	0.285
Private Domestic Banks$_t$	0.297	0.324	0.329	0.334
Foreign Controlled Banks$_t$	0.125	0.144	0.149	0.159
Foreign Share Banks$_t$	0.006	0.008	0.007	0.006
State Banks$_t$	0.012	0.015	0.015	0.017

Notes: Table 3A presents the sum of total credit, by type of bank ownership, at the fourth quarter of each year *t* (in BRL trillion).

Table 3B – Total Assets – by bank ownership

Ownership	2011:Q4	2012:Q4	2013:Q4	2014:Q4
Federal Banks$_t$	1.350	1.680	1.980	2.320
Private Domestic Banks$_t$	2.320	2.550	2.640	2.770
Foreign Controlled Banks$_t$	0.891	0.928	0.979	1.160
Foreign Share Banks$_t$	0.053	0.077	0.095	0.146
State Banks$_t$	0.062	0.075	0.086	0.095

Notes: Table 3B presents the sum of total assets, by type of bank ownership, at the fourth quarter of each year *t* (in BRL trillion).

Table 4 – Bank outstanding credit growth

Independent variables	Dependent variable: Logarithm of outstanding credit$_{b,l,s,r,t}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Post$_t$	0.102	-0.100				
	(0.082)	(0.089)				
Fedbanks$_b$	1.163***	-0.553**	-0.918***	-1.152***	-1.653***	-1.613***
	(0.095)	(0.234)	(0.283)	(0.266)	(0.266)	(0.187)
Post$_t$*Fedbanks$_b$	0.476***	0.285***	0.296***	0.316***	0.325***	0.256***
	(0.114)	(0.109)	(0.109)	(0.102)	(0.104)	(0.062)
Privbanks$_b$	1.910***	0.721**	0.650**	0.630**	0.633**	0.589***
	(0.096)	(0.286)	(0.302)	(0.287)	(0.290)	(0.165)
Post$_t$*Privbanks$_b$	-0.112	-0.043	0.008	0.059	0.156	0.143**
	(0.116)	(0.117)	(0.119)	(0.115)	(0.117)	(0.070)
log_assets$_{b,t}$		0.902***	0.983***	1.001***	1.154***	1.386***
		(0.063)	(0.074)	(0.069)	(0.069)	(0.051)
liquidity$_{b,t}$		-0.774*	-0.363	-0.657	-2.442***	-3.405***
		(0.414)	(0.459)	(0.428)	(0.429)	(0.345)
capital_ratio$_{b,t}$		-1.399	-4.557	-6.636*	-9.512***	-8.060***
		(3.275)	(3.674)	(3.480)	(3.507)	(2.071)
retail_funding$_{b,t}$		2.009**	2.771***	3.129***	3.655***	3.405***
		(0.803)	(0.898)	(0.852)	(0.852)	(0.598)
Observations	12,117	12,117	12,117	12,117	12,117	12,117
Adjusted R-squared	0.129	0.209	0.209	0.262	0.433	0.760
Fixed Effects	No	No	T	TS	TSR	TSRL
Bank Controls	No	Yes	Yes	Yes	Yes	Yes
Cluster	BLST	BLST	BLST	BLST	BLST	BLST

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Table 4 presents the results of the impact of federal banks' credit programs on banks' outstanding credit growth in the free corporate credit market. It is related to specification (1), considering the whole sample. The dependent variable is the logarithm of outstanding credit granted by bank ownership type *b*, in locality *l*, to firms of size *s*, classified with credit risk *r*, at time (quarter) *t*. Post$_t$ is a dummy variable that accounts for the initiatives to increase the supply of credit by means of state-owned banks. It takes the value 1 from 2012:Q2, and 0 otherwise. Fedbanks$_b$ is a dummy variable that takes the value 1 for federal government-owned banks and 0 otherwise. Privbanks$_b$ is a dummy variable that takes the value 1 for private domestic banks and 0 otherwise. I report the results first without any control variable in columns (1), and with aggregated bank controls (log_assets$_{b,t}$, liquidity$_{b,t}$, retail_funding$_{b,t}$, and capital_ratio$_{b,t}$) in column (2). Then, I introduce different approaches for fixed effects, starting with time fixed effects in column (3), time and group fixed effects by firm size in column (4), time and group fixed effects by firm size and credit risk rating in column (5), and, finally, time and group fixed effects by firm size, credit risk rating, and locality in column (6). I cluster the errors by bank ownership, locality, firm size and time (BLST). My coefficients of interest are those given by the interaction between Fedbanks$_b$ and Privbanks$_b$ with Post$_t$ respectively. These two coefficients provide estimates of the differences (in percentage points) in the outstanding credit growth between federal government banks and private domestic banks other banks operating in Brazil after the introduction of federal banks' credit programs.

Table 5 – Bank outstanding credit growth – by firm size

| Independent variables | Dependent variable: Logarithm of outstanding credit$_{b,l,s,r,t}$ | | | |
	All firms	SME	Large	Difference
	(1)	(2)	(3)	(4)
Fedbanks$_b$	-1.613***	-1.673***	-1.286***	-1.286***
	(0.187)	(0.188)	(0.486)	(0.469)
Post$_t$*Fedbanks$_b$	0.256***	0.275***	0.087	0.087
	(0.062)	(0.065)	(0.157)	(0.152)
Post$_t$*Fedbanks$_b$*SME$_s$				0.188
				(0.165)
Privbanks$_b$	0.589***	0.752***	-0.341	-0.341
	(0.165)	(0.174)	(0.372)	(0.359)
Post$_t$*Privbanks$_b$	0.143**	-0.001	0.704***	0.704***
	(0.070)	(0.073)	(0.150)	(0.145)
Post$_t$*Privbanks$_b$*SME$_s$				-0.704***
				(0.162)
Observations	12,117	9,768	2,349	12,117
Adjusted R-squared	0.760	0.777	0.752	0.775
Fixed Effects	TSRL	TSRL	TSRL	TSRL
Bank Controls	Yes	Yes	Yes	Yes
Cluster	BLST	BLST	BLST	BLST

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Table 5 presents the results of the impact of federal banks' credit programs on banks' outstanding credit growth in the free corporate credit market by firm size. It is related to specification (1), which I split into SME (micro, small, and medium firms) and large firms' subsamples. The dependent variable is the logarithm of outstanding credit granted by bank ownership type b, in locality l, to firms of size s, classified with credit risk r, at time (quarter) t. Post$_t$ is a dummy variable that accounts for the initiatives to increase the supply of credit by means of state-owned banks. It takes the value 1 from 2012:Q2, and 0 otherwise. Fedbanks$_b$ is a dummy variable that takes the value 1 for federal government-owned banks and 0 otherwise. Privbanks$_b$ is a dummy variable that takes the value 1 for private domestic banks and 0 otherwise. SME$_s$ is a dummy variable that takes the value 1 for SMEs, and 0 otherwise. Bank controls are the natural logarithm of total assets, liquidity, retail funding, and capital ratio. To facilitate the comparison, I repeat the results for the whole sample in column (1), using time and group fixed effects by firm size, credit risk rating, and locality, and then I report the coefficients for the SME subsample in column (2), and for the large firms' subsample in column (3). In column (4), I use the whole sample, adding a dummy SME to test the difference between federal banks' and private domestic banks' coefficients in both subsamples.

Table 6 – Share of the Brazilian national GDP by regions and states in 2011 (%)

North	**5.4**
Rondônia (RO)	0.7
Acre (AC)	0.2
Amazonas (AM)	1.6
Roraima (RR)	0.2
Pará (PA)	2.1
Amapá (AP)	0.2
Tocantins (TO)	0.4
Northeast	**13.4**
Maranhão (MA)	1.3
Piauí (PI)	0.6
Ceará (CE)	2.1
Rio Grande do Norte (RN)	0.9
Paraíba (PB)	0.9
Pernambuco (PE)	2.5
Alagoas (AL)	0.7
Sergipe (SE)	0.6
Bahia (BA)	3.9
Southeast	**55.4**
Minas Gerais (MG)	9.3
Espírito Santo (ES)	2.4
Rio de Janeiro (RJ)	11.2
São Paulo (SP)	32.6
South	**16.2**
Paraná (PR)	5.8
Santa Catarina (SC)	4.1
Rio Grande do Sul (RS)	6.4
Midwest	**9.6**
Mato Grosso do Sul (MS)	1.2
Mato Grosso (MT)	1.7
Goiás (GO)	2.7
Distrito Federal (DF)	4.0

Source: IBGE

Notes: Table 6 breaks down Brazilian national GDP in 2011 by its five geographical regions and 26 states and the Federal District. I classify as "higher GDP" the five Brazilian states that account for almost 2/3 of the country's economy (SP, MG, RJ, RS, and PR), and as "lower GDP" the remaining 21 states and the Federal District
.

Table 7 – Bank outstanding credit growth – by firm size and Brazilian state GDP

	Dependent variable: Logarithm of outstanding credit$_{b,l,s,r,t}$							
	SME				Large Firms			
	Brazil	Lower GDP	Higher GDP	Difference	Brazil	Lower GDP	Higher GDP	Difference
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fedbanks$_b$	-1.673***	-1.673***	-1.894***	-1.894***	-1.286***	-1.245*	-1.310***	-1.310***
	(0.188)	(0.217)	(0.369)	(0.377)	(0.486)	(0.730)	(0.459)	(0.484)
Post$_t$*Fedbanks$_b$	0.275***	0.404***	-0.124	-0.124	0.087	0.142	-0.082	-0.082
	(0.065)	(0.070)	(0.149)	(0.152)	(0.157)	(0.183)	(0.307)	(0.324)
Post$_t$*Fedbanks$_b$*Lower_GDP$_l$				0.528***				0.224
				(0.168)				(0.370)
Privbanks$_b$	0.752***	0.734***	0.794**	0.794*	-0.341	-0.463	-0.009	-0.009
	(0.174)	(0.189)	(0.401)	(0.409)	(0.372)	(0.483)	(0.539)	(0.568)
Post$_t$*Privbanks$_b$	-0.001	0.097	-0.277*	-0.277	0.704***	0.691***	0.722***	0.722***
	(0.073)	(0.079)	(0.167)	(0.170)	(0.150)	(0.195)	(0.247)	(0.261)
Post$_t$*Privbanks$_b$*Lower_GDP$_l$				0.374**				-0.031
				(0.187)				(0.323)
Observations	9,768	7,709	2,059	9,768	2,349	1,693	656	2,349
Adjusted R-squared	0.777	0.743	0.782	0.780	0.752	0.704	0.729	0.751
Fixed Effects	TSRL	TSRL	TSRL	TSRL	TSRL	TSRL	TSRL	TSRL
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	BLST	BLST	BLST	BLST	BLST	BLST	BLST	BLST

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Table 7 presents the results of the impact of federal banks' credit programs on banks' outstanding credit growth in the free corporate credit market by firm size and regional economic output (Brazilian State GDP). It is related to specification (1), which I split twice: first into SME and large firms' subsamples, and then each one into Brazilian states with lower and higher GDP, respectively. The dependent variable is the logarithm of outstanding credit granted by bank ownership type b, in locality l, to firms of size s, classified with credit risk r, at time (quarter) t. Post$_t$ is a dummy variable that accounts for the initiatives to increase the supply of credit by means of state-owned banks. It takes the value 1 from 2012:Q2, and 0 otherwise. Fedbanks$_b$ is a dummy variable that takes the value 1 for federal government-owned banks and 0 otherwise. Privbanks$_b$ is a dummy variable that takes the value 1 for private domestic banks and 0 otherwise. Lower_GDP$_l$ is a dummy that takes the value 1 for the 21 Brazilian states and the Federal District that together account for only 1/3 of the country's GDP. Bank controls are the natural logarithm of total assets, liquidity, retail funding, and capital ratio. To facilitate the comparison, I repeat the results using time and group fixed effects by firm size, credit risk rating, and locality for the firm size subsamples in columns (1) and (5), respectively. Then, I report the coefficients for lower and higher GDP states for each of the firms' sizes' segmentation (columns (2), (3), (6) and (7)). Finally, I use the dummy lower_GDP$_l$ to test the difference between federal banks' and private domestic banks' credit growth in lower and higher GDP states within each type of firm size.

Table 8 - Bank outstanding credit growth to SMEs - by Brazilian state GDP and credit risk rating

	Dependent variable: Logarithm of outstanding credit$_{b,l,s,r,t}$							
	Lower GDP				Higher GDP			
	SME	Higher risk	Lower risk	Difference	SME	Higher risk	Lower risk	Difference
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fedbanks$_b$	-1.673***	-1.148*	-1.785***	-1.785***	-1.894***	-3.051***	-1.736***	-1.736***
	(0.217)	(0.648)	(0.239)	(0.242)	(0.369)	(0.719)	(0.397)	(0.403)
Post$_t$*Fedbanks$_b$	0.404***	0.506***	0.363***	0.363***	-0.124	0.184	-0.334**	-0.334**
	(0.070)	(0.078)	(0.083)	(0.084)	(0.149)	(0.193)	(0.163)	(0.166)
Post$_t$*Fedbanks$_b$*higher-risk$_r$				0.143*				0.518***
				(0.087)				(0.176)
Privbanks$_b$	0.734***	1.195***	0.188	0.188	0.794**	1.060**	0.397	0.397
	(0.189)	(0.248)	(0.241)	(0.244)	(0.401)	(0.482)	(0.457)	(0.464)
Post$_t$*Privbanks$_b$	0.097	-0.084	0.237***	0.237**	-0.277*	-0.075	-0.236	-0.236
	(0.079)	(0.154)	(0.091)	(0.092)	(0.167)	(0.253)	(0.164)	(0.166)
Post$_t$*Privbanks$_b$* higher-risk$_r$				-0.321**				0.161
				(0.158)				(0.217)
Observations	7,709	3,556	4,153	7,709	2,059	919	1,140	2,059
Adjusted R-squared	0.743	0.739	0.753	0.767	0.782	0.688	0.812	0.783
Fixed Effects	TSRL	TSRL	TSRL	TSRL	TSRL	TSRL	TSRL	TSRL
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cluster	BLST	BLST	BLST	BLST	BLST	BLST	BLST	BLST

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: Table 8 presents the results of the impact of federal banks' credit programs on banks' outstanding credit growth in the free corporate credit market by firm size, regional economic output (Brazilian State GDP), and credit risk rating. It is related to specification (1), considering only the SME segment, which I split by Brazilian states with lower and higher GDP and then by credit risk rating. The dependent variable is the logarithm of outstanding credit granted by bank ownership type *b*, in locality *l*, to firms of size *s*, classified with credit risk *r*, at time (quarter) *t*. Post$_t$ is a dummy variable that accounts for the initiatives to increase the supply of credit by means of state-owned banks. It takes the value 1 from 2012:Q2, and 0 otherwise. Fedbanks$_b$ is a dummy variable that takes the value 1 for federal government-owned banks and 0 otherwise. Privbanks$_b$ is a dummy variable that takes the value 1 for private domestic banks and 0 otherwise. higher_risk$_r$ is a dummy variable that takes the value 1 for firms with credit ratings from D to H, and 0 otherwise. Bank controls are the natural logarithm of total assets, liquidity, retail funding, and capital ratio. To facilitate the comparison, I repeat the results using time and group fixed effects by firm size, credit risk rating, and locality for the SME segment divided into lower and higher GDP states in columns (1) and (5), respectively. Then, I report the coefficients for the higher risk and lower risk firms for each of the groups of Brazilian states (columns (2), (3), (6) and (7)). Finally, I use the dummy higher_risk$_r$ to test the difference between federal banks' and private domestic banks' credit growth for higher and lower risk firms each level of regional economic output.

Table 9 – Bank concentration (whole sample)

Independent Variables	Dep. Variable: HHI$_{l,t}$	
	(1)	(2)
Treat$_{l,2011}$	-34.12***	-79.12**
	(7.84)	(36.36)
Post$_t$*Treat$_{l,2011}$	37.01***	37.51***
	(9.43)	(4.24)
Observations	432	432
Adjusted R-squared	0.11	0.73
Subsample	None	None
Fixed Effects	T	T & L

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Table 9 presents the results concerning the impact of federal banks' credit programs on bank concentration, taking into account the whole sample, irrespective of firm size (specification 3). *Post$_t$* is a dummy variable that accounts for the credit stimulus by means of state-owned banks and takes the value 1 from 2012:Q2, and 0 otherwise. I apply a treatment intensity strategy, which relates the median of the credit market share of federal banks in 2011 for each Brazilian state (*Treat$_{l,2011}$*), before the introduction of the credit programs, to the respective bank concentration index (Herfindahl-Hirschman index), which is the dependent variable in this regression model.

Table 10 - Bank concentration – by firm size

Independent Variables	Dep. Variable: HHI$_{l,t}$		
	SME	Large	Difference
	(1)	(2)	(3)
Treat$_{l,2011}$	37.92***	365.10*	98.72***
	(8.80)	(208.15)	(26.91)
Post$_t$*Treat$_{l,2011}$	64.34***	-34.58***	-34.58***
	(4.72)	(7.56)	(7.54)
Post$_t$*Treat$_{l,2011}$*SME$_s$			98.92***
			(8.90)
Observations	432	368	800
Adjusted R-squared	0.76	0.53	0.65
Fixed Effects	TL	TL	TL

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Table 10 presents the results concerning the impact of federal banks' credit programs on bank concentration, considering SME and large firms' subsamples (specification 3A and 3B, respectively). Post$_t$ is a dummy variable that accounts for the credit stimulus by means of state-owned banks and takes the value 1 as from 2012:Q2, and 0 otherwise. SME$_s$ is a dummy variable that takes the value 1 for SME, and 0 otherwise. I apply a treatment intensity strategy, which relates the median of the credit market share of federal banks in 2011 for each Brazilian state (*Treat$_{l,2011}$*), before the introduction of the credit programs, to the respective concentration index (Herfindahl-Hirschman index), which is the dependent variable in this regression model.

Table 11 – Economies of scale - Bank ownership types' absolute behavior

	Federal Banks			Private Domestic Banks			Foreign Banks		
	Dependent variable: Ln credit$_{l,s,r,t}$								
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post$_t$*gdp_share$_l$	-0.003	-0.009***	0.024*	0.004**	-0.005***	0.022***	0.005	0.005	0.013***
	(0.003)	(0.001)	(0.012)	(0.002)	(0.001)	(0.006)	(0.004)	(0.005)	(0.004)
Observations	3,185	2,592	593	3,248	2,592	656	3,184	2,574	610
Adjusted R-squared	0.602	0.628	0.716	0.600	0.587	0.736	0.607	0.589	0.681
Firms' size	All	SME	Large	All	SME	Large	All	SME	Large
Fixed Effects	TR	TR	TR	TR	TR	TR	TR	TR	TR
Cluster	T	T	T	T	T	T	T	T	T

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Table 11 presents the results concerning the absolute behavior of banks operating in Brazil, by each type of ownership, in the aftermath of the introduction of federal banks' credit programs (specification 4). I apply a treatment intensity approach, relying on the prior results that showed different strategic behavior by banks across the country depending on the regional economic output (Brazilian state GDP). The dependent variable (Ln credit $_{l,s,r,t}$) is the natural logarithm of the outstanding credit granted by federal, private domestic, and foreign banks, respectively, in the locality (Brazilian state) *l*, to the set of firms of size *s*, classified with credit risk *r*, at time (quarter) *t*. $\delta_{t,r}$ controls for time and risk fixed effects. Post$_t$ is a dummy variable that accounts for the credit stimulus and takes the value 1 as from 2012:Q2, and 0 otherwise. The variable gdp_share$_{l,2011}$ accounts for the share of Brazilian states' GDP in the national output in 2011.

Table 12 – 2010 Brazilian presidential election – by Brazilian states

Brazilian States	Dilma Rouseff	José Serra
Acre	30.3%	69.7%
Alagoas	53.6%	46.4%
Amapá	62.7%	37.3%
Amazonas	80.6%	19.4%
Bahia	70.9%	29.2%
Ceará	77.4%	22.7%
Espírito Santo	49.2%	50.8%
Distrito Federal	52.8%	47.2%
Goiás	49.3%	50.8%
Maranhão	79.1%	20.9%
Mato Grosso	48.9%	51.1%
Mato Grosso do Sul	44.9%	55.1%
Minas Gerais	58.5%	41.6%
Pará	53.2%	46.8%
Paraíba	61.6%	38.5%
Paraná	44.6%	55.4%
Pernambuco	75.7%	24.4%
Piauí	70.0%	30.0%
Rio de Janeiro	60.5%	39.5%
Rio Grande do Norte	59.5%	40.5%
Rio Grande do Sul	49.1%	50.9%
Rondônia	47.4%	52.6%
Roraima	33.4%	66.6%
Santa Catarina	43.4%	56.6%
São Paulo	46.0%	54.1%
Sergipe	53.6%	46.4%
Tocantins	58.9%	41.1%
Total	56.1%	44.0%

Source: Superior Electoral Court (TSE)

Notes: Table 12 presents the results of the 2010 presidential election by percentage of valid votes by each administrative unit of the Brazilian federation. I label Brazilian states "more aligned" if the elected president was also the most popular candidate in a given state, and "less aligned" otherwise.

Table 13 – Bank outstanding credit growth – by political alignment

	Dependent variable: Logarithm of outstanding credit$_{b,l,s,r,t}$			
	Brazil	More aligned	Less aligned	Difference
Independent variables	(1)	(2)	(3)	(4)
Fedbanks$_b$	-1.613***	-1.873***	-1.467***	-1.467***
	(0.187)	(0.226)	(0.278)	(0.281)
Post$_t$*Fedbanks$_b$	0.256***	0.286***	0.194**	0.194*
	(0.062)	(0.077)	(0.099)	(0.100)
Post$_t$*Fedbanks$_b$*more_aligned$_t$				0.092
				(0.126)
Privbanks$_b$	0.589***	0.329*	0.955***	0.955***
	(0.165)	(0.194)	(0.271)	(0.275)
Post$_t$*Privbanks$_b$	0.143**	0.211**	0.082	0.082
	(0.070)	(0.089)	(0.109)	(0.111)
Post$_t$*Privbanks$_b$*more_aligned$_t$				0.128
				(0.141)
Observations	12,117	6,872	5,245	12,117
Adjusted R-squared	0.760	0.782	0.748	0.767
Fixed Effects	TSRL	TSRL	TSRL	TSRL
Bank Controls	Yes	Yes	Yes	Yes
Cluster	BLST	BLST	BLST	BLST

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Table 13 presents the results of the impact of federal banks' credit programs on banks' outstanding credit growth in the free corporate credit market by levels of political alignment. It is related to specification (1), which I split into Brazilian states more and less aligned to the former president elected in 2010. The dependent variable is the logarithm of outstanding credit granted by bank ownership type *b*, in locality *l*, to firms of size *s*, classified with credit risk *r*, at time (quarter) *t*. Post$_t$ is a dummy variable that accounts for the initiatives to increase the supply of credit by means of state-owned banks. It takes the value 1 from 2012:Q2, and 0 otherwise. Fedbanks$_b$ is a dummy variable that takes the value 1 for federal government-owned banks and 0 otherwise. Privbanks$_b$ is a dummy variable that takes the value 1 for private domestic banks and 0 otherwise. More_aligned$_l$ is a dummy variable that takes the value 1 if the elected president was also the most popular candidate in a given state, and 0 otherwise. The logarithm of total assets, liquidity, retail funding, and capital ratio are bank specific characteristics. To facilitate the comparison, I repeat the results for the whole sample in column (1), using time and group fixed effects by firms' sizes, credit risk rating, and locality, and then I report the coefficients for the more aligned subsample in column (2), and for the less aligned subsample in column (3). In column (4), I use once more the whole sample, adding a dummy More_aligned$_l$ to test the difference between federal banks' and private domestic banks' coefficients in both subsamples.