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Monopoly Power: Impacts of Location on the Cost of Credit for Small Firms in Brazil

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Abstract

The objective of this study is to observe the impact of bank monopoly power on credit costs for micro and small firms in different regions of Brazil. The finance literature offers a wide range of results regarding the effects of bank monopoly. However, few studies explore how these impacts vary according to the location of firms. The central hypothesis is that monopoly power allows banks to discriminate prices across regions of Brazil. To test this hypothesis, a panel data structure was used at the municipal level, covering the period from 1995 to 2022. The results indicate that monopoly power amplifies credit constraints for micro and small firms in the North, Northeast, and Central-West regions, while exerting an opposite effect in the South and Southeast regions. Thus, this study suggests that geographic location modifies the effects of bank monopoly power on credit conditions for smaller firms.

Keywords: Location, Monopoly power, Banks, Credit cost, Micro and small firms

1. Introduction

This study investigates credit discrimination in the space of micro and small firms based on the local monopoly power of banks. The literature provides evidence on the influence of monopoly power and the spatial characteristics of banking institutions. Research indicates that increasing the distance between banks and firms intensifies information asymmetry,

which can, in turn, result in higher bankruptcy rates Carling and Lundberg (2005); Bellucci et al. (2019); Sun et al. (2023). However, studies on the effect of bank monopoly power present divergences. Some studies point to an increase, others to a reduction in credit restrictions due to bank monopoly power Petersen and Rajan (1995); Levine (2005). This work, therefore, will demonstrate that the effects of banking monopoly power vary according to the geographic location of firms.

Studies in the finance literature investigate whether bank monopolies increase or reduce credit rationing for smaller firms. However, this research contributes to the literature by showing that the effects of monopoly power may vary according to the location of firms. The central hypothesis of the research is that banks use their market power to discriminate credit prices among firms, depending on the regions of Brazil in which they are located. Thus, the article incorporates the geographic dimension as one of the elements to explain the dynamics of credit to smaller firms.

The literature on creditor-debtor relationship suggests that bank monopolies reduce credit constraints for smaller firms Petersen and Rajan (1995). Research by Delis et al. (2017) indicates that increased market power of financial institutions is associated with improved firm performance. In a similar way, Fung´aˇcov´a et al. (2017) conclude that monopolies reduce credit rationing for small firms. Furthermore, Shamshur and Weill (2019) argue that monopolies make banks more efficient, enabling a reduction in credit constraints. Thus, a significant portion of the literature suggests that bank monopoly power can improve credit conditions for smaller firms.

However, post keynesian perspectives offer arguments that may restrict the results of the creditor-debtor relationship literature. Studies by Crocco et al. (2003); Rodr´ıguez-Fuentes (1998) suggest that in less developed regions there is less demand for banking services, such as deposits, which discourages financial institutions from offering larger amounts of credit. This dynamic reflects a preference for liquidity that limits the credit relationship between banks and firms. Thus, post keynesian evidence, based on liquidity preference, could justify the increase in credit restrictions under banking monopoly Ryan et al. (2014); Samantas (2017); Joaquim et al. (2019).

The geographic location of firms, as well as liquidity preferences, can explain the increase in credit constraints despite the monopoly power of banks. According to Degryse and Ongena (2005); Alessandrini et al. (2009); Geng et al. (2023), the physical distance between creditors and debtors limits access to information and increases monitoring costs. In addition, the distance between bank headquarters and branches generates agency costs and increases credit rationing Degryse and Ongena (2005); do Carmo et al. (2023). Thus, the spatial dimension tends to increase credit costs, resulting in price dis crimination by banks Bellucci et al. (2019).

Spatial characteristics tend to increase credit restrictions for micro and small firms. Physical distance makes information about these firms, such as honesty, management of directors and competence, more difficult to assess Cotugno et al. (2013). For Fredriksson and Moro (2014), these firms should have relationships with banks of similar size. However, the Brazilian

banking sector is dominated by large financial conglomerates present in all regions do Carmo et al. (2023). Thus, smaller firms often have relationships with large banks, which results in price discrimination due to spatial differences.

In view of this, the monopolistic structure of banks and spatial characteristics interfere with the availability of credit to smaller firms. These characteristics are observed in the Brazilian economy, making this research relevant. Brazil is made up of 5,565 municipalities, distributed across five major regions: North, Northeast, Central- West, South and Southeast. Additionally, five large banks account for approximately 60% of the credit supply in the country and are present in all regions. This market concentration allows the largest financial institutions to adjust credit prices according to the geographic location of each debtor. Thus, this study is viable due to the spatial characteristics and the Brazilian banking sector.

Regional inequality contributes to price discrimination by banks. Data from the Brazilian Institute of Geography and Statistics for 2021 shows that the North, Northeast and Central-West regions, made up of 20 states, account for 30% of the GDP. The South and Southeast regions, with only 6 states, account for 70% of the national GDP. Therefore, these data show that the South and Southeast regions are more economically developed than the North, Northeast and Central-West regions.

In addition to the introduction, this article is structured in five more sections. The section 2 details the database and empirical strategies. The section 3 highlights the econometric models. The section 4 and section 5 present the main results for the model and robustness tests. Finally, the section 6 presents the final considerations.

2. Data and Empirical Strategies

This section describes the database used in this research. Information was collected for micro and small firms, banks, and local economic characteristics, covering the period from 1995 to 2022. Data were obtained from public information sources, including: the Brazilian Institute of Geography and Statistics (IBGE) (Note 1); the Annual Report of Social Information (RAIS) (Note 2); the Monthly Banking Statistics by Municipality (Estban) (Note 3); the Finance of Brazil (Finbra) (Note 4) and Ipeadata (Note 5). The Table 1 presents the statistical description of the variables that make up the database used in the econometric model.

Table 1. Descriptive statistics of the variables used in the regression

Variables	Units	Definition	N	Mean	St. Dev.	Min	Max
Dependent variable	-	Cost of credit for firms	88,442	0.69	0.71	0.00	8.99
Index power banks							
Lener	-	Difference between price and marginal cost	89,812	0.97	0.07	0.00	1.00
HHI	-	Squared deposit ratio	89,808	0.64	0.34	0.00	1.00
CR5	-	Asset share of the 5 largest banks	89,673	0.99	0.03	0.42	1.00
Index complexitivy							
HHI Deposit	-	HHI on deposit	79,86	0.39	0.34	0.00	1.00
HHI Loan	-	HHI on loan	79,863	0.39	0.36	0.00	1.00
Distance SP (Km)	Million	Distance from S˜ao Paulo to the municipalities	78,805	40.00	154.00	0.00	4,727.00
Distance BR (Km)	Million	Distance from Brasilia to the municipalities	78,805	51.00	304.00	0.00	17,415.00
Firms characteristics							
Firm size	-	Number of employees	88,699	761.62	5,376.28	0.00	295,03
Firm assets	Billion	Firm salaries	88,698	186.00	1,057.00	0.00	14,403.00
Regional characteristics							
GDP	Million	GDP per capita	63,880	1.00	11.00	−0.19	763.00
Inflation	Million	Public collection of municipalities	86,738	5.00	110.00	0.000	13,391.00
Credit	Billion	Loans and discounted securities	89,812	1.00	42.00	0.00	4,742.00
Institutional	-	Homicide rate per 100.000hab	61,488	23.00	18.90	0.22	393.18

The table presents the definitions of the variables. The mean, standard deviation, minimum and maximum are present for each variable.

The estimated model was developed based on two sets of variables. The first was extracted directly from public databases: the variables related to the size and assets of micro and small firms were obtained through RAIS; the variables GDP per capita, inflation, credit and homicide rate were collected from the databases of IBGE, Finbra, Estban and Ipeadata, respectively. The second set of variables was generated through empirical strategies. These variables are detailed in the two subsequent subsections. subsection 2.1 presents the variable credit cost of micro and small firms, while subsection 2.2 describes the indicators of bank concentration.

2.1 Credit Cost

Studies define the variable cost of credit as the difference between the ratio of financial expenses divided by bank debts and the interest rate Shamshur and Weill (2019); Fung´a˘cov´a et al. (2017); Carbo-Valverde et al. (2009). However, this research uses arguments from the literature to construct the approximate variable of the cost of credit. The variables hours and working time are proxies for the variables financial expenses and bank debts. The ratio between debtor and credit balance is an approximate measure for the interest rate.

The work of Modigliani and Miller (1963) points out that firms with debts are encouraged to increase their productivity due to financial costs. This research suggests that the number of

hours worked may be correlated with the productivity of firms. An increase in the number of hours worked signals an increase in the production of firms. Thus, working hours are a proxy for the financial expense variable.

The research by Diamond (1989) indicates that firms with longer time in the market tend to have lower credit restrictions. The hypothesis of this study is that employee time is a measure of the firms' time in the market. Therefore, working time is an approximate variable for the firms' time in companies.

Finally, the approximate variable for the interest rate is the ratio between debtor and credit accounts. Debtor accounts are the operating expenses and credit accounts are the banks' income. Both accounts make up the result for each financial institution. The increase in this ratio causes bank head- quarters to reduce financial targets and the number of managers in affiliates. This compromises the provision of banking services (Note 6). Therefore, the ratio between debtor and credit accounts is a good proxy for the interest rate of banks.

Given these considerations, the study constructs proxies for the variables financial expenses, bank debts and interest rate. Therefore, the cost of credit is calculated by the difference between the ratio of the growth rate of hours worked divided by working time and the ratio of the growth rate of debit and credit accounts:

$$C_{it} = [ln(\frac{H_{i,t}}{T_{i,t}} - \frac{D_{i,t}}{C_{i,t}})]^2 \quad (1)$$

Where $C_{t,i}$ is the cost of credit in municipality i, at time t for micro and small firms; H_{it} are the hours worked by employees of micro and small firms, in municipality i, at time t; T_{it} is the working time of employees of micro and small firms, in municipality i, at time t; D_{it} is the debtor accounts of banks in municipality i, at time t; and C_{it} is the credit balance of banks in municipality i, at time t.

2.2 Concentration Indicators

The literature suggests different concentration measures to analyze the effects of banks' monopoly power. The studies by Carbo-Valverde et al. (2009); Ryan et al. (2014); Delis et al. (2017) use the Lerner and Herfindahl- Hirschman (HHI) indicators. However, the study by Carbo-Valverde et al. (2009) points out that bank concentration indicators can lead to misleading conclusions. The research by Fung´aˇcov´a et al. (2017) uses four concentration measures, Lerner index, HHI, h-statistic and CR5. For this research, the h-statistic indicator has limitations due to the use of dummys for municipalities. The sample has more than 3,000 municipalities per year, limiting data processing. Therefore, this work will use three indicators of banking concentration: Lerner index, HHI and CR5.

The CR5 index is measured by the ratio of the assets of the five largest banks in the municipality to the total assets of all banks in the municipality.

$$CR5_{it} = \frac{Atv5_{it}}{Atv_{it}} \quad (2)$$

Where $Atv5_{it}$ is the total assets of the five largest banks in municipality i, at time t. Atv_{it} is the assets of all banks in municipality i, at time t.

The Herfindahl-Hirschman Index (HHI) measures the ratio of a bank's deposit in a municipality to the deposits of all banks in that municipality.

$$Herfindahl_{it} = \Sigma(\frac{D_{jit}}{D_{it}})^2 \quad (3)$$

Where D_{jit} is the deposit volume of bank j, in municipality i, at time t; and D_{it} is the total deposit volume of all banks in municipality i, at time t.

The Lerner index measures the ratio of the difference between price and marginal cost per asset price. The ratio between the sum of total time deposits and savings per asset is the proxy for the asset price. (Note 7) The marginal cost will be obtained by estimating the translog function. The inputs of this function are the wage, financial and physical capital expenses of the banks. The salaries of the financial sector in the municipality, extracted from Rais, will be the proxy for the expenses with salaries of the banks. The "fixed assets in use" (Note 8), and the "debtor accounts", both extracted from Estban, will be proxies for expenses with physical capital and financial. Thus, the construction of the Lerner index will use approximate variables to estimate the marginal cost of the banks.

$$Lerner_{it} = \frac{PTA_{it} - CMG_{it}}{PTA_{it}} \quad (4)$$

Where PTA_{it} is the total asset price of banks in municipality i, at time t and CMG_{it} is the marginal cost of banks in municipality i, at time t.

The marginal cost is found by minimizing the translog function from the expansion of the Taylor series polynomial, as per Carbo-Valverde et al. (2009); Ryan et al. (2014):

$$LnC_{it} = \beta_0 + \Sigma_j \beta_{ijt} lnP_{ijt} + 0.5\Sigma_j\Sigma_k \Theta_{ijkt} lnP_{ikt} lnP_{ijt} + \beta_{ity} lnY_{it} + 0.5\beta_{ityy} lnY^2{}_{it} + \Sigma_i\Sigma_j \Theta_{ijtylnP_{itj}lnY_{it}} \quad (5)$$

Where cost (C_{it}) is the sum of expenses with the balance of debtor accounts of each bank, staff salaries and other operating expenses, indexes k,j=1,2,3. The variable variable Y is the total product (Total assets).

3. Empirical Analysis

The estimated model will consider the effects of monopoly power based on the location of micro and small firms. Location is measured through dummy variables indicating the region

in which the firm operates (North, Northeast, Central-West, South and Southeast). The study will estimate two models. The first is analyzed with additive dummy Equation 6.

$$Cit = \alpha + D_j + \beta X_{it} + \gamma Z_{it} + \delta PM_{it} + \theta_i + \mu_t + \varepsilon_{it} \quad (6)$$

Where C_{it} is the cost of credit for micro and small firms in municipality i at time t ; D_j is the additive dummy, indicating the difference in the cost of credit between the j regions (North, Northeast, Central-West, South and Southeast); X are the firms characteristics (size and intangible assets); Z are the regional variables (GDP per capita, inflation, credit, institutional instability); PM are three measures of market power (Lerner, Herfindahl - Hirschman (HHI) and CR5 indicators); θ is the municipality fixed effect; μ is the time fixed effect and ε is the random error term.

The second model will use the multiplicative dummy variable (Equation 7)

$$Cit = \alpha + \beta X_{it} + \gamma Z_{it} + \Omega D_j{}^{*} PM_{it} + \delta PM_{it} + \theta_i + \mu_t + \varepsilon_{it} \quad (7)$$

Where C_{it} is the cost of credit for micro and small firms in municipality i at time t ; D_j is the multiplicative dummy indicating the intensity of monopoly power over smaller firms for the region located in one of the j regions (North, Northeast, Central-West, South and Southeast); X are firms characteristics (size and intangible assets); Z are regional variables (GDP per capita, inflation, credit, institutional instability); PM are three measures of market power (Lerner, Herfindahl - Hirschman (HHI) and CR5 indicators); θ is the municipality fixed effect; μ is the time fixed effect and ε is the random error term.

The models were estimated by fixed effects, controlling for the heterogeneity of municipalities and the effect of time (μ_t). In addition, we included lags in all independent variables to correct for simultaneity Fung´aˇcov´a et al. (2017); Shamshur and Weill (2019); Garcia-Appendini et al. (2023).

However, before defining the fixed effect definition method, the Hausman test was performed. The evidence revealed brightness between the individual effect and the explanatory variables, in addition to the model showing brightness between the Lener index and the firms located in the Northeast, North and South regions. In view of this, we estimated the models with multiplicative dummies for the Lener index using both the fixed effect and random effect methods. On the other hand, the models with additive and multiplicative dummies for the concentration indices (CR5 and HHI) were estimated only using the fixed effects method.

4. Results

The results for the econometric models are presented in this section. Table 2 and Table 3 show results for the non-structural (HHI and CR5) and structural (Lener) concentration indicators, using additive dummies (Equation 6). Table 2 shows that the dummy variables were statistically significant, but with different signs. The dummies for the Northeast, North and Central-West regions were statistically significant and positive, while for the Southeast and South regions they were statistically significant, but negative. The results for the concentration coefficient are statistically significant and positive, similar to Joaquim et al. (2019), but divergent from Petersen and Rajan (1994); Fung´aˇcov´a et al. (2017); Delis et al.

(2017); Shamshur and Weill (2019). Thus, the evidence indicates that the credit costs of micro and small firms in less developed regions (Northeast, North and Central-West) are higher than in more developed regions (Southeast and South), regardless of the monopoly power of banks.

The firm assets coefficient is also positive and statistically significant, while the firm size coefficient is negative and statistically significant. The local characteristics: credit and inflation variables were positive and statistically significant. The GDP variable is negative and statistically significant, reducing credit costs. Finally, institutional instability is not statistically significant.

Table 2. The regional difference between the cost of credit for micro and small firms with CR5 and HHI concentration index

Dependent Variable	Credit Cost									
Models	I	II	III	IV	V	VI	VII	VIII	IX	X
Dummy	0.1746***	0.2909***	0.7599***	-0.3557***	-0.1706***	0.1756***	0.2905***	0.7538***	-0.3491***	-0.1783***
	(0.0323)	(0.0542)	(0.0500)	(0.0300)	(0.0354)	(0.0322)	(0.0544)	(0.0503)	(0.0300)	(0.0355)
Concentration	10.2199***	10.2213***	10.2403***	10.2159***	10.2273***	1.0579***	1.0576***	1.056***	1.0508***	1.0610***
	(0.4472)	(0.4466)	(0.4432)	(0.4461)	(0.4467)	(0.0493)	(0.0493)	(0.0492)	(0.0493)	(0.0493)
Firm size	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Firm assets	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Credit	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Institutional	0.0003	0.0003	0.0003	0.0004	0.0003	0.0010	0.0010	0.0010	0.0010	0.0010
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Observations	55,067	55,067	55,067	55,067	55,067	55,067	55,067	55,067	55,067	55,067
Adjusted R^2	0.028	0.028	0.032	0.030	0.028	0.027	0.026	0.030	0.029	0.026
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The results for Equation 6. Columns I, II, III, IV and V use the CR5 concentration index, with additive dummies for the Northeast, North, Central-West, Southeast and South regions. Columns VI, VII, VIII, IX and X use the HHI concentration index, with additive dummies, for the Northeast, North, Central-West, Southeast and South regions. The model is estimated by panel data with robust fixed effects, controlling for heterogeneity through the cluster by municipality. *, ** and *** denote a significant statistic different from 0 to 10%, 5% and 1% respectively. Variable definitions are in Table 1.

The Table 3 shows similar results to Table 2. The equal results between structural and

non-structural indicators suggest that there are no differences between structural and non-structural measures of competition Fung´aˇcov´a et al. (2017).

Table 3. The regional difference between the cost of credit for micro and small firms with Lerner concentration index

Dependent Variable	Credit Cost				
Models	I	II	III	IV	V
Dummy	0.1735***	0.2895***	0.7550***	-0.3561***	-0.1659***
	(0.0326)	(0.0547)	(0.0499)	(0.0301)	(0.0356)
Concentration	8.7625***	8.7973***	8.7330***	8.8005***	8.7469***
	(2.7921)	(2.7757)	(2.7781)	(2.8296)	(2.7660)
Firm size	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Firm assets	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Credit	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Institutional	-0.0006	-0.0006	-0.0006	-0.0006	-0.0006
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Observations	55,067	55,067	55,067	55,067	55,067
Adjusted R^2	0.019	0.019	0.022	0.021	0.019
Region FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

The results for Equation 6. Columns I, II, III, IV and V use the Lener concentration index, with additive dummies for the Northeast, North, Central-West, Southeast and South regions. The model is estimated by panel data with robust fixed effects, controlling for heterogeneity across the cluster by municipality. *, ** and *** denote a significant statistic different from 0 to 10%, 5% and 1% respectively. Variable definitions are in Table 1.

The study also analyzes the dummy variable interacting with the monopoly power indexes (Equation 7). This strategy allows us to verify that the intensity of the effects of the banks' monopoly power change according to the location of micro and small firms. The Table 4 shows that the effects of the banks' monopoly power on the cost of credit are greater for smaller firms located in the North, Northeast and Central-West regions. On the other hand,

these effects are less intense in firms located in the South and South- east regions. This is because the dummy variable is positive and statistically significant for the North, Northeast and Central-West regions, but negative and statistically significant for the South and Southeast regions. Thus, the evidence suggests that credit restrictions in the face of the banks' monopoly power have greater effects on firms located in undeveloped regions than in developed regions.

Table 4. The regional intensity of banks' monopoly power over the cost of credit for micro and small firms: CR5 and HHI index

Dependent Variable	Credit Cost									
Models	I	II	III	IV	V	VI	VII	VIII	IX	X
Dummy	0.1827***	0.2947***	0.7584***	-0.3616***	-0.1730***	0.4377***	0.4208***	0.6174***	-0.4614***	-0.3217***
	(0.0327)	(0.0548)	(0.0504)	(0.0303)	(0.0356)	(0.0439)	(0.0749)	(0.0689)	(0.0412)	(0.0469)
Concentration	10.1718***	10.20199***	10.1781***	10.3584***	10.2612***	0.9397***	1.0283***	1.0057***	1.2226***	1.1283***
	(0.4472)	(0.4467)	(0.4436)	(0.4462)	(0.4468)	(0.0508)	(0.0494)	(0.0495)	(0.0518)	(0.0504)
Firm size	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Firm assets	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Credit	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Institutional	0.0003	0.0003	0.0003	0.0003	0.0003	0.0010	0.0010	0.0010	0.0010	0.0010
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Observations	55,067	55,067	55,067	55,067	55,067	55,067	55,067	55,067	55,067	55,067
Adjusted R^2	0.028	0.028	0.031	0.030	0.028	0.028	0.027	0.027	0.028	0.027
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The results for Equation 7. Columns I, II, III, IV and V use the CR5 concentration index and the interaction of the index with the dummy variable for the Northeast, North, Central-West, Southeast and South regions. Columns VI, VII, VIII, IX and X use the HHI concentration index and the interaction of the index with the dummy variable for the Northeast, North, Central-West, Southeast and South regions. The model is estimated by panel data with robust fixed effects, controlling for heterogeneity through the cluster by municipality. *, ** and *** denote a significant statistic different from 0 to 10%, 5% and 1% respectively. Variable definitions are in Table 1.

The results do not change when the structural concentration index is analyzed (Table 5). Monopoly power measured by the Lener indicator remains positive and statistically significant for the North, Northeast and Central-West regions, but negative and statistically

significant for the South and Southeast regions. This evidence indicates that the cost of credit for smaller firms in the face of monopoly power is higher for firms located in the North-east, North and Central-West regions than in the Southeast and South regions. Furthermore, the results showed that there were no differences between the fixed and random effect estimation methods.

Table 5. The regional intensity of banks' monopoly power over the cost of credit for micro and small firms: Lener index

Dependent Variable	Credit Cost									
Models	I	II	III	IV	V	VI	VII	VIII	IX	X
Dummy	0.1750***	0.2886***	0.7556***	-0.3574***	-0.16592***	0.1862***	0.3065***	0.8101***	-0.3926***	-0.1642***
	(0.0326)	(0.0548)	(0.0500)	(0.0301)	(0.03563)	(0.0317)	(0.0541)	(0.0488)	(0.0294)	(0.0346)
Concentration	8.72667***	8.7681***	8.7360***	8.9529***	8.7924***	9.0925***	9.1451***	9.1072***	9.3251***	9.1738***
	(2.7838)	(2.7734)	(2.7787)	(2.7931)	(2.7734)	(2.7833)	(2.7821)	(2.7830)	(2.7886)	(2.7798)
Firm size	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Firm assets	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Credit	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Institutional	-0.0006	-0.0006	-0.0006	-0.0006	-0.0006	-0.0006	-0.0006	-0.0006	-0.0006	-0.0006
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Observations	55,067	55,067	55,067	55,067	55,067	55,067	55,067	55,067	55,067	55,067
Adjusted R^2	0.019	0.019	0.022	0.021	0.019	0.021	0.020	0.025	0.023	0.020
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The results for Equation 7. Columns I, II, III, IV and V use the Lerner concentration

index and the interaction of the index with the dummy variable for the Northeast, North, Central-West, Southeast and South regions. Columns VI, VII, VIII, IX and X too use the Lerner concentration index and the interaction of the index with the dummy variable for the Northeast, North, Central-West, Southeast and South regions. However, columns I, II, III, IV and V are estimated by panel data with robust fixed effects, controlling for heterogeneity across the cluster by municipality. While, columns VI, VII, VIII, IX and X are estimated by panel data with robust random effects, controlling for heterogeneity across the cluster by municipality. *, ** and *** denote a significant statistic different from 0 to 10%, 5% and 1% respectively. Variable definitions are in Table 1.

5. Robustness Tests

The study performs two robustness tests, changing the sample composition. The analysis is performed with a multiplicative dummy model (Equation 7). The first excludes the capitals from the sample. This method reduces the sample size and verifies whether the effects of the monopoly power of banks are maintained even if the large economic centers are not present. The second excludes the values of missings. The presence of missing data may interfere with the results of the main model.

The first test maintains the results for the main model (Table 6). That is, the credit costs of micro and small firms in the Northeast, North and Central-West regions are higher than those in the Southeast and South regions, regardless of the monopoly power of the banks.

Table 6. The regional intensity of banks' monopoly power over the cost of credit for micro and small firms (without large cities): CR5 and HHI index

Dependent Variable	Credit Cost									
Models	I	II	III	IV	V	VI	VII	VIII	IX	X
Dummy	0.1895***	0.3414***	0.7893***	-0.3799***	-0.1817***	0.1906***	0.3401***	0.7842***	-0.3733***	-0.1895***
	(0.0325)	(0.0551)	(0.0499)	(0.0301)	(0.0355)	(0.0324)	(0.0553)	(0.0502)	(0.0302)	(0.0356)
Concentration	10.3261***	10.3308***	10.3446***	10.3243***	10.3339***	1.0761***	1.0758***	1.0744***	1.0689***	1.0793***
	(0.4528)	(0.4523)	(0.4486)	(0.4517)	(0.4523)	(0.0496)	(0.0496)	(0.0495)	(0.0496)	(0.0496)
Firm size	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Firm assets	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	-0.0000**	-0.0000***	-0.0000***	-0.0000**	-0.0000***	-0.0000*	-0.0000*	-0.0000*	-0.0000	-0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Credit	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Institutional	0.0002	0.0002	0.0002	0.0003	0.0002	0.0009	0.0009	0.0009	0.0009	0.0009
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Observations	54,609	54,609	54,609	54,609	54,609	54,609	54,609	54,609	54,609	54,609
Adjusted R^2	0.030	0.030	0.033	0.032	0.030	0.028	0.028	0.032	0.031	0.028
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The results for robustness. Columns I, II, III, IV and V use the CR5 concentration index

and the interaction of the index with the dummy variable for the Northeast, North, Central-West, Southeast and South regions. Columns VI, VII, VIII, IX and X use the HHI concentration index and the interaction of the index with the dummy variable for the

Northeast, North, Central-West, Southeast and South regions. The model is estimated by panel data with robust fixed effects, controlling for heterogeneity through the cluster by municipality. *, ** and *** denote a significant statistic different from 0 to 10%, 5% and 1% respectively. Variable definitions are in Table 1.

The inclusion of the non-structural indicator does not change the results (Table 7). Smaller firms in less developed regions continue to have higher financial costs than those located in more developed areas of the country.

Table 7. The regional intensity of banks' monopoly power over the cost of credit for micro and small firms (Without large cities): Lerner index

Dependent Variable	Credit Cost				
Models	I	II	III	IV	V
Dummy	0.1883***	0.3384***	0.7847***	-0.3800***	-0.1769***
	(0.03277)	(0.0557)	(0.0498)	(0.0302)	(0.0357)
Concentration	8.9812***	9.0176***	8.9460***	9.0205***	8.9646***
	(2.8603)	(2.8423)	(2.8445)	(2.9001)	(2.8322)
Firm size	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Firm assets	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Inflation	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
GDP	-0.0000*	-0.0000*	-0.0000*	-0.0000*	-0.0000*
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Credit	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Institutional	-0.0007	-0.0007	-0.0008	-0.0007	-0.0008
	(0.00075)	(0.00075)	(0.00075)	(0.00075)	(0.00075)
Observations	54,609	54,609	54,609	54,609	54,609
Adjusted R^2	0.020	0.020	0.024	0.023	0.020
Region FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

The results for robustness. Columns I, II, III, IV and V use the Lerner concentration index and the interaction of the index with the dummy variable for the Northeast, North, Central-West, Southeast and South regions. The model is estimated by panel data with robust fixed effects, controlling for heterogeneity across the cluster by municipality. *, ** and *** denote a significant statistic different from 0 to 10%, 5% and 1% respectively. Variable

definitions are in Table 1.

The second robustness test excludes all missing data, reducing the sample size (Table 8). However, the results continue to indicate an increase in the cost of credit for smaller firms in less developed locations and a lower cost in developed regions.

Table 8. The regional intensity of banks' monopoly power over the cost of credit for micro and small firms (No missing data): CR5 and HHI index

Dependent Variable	Credit Cost									
Models	I	II	III	IV	V	VI	VII	VIII	IX	X
Dummy	0.1596***	0.2846***	0.7607***	-0.3512***	-0.1565***	0.1621***	0.2822***	0.7514***	-0.3438***	-0.1649***
	(0.0344)	(0.0586)	(0.0537)	(0.0319)	(0.0378)	(0.0344)	(0.0586)	(0.0542)	(0.0319)	(0.0380)
Concentration	9.8677***	9.8668***	9.8979***	9.8758***	9.8708***	1.0405***	1.0389***	1.0372***	1.0337***	1.0426***
	(0.4612)	(0.4607)	(0.4574)	(0.4602)	(0.4607)	(0.0522)	(0.0521)	(0.0520)	(0.0521)	(0.0521)
Firm size	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Firm assets	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000**	-0.0000**	-0.0000**	-0.0000**	-0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Credit	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000**	0.0000*	0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Institutional	0.0002	0.0002	0.0002	0.0003	0.0002	0.0009	0.0009	0.0009	0.0009	0.0009
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Observations	48,993	48,993	48,993	48,993	48,993	48,993	48,993	48,993	48,993	48,993
Adjusted R^2	0.029	0.029	0.032	0.031	0.028	0.027	0.027	0.030	0.029	0.027
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

The results for robustness. Columns I, II, III, IV and V use the CR5 concentration index and the interaction of the index with the dummy variable for the Northeast, North, Central-West, Southeast and South regions. Columns VI, VII, VIII, IX and X use the HHI concentration index and the interaction of the index with the dummy variable for the Northeast, North, Central-West, Southeast and South regions. The model is estimated by panel data with robust fixed effects, controlling for heterogeneity through the cluster by municipality. *, ** and *** denote a significant statistic different from 0 to 10%, 5% and 1% respectively. Variable definitions are in Table 1.

The results for the Lener index also indicate a higher cost of credit for small firms located in the Northeast, North and Central-West regions and a lower cost in the Southeast and South regions, regardless of the monopoly power of the banks (Table 9).

Table 9. The Regional intensity of banks' monopoly power over the cost of credit for micro and small firms (No missing data): Lerner index

Dependent Variable	Credit Cost				
Models	I	II	III	IV	V
Dummy	0.1576***	0.2825***	0.7531***	-0.3499***	-0.1516***
	(0.03474)	(0.0591)	(0.0538)	(0.0320)	(0.0380)
Concentration	9.1117***	9.1271***	9.0700***	9.1616***	9.0818***
	(2.9661)	(2.9497)	(2.9546)	(3.0099)	(2.9394)
Firm size	-0.0000**	-0.0000**	-0.0000**	-0.0000**	-0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Firm assets	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Inflation	0.0000**	0.0000**	0.0000**	0.0000**	0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
GDP	-0.0000**	-0.0000**	-0.0000**	-0.0000**	-0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Credit	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Institutional	-0.0011	-0.0011	-0.0011	-0.0010	-0.0011
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Observations	48,993	48,993	48,993	48,993	48,993
Adjusted R^2	0.019	0.019	0.023	0.021	0.019
Region FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes

The results for robustness. Columns I, II, III, IV and V use the Lerner concentration index and the interaction of the index with the dummy variable for the Northeast, North, Central-West, Southeast and South regions. The model is estimated by panel data with robust fixed effects, controlling for heterogeneity across the cluster by municipality. *, ** and *** denote a significant statistic different from 0 to 10%, 5% and 1% respectively. Variable definitions are in Table 1.

6. Final Considerations

The results of this study are relevant to the literature by showing that the effects of banking monopoly are unequal across space. Firms located in less developed regions have higher credit costs than those located in more developed regions. The financing constraint compromises the dynamics of the local economy. Firms will have lower investment capacity, limited cash flow, low number of hires and, therefore, a higher probability of bankruptcy. In

view of this, the monopoly power of banks in Brazil may increase regional inequality.

Based on the evidence identified in this study, we propose improving the local credit market, combined with increased competition between financial institutions. This would increase proximity between creditors and debtors, resulting in a reduction in information asymmetry, as well as mitigating the monopolistic power of financial institutions. However, spatial heterogeneity and socioeconomic inequalities present in the various regions of Brazil may limit the positive impacts of this policy. Thus, the development of microfinance and the strengthening of credit unions emerge as viable alternatives to expand access to banking services in remote and economically disadvantaged areas.

Regional socioeconomic heterogeneity and the significant monopoly power of large banks make future research feasible. The literature indicates that the expansion of financial conglomerates in space creates geographic complexity, generating agency costs, which would increase credit restrictions. In addition, the literature also presents dual results on the monopoly power of banks. Thus, further studies on geographic complexity and the monopoly power of banks may explain the discrimination in credit costs between regions.

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Notes

Note 1. The IBGE provides economic and social information at the regional and national levels.

Note 2. The RAIS presents a wide range of information on private firms, with regional, national, and size breakdowns, among other characteristics.

Note 3. Estban contains financial data on multiple banks operating in Brazil, at the regional level.

Note 4. Finbra provides financial information on local governments in Brazil.

Note 5. Ipeadata is a macroeconomic, financial and regional database for Brazil, maintained by the Institute of Applied Economic Research (Ipea).

Note 6. This evidence corroborates the post-Keynesian literature. Studies indicate that the greater preference for liquidity in less developed regions restricts the supply of credit Crocco et al. (2003, 2005); Alexandre et al. (2008).

Note 7. The volume of deposits measures the cost of the loan offered by the bank. According to Bustos et al. (2016), the increase in the amount of deposits causes banks to resort less to the interbank market, making loans cheaper. Therefore, the greater the volume of deposits in

the region, the lower the cost of money should be.

Note 8. The expense of fixed assets in use is composed of expenses with equipment in stock, furniture and real estate, leased assets, in addition to intangible assets.