The real effects of bank-firm relationships

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Abstract

We investigate whether and how bank relationships affect real economic activity. We base our analysis on matched credit and labor data from Brazilian firms during 2005-2014. We document that firms with more bank relationships employ more workers and pay higher wages. Moreover, increases (decreases) of bank relationships result in higher (lower) economic activity. These effects are independent of firm size and due (but not limited) to higher credit availability and lower cost of credit. Importantly, the firm-level results consistently translate into positive macroeconomic effects at the municipality and state level. The evidence suggests positive real effects of multiple bank relationships.

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1. Introduction

Well-developed financial systems, in particular a well-developed banking sector, are crucial for economic growth (e.g., Burgess and Pande, 2005; Black and Strahan, 2002; Beck et al., 2000; Rajan and Zingales, 1998; Jayaratne and Strahan, 1996). However, there is little research on whether and how finance affects real economic activity. Does firms' access to finance and the financing terms influence their employment decisions? Does it matter if firms have more or less sources of external finance? And how do any ensuing effects at the firm level translate into macroeconomic output?

In this paper, we seek to provide answers to these fundamental questions. We investigate whether bank-firm relationships influence real economic activity. Specifically, we are interested in whether firms with multiple bank relationships take different labor market decisions than firms with a single bank relationship and how changes of the number of bank relationships affect labor market outcomes. Furthermore, we analyze whether and how the number of bank relationships at different aggregation levels influences macroeconomic output. Firms' bank relationships can have real effects because of different reasons. For instance, firms can diversify their access to credit across banks and over time, obtain more favorable price and non-price credit terms, and shield themselves against the negative credit supply shocks.

We base our analysis on matched credit and labor market data from Brazilian firms. Brazil is an ideal laboratory to provide first answers to our research questions because every Brazilian firm is required to send annual information to the Ministry of Labor including the number of employees and the total of wages paid for all employees as of the end of each year. Moreover, every Brazilian financial institution has to send monthly information to the Brazilian Central Bank (*Banco Central do Brasil*) including a large number of characteristics of the loans granted. We use the nationwide firm identifier (*Cadastro Nacional de Pessoas Jurídicas, CNPJ*) to match firms' credit and labor data. This setting enables us to observe labor market

outcomes at the firm level, the firm's bank relationships, and corresponding loan data of the banks from which the firm borrows over time.

In our main tests, we regress different labor market outcomes on measures of firms' bank relationships for more than 1.8 million firms over the period 2005-2014, controlling for fixed effects at the firm level and the bank-time level. We document a positive effect of firms' number of bank relationships on real economic activity. Firms with a higher number of bank relationships employ more workers and pay a higher total of wages. These results remain robust in instrumental variable regressions and Heckman selection models. We further find that firms increase (decrease) employment in years when they increase (decrease) their number of bank relationships. These results are independent of firm size: the number of bank relationships has a significantly positive impact on labor market outcomes for firms in different size categories. We then show that these positive real effects are due (but not limited) to higher credit availability and lower the cost of credit. Finally, we find that these positive effects exist when we aggregate firms' number of bank relationships at the municipality and state level. In these tests, we add municipality (or state) and time fixed effects that control for any cross-sectional differences, for instance, due to local bank competition (e.g., Kysucky and Norden, 2016; Presbitero and Zazzaro, 2011) or bankruptcy law enforcement (e.g., Ponticelli and Alencar, 2016). We also show that firms' number of bank relationships has a positive impact on different macroeconomic outputs at the state level such as industrial production, sales and revenues. Our findings provide novel evidence that suggests that multiple bank relationships have significantly positive effects on real economic activity.

We contribute to the finance and banking literature in two ways. First, we contribute to recent studies on real effects of finance that make the next step after research on the

transmission of monetary policy and economic shocks to banks.[1] Some of these recent studies show that finance has a positive effect on innovation, productivity, and economic growth (e.g., Bai et al., 2018; Neuhann and Saidi, 2018; Cornaggia et al., 2015; Chava et al., 2013; Amore et al., 2013). For example, Bai et al. (2018) show that the geographic banking deregulation in the United States has increased employment of young local firms with relatively high productivity. The effect is driven by a credit supply and labor reallocation towards more productive firms. Neuhann and Saidi (2018) provide evidence that universal banks, after the repeal of the Glass-Steagall act, finance riskier but also more productive firms. They show that informational economies of scope across loans and non-loan products account for the positive firm-level real effects of universal banking.

Other studies examine the impact of finance on labor. Campello et al. (2010) provide survey evidence that credit constrained firms plan to cut their investment and employment more than unconstrained firms in times of crisis. Pagano and Pica (2012) show that financial development promotes employment growth in developing countries. However, during banking crisis, employment grows less in external finance-dependent industries and in more financially developed countries. Chodorow-Reich (2014) shows that small and medium-sized firms in the United States that had pre-crisis relationships with less healthy banks were less likely to obtain credit following the Lehman bankruptcy, paid higher interest rates (if they received credit), and reduced the number of employees more compared to pre-crisis borrowers of healthier banks. Duygan-Bump et al. (2015) show that the rise of unemployment in the United States during the 2007-2009 recession can be explained with credit constraints of small firms. Popov and Rocholl (2018) show that German firms borrowing from banks affected by the U.S. subprime mortgage crisis reduce their employment by 1.5 percent and average wages by 1.8 percent.

[1] The focus of this research is on credit supply and the functioning of the bank lending channel (e.g., Bernanke and Gertler, 1995; Kashyap and Stein, 2000; Jiménez et al., 2012).

Berton et al. (2018) analyze rich firm-level labor and credit data from a region in Italy and document that the firms' sensitivity of employment to changes in credit supply is 0.36. Alfaro et al. (2018) combine bank-firm loan data from Spain with firm-specific measures of upstream and downstream credit exposure and document sizable direct and downstream propagation effects on employment, output and investment. There are also studies on real effects of finance at Brazilian firms. Carvalho (2014) documents positive real effects of credit on employment in politically attractive regions in Brazil. The increase in employment is due to credit at favorable terms from the national development bank, occurs before competitive elections, and reduces future employment growth in politically unattractive regions. Silva et al. (2018) show that credit at the municipality level positively affects economic growth. In booms, credit from domestic private banks affects economic growth more than credit from government banks, while the latter stabilizes economic growth in recessions. Van Doornik et al. (2018) show that credit finance of lottery-assigned vehicles in Brazil promotes mobility, employment, income and entrepreneurship. For comparison, in our study, we provide evidence that employment at Brazilian firms increases by 8 percent when they add one bank relationship. Moreover, various indicators of macroeconomic output increase when the number of bank relationships is higher at the municipality and state level. Importantly, the results remain robust when we control for the credit available to firms.

Second, our study contributes to research on the number of bank relationships and switching. Theoretical work has analyzed the effects of exclusive versus multiple bank relationships on finance and financing conditions, considering the benefit of greater diversification versus the costs of free-riding and duplicated monitoring (e.g., Detragiache et al., 2000; Carletti et al., 2007). Multiple-bank lending is more likely when banks have lower equity, firms are less profitable and monitoring costs are high. Related empirical studies have focused on the impact of the number of bank relationships on credit availability and loan terms.

Ongena and Smith (1999) conduct a cross-country study and show that firms have more bank relationships in countries with inefficient judicial systems and poor enforcement of credit rights. Farinha and Santos (2002) show that Portuguese firms increase the number of bank relationships when they mature. Gopalan et al. (2011) document that firms form new banking relationships to expand their access to credit and capital market services. They interpret their finding as an important cost of exclusive banking relationships. Illueca et al. (2014) find that during the deregulation-driven expansion of Spanish Cajas, firms added (and did not replace) bank relationships. Firms managed to obtain additional credit that was unavailable from their previous banks, leading to a credit bubble in Spain that burst in 2007. Bonfim, Dai and Franco (2018) find that firms with a higher number of bank relationships pay lower loan rates. This effect holds for small firms, independent of firm age, but not for medium-sized and large firms. Nakashima and Takahashi (2018) find that bank-driven terminations of relationships significantly decrease firms' investments and create difficulties for firms to obtain funding from other sources.

A subset of studies in this area focuses on the direct effects of switching. Ioannidou and Ongena (2010) investigate whether and how price and non-price terms of loans change when Bolivian firms switch to new banks. They find that firms obtain more favorable loan terms from the new bank, especially lower loan rates, but these benefits are short-lived. Degryse et al. (2011) show that single-relationship borrowers of target banks are most likely to be dropped by the acquirer after the takeover and their performance deteriorates subsequently. Bonfim, Nogueira and Ongena (2018) show that firms that had to switch their bank because of branch closures of their previous bank do not receive discounts in loan rates. Degryse et al. (2016) show that a firm's first bank reduces its credit supply when the firm adds a second bank. This negative externality suggests that adding bank relationships does not necessarily increase the total credit available to a firm.

The remainder of this paper is organized as follows. In Section 2, we describe the data, empirical strategy and provide summary statistics. In Section 3, we present the results on the effect of firms' bank relationships on real economic activity at the micro level. In Section 4, we provide further evidence at the macro level. Section 5 concludes.

2. Data, empirical strategy, and summary statistics

2.1. Data sources

We combine data from four different sources in our analysis. For the main tests, we build a firm-level dataset based on monthly loan-level data from the Brazilian Credit Information System (*Sistema de Informações de Crédito, SCR*). This confidential database is owned and managed by the Central Bank of Brazil and includes monthly information of virtually all loans to firms made by the financial sector in Brazil. Specifically, all registered financial institutions have to report individual information of their outstanding loans whenever a borrower's total liability is equal to or above the regulatory threshold. The report includes loan-specific information such as the loan amount outstanding, the interest rate, and the credit rating. The data also include borrower level information, such as firms' industry codes and locations of headquarters (municipality) but no firm balance sheet data. As in the study of Ponticelli and Alencar (2016), the location of the borrower is essential to our analysis. The SCR data allow us to capture the dynamics of bank-firm credit relationships over time by computing the number of relationships with financial institutions[2] per time unit. The main explanatory variables in our study capture the number of bank-firm relationships and their changes over time. We define and discuss these variables in the next subsection.

The two main outcome variables are the number of employees per firm and total wages paid per firm. We retrieve this information from the Annual Social Information Report

[2] We use the terms financial institution and bank interchangeably unless otherwise noted.

(*Relação Anual de Informações Sociais, RAIS*). In Brazil, it is mandatory for each firm, independent of the legal form or the firm size, to report these data to *RAIS* as per December 31 each year. The database is confidential and owned and managed by the Ministry of Labor. These two firm-level outcomes enable us to study the firm-level real effects of the number of bank relationships. We match the variables from *RAIS* with the *SCR* data using the unique identification number for firms in Brazil (*CNPJ*).

For the instrumental variable regression approach described below, we make use of data about the number of banks and branches active in each municipality. These data are retrieved from the UNICAD dataset, which is also owned and managed by the Central Bank of Brazil. We match the number of banks and branches to the firm-level dataset using the borrower municipality identifier created by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística, IBGE*).

The fourth source of data is information provided by *IBGE*. While most of our analyses are firm-level tests and therefore use firm-level variables, we also perform additional aggregate tests at the municipality and state level. For the latter, we collect monthly data from *IBGE* for the outcome variables *Industrial Production*, *Sales Volume*, and *Nominal Revenue*. All three variables are expressed as indices with a base value of 100 in 2011 for the variables *Sales Volume* and *Nominal Revenue* and a base value of 100 in 2012 for the variable *Industrial Production*.

The sample period spans from January 2005 through December 2014. In this 10-year period, the Brazilian economy went through four monetary policy cycles (Banco Central do Brasil, 2018), which allows us to examine periods of economic upturns and downturns. We therefore can rule out that the effects we document below depend on particular stages of the macro-economic cycle.

To build our firm-level data we focus on loans to non-financial private firms with a minimum value of BRL 5,000 (USD 2,000 as per end of 2014). We apply this filter to exclude loans to very small or micro firms as these may not be comparable to the other firms in the sample. Furthermore, the regulatory threshold for submitting individualized loan-level information to the *SCR* was BRL 5,000 for most of the years in our sample period. In January 2012, this threshold was lowered to BRL 1,000. By focusing on loans above a minimum of BRL 5,000, we avoid introducing any bias that might stem from the non-inclusion of very small or microloans in the *SCR* before January 2012. We also drop loans that have variable interest rates to use a homogeneous sample. We further exclude from the dataset firms that borrow from banks that failed at some time during the sample period to avoid confounding exogenous reasons for changes to firms' bank relationships. Finally, we exclude firms that borrow from investment banks because these offer a different array of services and products.

After applying these filters, our final dataset comprises 31,153,687 loans to 1,801,168 firms, granted by 1,102 financial institutions in the time period 2005-2014. Since we keep one observation per firm and year in our final dataset to match the annual frequency of the labor market data, there are around 5 million observations, indicating that each firm appears approximately three times in the dataset. Banks grant 90.5% of the loans and non-bank financial institutions, such as credit cooperatives and finance companies, grant the remaining 9.5%.

2.2. Empirical strategy

For our main tests, we estimate OLS regressions at the firm-level. The regression model has the following specification:

$$F_{it} = \beta_0 + \beta_1 \textit{mean bank relationships}_{it} + x + e_{it} \qquad (1)$$

where F_{it} is either the natural log of the number of employees per firm i and per end of December in year t or the natural log of total wages paid per firm i and per end of December in year t, as retrieved from *RAIS*. The variable *mean bank relationships* measures a firm's average number of bank relationships per year. To create this variable, we use the monthly loan-level dataset and sum up the number of financial institutions with which a firm has active relationships each month and divide that number by 12. It is our main explanatory variable and its coefficient β_1 indicates whether firms with more bank relationships have a higher number of employees or pay a higher total of wages. Hence, a significant and positive β_1 would indicate positive real effects of bank relationships.[3] The vector X contains a set of fixed effects that include firm fixed effects, year fixed effects, bank fixed effects, interacted industry-state fixed effects, and interacted bank-year fixed effects. We present the baseline regression results using different combinations of fixed effects. In all other analyses at the firm level, we estimate our main specification using firm and bank-year fixed effects. Standard errors in all firm-level regressions are clustered by firms.

For the regressions at the municipality and the state level, we use two different specifications. In the municipality-level regressions, we estimate the following OLS regression model:

$$M_{jt} = \beta_0 + \beta_1 \, \textit{municipality mean bank relationships}_{jt} + Z + e_{jt} \qquad (2)$$

[3] We also estimated models with the number of employees and total wages paid as outcome variables, but instead of a continuous variable for the average number of bank relationships, we added dummy variables that indicate the number of bank relationships. In these tests, we find that the effect increases for each dummy variable indicating two, three, four, five or more than five bank relationships. This confirms the baseline findings that we report below. Results are available upon request.

where M_{jt} is the average number of employees or average total of wages paid over all firms in municipality j and per end of December of year t. The main explanatory variable is *municipality mean bank relationships*$_{jt}$. It measures the average number of bank relationships across all firms in municipality j and year t. To build this variable, we use the firm-level dataset and compute the mean of the variable *mean bank relationships* per year using the municipality of each firm. The number of municipalities increases throughout the sample period, from 4,545 in 2005 to 5,512 in 2014. The vector Z includes fixed effects for the municipality and the year. Standard errors in these regressions are clustered on the municipality level.

For the analyses on the state-level, we estimate the following specification:

$$S_{km} = \beta_1 \textit{state mean bank relationships}_{km} + W + e_{km} \quad (3)$$

where S_{km} is one of the four state-level outcomes number of employees computed as the average number of employees across all firms in federal state k and month m[4], the industrial production index, the sales volume index, and the nominal revenues index in a given state k-month m combination. The main variable of interest is *state mean bank relationships*$_{km}$ that measures the average number of bank relationships for all firms in state k and month m. To build this variable, we use the monthly loan-level dataset and compute the mean of the variable *mean bank relationships* by firm's state and month. There are 27 federal states in Brazil and all of them are included in our data. The vector W contains fixed effects for the state k, the month m and interacted state-quarter fixed effects. The inclusion of state-quarter fixed effects controls for supply-side shocks that may affect all firms operating in the same state in a given quarter. Standard errors in these regressions are clustered on the month level.

[4] In our dataset, we have one observation for the number of employees per firm and year. Hence, there is no within year variation of this variable per firm; we use the same number of employees for each month. The variation in these regressions is driven by changes of the main explanatory variable.

2.3. Summary statistics

Table 1 Panel A reports summary statistics of firm characteristics, including the number of workers, the wage bill, and several bank relationships indicators based on yearly data, such as the average number of financial institutions with which a firm has a loan relationship, its respective change in the number of loan relationships (increases and decreases), and dummies for yearly increases and decreases in the number of loan relationships.

The average firm employs 11 workers and the 95-percentile of workers is 34, both numbers reflecting that the dataset includes mainly small and medium-sized companies. As we have more than 1.8 million firms in the dataset, this is not surprising, given that the vast majority of firms in any economy are small and medium-sized firms. The average salaries paid in December of each year is BRL 13,861 and its 95-percentile is BRL 38,357 again reflecting that these firms are small and medium-sized firms. On average, firms have slightly more than one bank relationship and 5.7 percent (6.4 percent) of all firms increase (decrease) the number of bank relationships per year during the sample period.

The summary statistics for the variables aggregated on the level of the municipality are lower than the ones on the firm level, with the most notable difference being the wages paid. The total wages paid as of December in a given year, averaged across all firms in each municipality is around 50 percent smaller than the average wages paid by each firm independent of the municipality. For this reason, we control for municipality fixed effects in the regressions on the municipality level.

The number of bank relationships and the number of employees aggregated on the level of the federal state are much larger than the respective variables on the firm level. As in the case of the municipality level regressions, we control for fixed effects at the state level to account for these differences. Finally, the index values for industrial production, sales volume, and

nominal revenues are all below their base values of 100, indicating that in the sample period, economic activity was slightly below the reference year.

(Insert Table 1 here)

3. Empirical analysis

We present five sets of results. We start by presenting the baseline results for the number of employees and the total amount of wages paid at the firm level and by year. We then present the results of two robustness tests whereby we perform an instrumental variable regression and a Heckman Two-Stage Selection Model (Heckman, 1979). To further investigate the importance of the number of bank-firm relationships on real economic activity, we analyze the effects when the number of bank relationships increases or decreases and whether the results we document depend on the firm size. Finally, we provide evidence about the channels that explain how the number of bank relationships matters for real economic activity.

3.1. Baseline results

Table 2 presents the results of the estimation of equation (1) with the natural log of the number of employees as dependent variable for the sample with over 5 million firm-level observations. To document that the results do not depend on the inclusion of a certain set of fixed effects, we present the results using different sets of fixed effects as controls.

(Insert Table 2 here)

In column (1) of Table 2, we first include firm as well as year fixed effects. The coefficient of the variable *mean bank relationships* is positive and highly significant. This result indicates

that firms with a higher number of bank relationships have a higher number of employees. As this specification includes firm fixed effects, this finding suggests a positive real effect of the number of bank relationships independent of any time-invariant firm characteristics. In column (2), we additionally include bank fixed effects. The coefficient size and significance remain unchanged, implying that the positive real effect of the number of bank relationships is also not a bank-specific result, but a general result across firm- and bank-types. In column (3), we include firm and interacted industry-state fixed effects. The industry-state fixed effects control for industry- and region-specific differences between firms' economic activity. They also control for industry shocks in certain regions that can affect firms differently. The size of the coefficient is almost unchanged and it remains highly significant. Finally, in column (4) we estimate our main specification that includes firm and interacted bank-year fixed effects. As before, the firm fixed effects control for the demand-side of bank financing. The bank-year fixed effects, on the other hand, control for supply-side driven differences, i.e., for the fact that banks may change their lending behavior over time and that this is the driver of the positive real effects of bank-firm relationships that we document. The size of the coefficient is unchanged compared to the other specifications and it remains highly significant.

Besides the high statistical significance, our findings are also economically significant. The coefficient size in column (4) of the table indicates that a firm with one more bank relationship has 8 percent more employees. Measured at the mean of 11.61 employees per firm, this resembles an increase in the workforce of the average firm of almost one worker.

Table 3 displays the results when the natural log of the total amounts of wages paid per firm and year is used as the dependent variable. We estimate several specifications of equation (1) using the same combinations of fixed effects as in Table 2.

(Insert Table 3 here)

The results of all four regressions are positive and highly significant, indicating a positive effect of the number of bank relationships on how much in total firms pay their workforce per year. While an overall higher payroll is consistent with an increase in the average wage per worker, the more obvious explanation is that payroll costs increase because of the higher number of employees documented in the previous tests. The coefficient size indicates a 9 percent higher payroll of a firm with one more bank relationship, again suggesting a large economic effect.[5]

Our baseline results indicate that the number of bank relationships is an important determinant of firms' real economic activity as measured by the two employment variables. This is a novel result in the literature.

3.2. Instrumental variable regressions and Heckman two-stage selection model

Given the absence of a clean experiment or the exploration of some truly exogenous variation, we saturated our regression model with appropriate sets of fixed effects. This way we can rule out that firm- or bank-specific time-invariant factors as well as industry-specific shocks drive our results. However, there might be remaining concerns about endogeneity and self-selection effects that might affect our previous results. We perform two further empirical tests to mitigate such concerns. In the first test, we perform an instrumental variable (IV) analysis to account for potential endogeneity of the number of bank relationships. The instrument we employ is the number of banks operating in a given municipality and year.

We collect the number of active banks per municipality and month from *UNICAD* and match it to our firm-level dataset using *IBGE*'s municipality code. We prefer using the number

[5] We also performed the baseline tests with the number of employees and the total wages paid as dependent variables adding a squared term for the number of bank relationships. The results for the linear term are unchanged in these regressions and the squared term display a coefficient that is not statistically significant in both cases.

of banks rather than the number of branches scaled by the number of inhabitants per municipality because the same bank may operate more than one branch in each municipality, as is common for the large Brazilian banks. Hence, the number of branches does not necessarily capture the presence of different banks. We use the number of banks per municipality as a proxy for competition, assuming that it is more likely to have more than one bank relationship if competition is intense.[6] If a bank has a local monopoly, by definition the number of bank relationships has to be equal to one. Furthermore, while it is plausible to expect that bank competition affects firms' number of bank relationships (relevance), there is no strong reason to expect that (all) firms are larger when bank competition is high (validity).

We employ the number of banks per municipality and year as the instrument for firms' mean number of bank relationships and estimate a two-stage least squares regression. The regressions of both stages include firm and bank-year fixed effects and standard errors are clustered at the firm level, consistent with columns (4) in Tables 2 and 3, which is our main specification. The results of both stages of the instrumental variable regression are shown in Panel A of Table 4.

(Insert Table 4 here)

The first stage results shown in column (1) of Panel A display a positive and highly significant coefficient indicating that the number of bank relationships is higher if the number of banks per municipality is higher.[7] This is consistent with the idea that firms may find it easier

[6] Our data do not allow us to compute other competition measures that may better capture the actual level of competition in each municipality.

[7] The number of observations decreases because we lack the data for some municipalities in some years.

to have more bank relationships if banks compete for them. The p-value of the Kleibergen-Paap weak identification test is highly significant, indicating that the instrument is not weak.[8]

The second stage results in columns (2) and (3) of Panel A suggest a positive and highly significant impact of the number of bank relationships on firms' number of employees as well as on total wages paid per year. The effect on the number of employees is around 80 percent bigger than the baseline effect from column (4) in Table 2. The same holds for the total payroll costs per firm and year. Here, the coefficient of the number of bank relationships is around 4.5 times as large as the OLS coefficient.[9]

In a second robustness test, we estimate a Heckman Two-Stage Selection Model. As the number of bank relationships might not be exogenous but a choice variable of the firm, it could be that our comparisons of firms with less and more bank relationships are subject to self-selection problems. Such self-selection should not matter as long as it is based on time-invariant firm characteristics because we include firm fixed effects in all our regressions. However, as firm self-selection may be based on time-varying firm characteristics, including firm fixed effects does not fully mitigate these concerns. The results of the Heckman Two-Stage Selection Model analysis are displayed in Panel B of Table 4. From the first stage results, we compute the inverse Mills Ratio and include it as an additional control variable in the regressions that also include firm and bank-year fixed effects.

Table 4 shows that including the inverse Mills Ratio does not alter our findings. The coefficient of the mean number of bank relationships continues to predict the number of employees per firm and year in column (2) of Panel B as well as the total payroll costs per firm and year in column (3) of Panel B, in both cases with high statistical significance. Further to

[8] We acknowledge that the instrument may not perfectly fulfill the exclusion restriction. Nevertheless, we believe that there is no strong reason to expect that (all) firms are larger when bank competition is high.
[9] The higher coefficient size of the IV estimates is in line with the vast majority of finance research published in the last 15 years (Jiang, 2017).

being significant on the 1 percent level, the coefficient sizes are almost identical to the ones in column (4) of Table 2 (0.08) and column (4) of Table 3 (0.09).

Overall, the results of these two additional tests alleviate concerns that endogeneity of the number of bank relationships or firm self-selection based on time-varying firm characteristics drive our findings.

3.3. Increases versus decreases of the number of bank relationships

Until now we have analyzed whether and how the level of bank relationships matter for labor market outcomes on the firm level. A related question is what happens if firms change the number of relationships throughout the year, either by adding one or more new banks (firm-bank relationships increase) or turning away from some banks (firm-bank relationships decrease). To examine this question, we first create the indicator variable *Increase of bank relationships*, which equals one if a firm decreased the number of bank relationships from one year to the other, and otherwise zero. As our sample has a fixed starting point, we cannot compute that indicator for the start year of our observation period. Hence, the first time we compute that indicator is from 2005 to 2006. This reduces our sample by the observations from 2005. Specifically, we examine whether the same firm had more bank relationships at the end of 2006 than at the end of 2005. If this was the case, the indicator takes on the value of one in that year and for that firm. We perform the same procedure for the alternative case, i.e., a firm reduces the number of bank relationships from one year to another and create the indicator variable *Decrease of bank relationships*. We do this for all nine years of our sample period and then regress both the natural log of the number of employees per firm and year and the natural log of the total payroll costs per firm and year on these new explanatory variables. The results of these tests are displayed in Table 5.

(Insert Table 5 here)

Table 5 shows positive and highly significant effects of the variable *Increase of bank relationships* on the number of employees in column (1) and the total payroll costs in column (3). This finding provides evidence that not only the level of the number of bank relationships matters, but also changes of that level. Moreover, the effect is consistent as shown in columns (2) and (4): a positive effect due to an increase in the number of bank relationships and a negative effect due to a decrease in the number of bank relationships. We note that the negative effect of a decrease in the number of bank relationships is bigger than the positive effect of an increase, suggesting that the impact of bank relationships on firms' real economic activity is not perfectly symmetric.

3.4. Results by firm size

We examine whether the positive effects of the number of firm-bank relationships on real economic activity depend on the size of the firm. In all previous analyses, we have already considered firm fixed effects that control for time-invariant unobservable heterogeneity between firms, including average size effects, but there might be the concern that our results can be explained by time-varying firm size effects such as differential growth and investment opportunities. Moreover, one might argue that it is easier for large firms to hire or fire new workers than for small firms simply because in absolute terms they have more financial resources. This, in turn, might increase their total payroll costs. To rule out that our findings can be explained by "growth effects" or "large firm-size effects" and are therefore purely mechanical, we split our sample of more than 5 million observations into three subsamples, according to firm size. Although firm balance sheet information is not available, the financial institutions report to the Brazilian Central Bank their assessment of each borrower's size

(among the categories small, medium, large, and very large). The Central Bank of Brazil then creates a variable that is the mode of the size categories reported by all the banks for a firm in a given month, and we build these subsamples accordingly. Because there are relatively few very large firms in our sample, we include them in the group of large firms.[10]

We estimate regressions by size category using our main specification from column (4) in Table 2 and cluster the standard errors by firm. Table 6 reports the corresponding regression results.

(Insert Table 6 here)

For both outcome variables and all six regressions across the different size categories, we find positive and highly significant results. This finding indicates that the positive effect of the number of bank relationships on firms' real economic activity is independent of the size of the firm, in particular, it suggests that the effect is not a "large firm effect". We also find that the coefficient sizes increase with the firm size. This is an intuitive result because it should be easier for large firms to scale up and down the workforce than for small firms, therewith also leading to a bigger increase of the overall payroll costs.

3.5. Loan volume, loan rates and real effects

In a final set of tests at the firm level, we examine potential gains that firms might realize when they borrow from more than one bank. Firms can diversify their access to credit across banks and over time, obtain more favorable price and non-price credit terms, and shield

[10] The size bucket small firms accounts for 24.25 percent of the sample, the size bucket medium 62.63 percent and the size bucket large and very large firms includes 13.12 percent of the sample. If the very large firms are excluded from the third size bucket, the results for this size bucket are unchanged.

themselves against negative credit supply shocks. Any of these potential gains provides explanations for the positive real effects we have documented beforehand.

For this purpose, we re-estimate the baseline models from column (4) in Tables 2 and 3 with the loan volume and loan rates as dependent variables, respectively. If a higher number of bank relationships increases the overall credit availability to firms (loan volume) and/or lowers the overall cost of credit (loan rate), then firms have more flexibility to employ more workers and/or pay higher salaries. As previously, we saturate the regression models with firm fixed effects and interacted bank-year fixed effects. Table 7 reports the results.

(Insert Table 7 here)

We find that a firm's number of bank relationships has a significantly positive impact on the loan volume (column 1 and 2) and a significantly negative impact on the mean loan rate (column 3 and 4). In column (2) and (4) we control for the firms' average rating in the same year, which is a key determinant of the loan approval decisions and loan pricing. The results hold when firm risk is controlled for. These findings suggest that the positive real effects of multiple bank relationships are due to (but not necessarily limited to) a credit availability channel and a cost of credit channel. While our setting does not enable us to determine which of these two channels is the more important driver of the documented real effects, the results indicate that both channels are statistically and economically significant.

Our findings so far document benefits of multiple bank relationships, but there might be the concern that the number of bank relationships just captures a loan volume effect. The higher the number of banks from which a firm borrows, the higher the total credit available to the firm, resulting into the positive effects on employment documented above. However, while this reasoning is clearly not wrong, it may not capture the full picture. First, the recent study of

Degryse et al. (2016) documents important negative externalities of additional bank relationships. Second, the positive real effects we document above are likely to be the product of various gains from multiple bank relationships and not exclusively due to a pure credit volume effect. To examine this, we regress the labor outcome variables on the number of bank relationships and the mean loan volume and, alternatively, the orthogonalized mean loan volume to mitigate confounding effects due to the positive correlation between both variables. The orthogonalized mean loan volume is obtained as the residuals from a regression of the firm's mean loan volume per year on the number of bank relationships in the same year plus firm and bank-time fixed effects. Table 8 reports the results.

(Insert Table 8 here)

We find that for both labor outcomes and in both specifications the positive effect of the number of bank relationships remains large and highly significant. Interestingly, in the specifications with the orthogonalized mean loan volume (column 2 and 4), where we rule out potential biases due to multicollinearity, the coefficient of the number of bank relationships more than doubles. The size of these coefficients in the regressions with the orthogonalized loan volume as control variable are almost identical to the size of coefficients in columns (4) of Tables 2 and 3. In sum, these additional analyses confirm that there are positive real effects of firms' bank relationships that go beyond pure credit volume effects.

4. From Micro to Macro: Results at the municipality and state level

In the analyses based on matched credit and labor data at the firm level, we document that the number of bank relationships positively affects firms' real economic activity. We now examine the same question at the macro- rather than the micro-economic level. This analysis

informs us whether the number of bank relationships does only entail positive real economic effects for the individual firm or if the effect carries over to the local economies at the level of the municipality and to the regional economies at the level of the federal states in Brazil. For these regressions at the macro-level, we collect additional data and create variables both at the level of the municipality and at the level of the federal state.

4.1. Aggregate results at the municipality level

For the regressions at the municipality level, we create the new variable *municipality mean bank relationships*. As mentioned above, this variable measures the mean number of bank relationships averaged over all firms in one of the municipalities in a given year. Using the *RAIS* database, we compute the average number of employees across all firms and the total payroll costs across all firms located in a particular municipality and for a given year. As the distributions of the ensuing averages are not very skewed, we do not use the natural log of these outcome variables, but rather their absolute values. We then estimate equation (2) by regressing *municipality mean bank relationships* on both municipality-level outcome variables. In these regressions, we include municipality and year fixed effects and cluster standard errors by municipality. The number of observations in these regressions is much smaller than in the firm-level regressions, it is computed as the product of the number of years of observations and the number of municipalities. Table 9 displays the results.

(Insert Table 9 here)

We find positive and highly significant coefficients for *municipality mean bank relationships* in both cases. In the first case, the average firm employs three more workers as a result of having one more bank relationship across all municipalities. Measured at the mean of

7.93 employees, this reflects an economically very large increase of almost 38 percent. As before, payroll costs also increase. The absolute increase of payroll costs for the average firm across all municipalities amounts to BRL 2,304, reflecting a percentage increase of 34 percent.

These results provide evidence that the positive effect of multiple bank relationships not only exists at the level of the individual firm, but also at the level of the municipality the firms are headquartered in. By including municipality fixed effects, we can also rule out two alternative explanations. First, the effects are not driven by differences between relatively poor and rich municipalities. Second, and as important, the effects are not due to issues related to the legal environment, in particular not due to cross-sectional variation in the enforcement of the bankruptcy law in Brazil, as shown by Ponticelli and Alencar (2016).

4.2. Aggregate results at the state level

For the analysis at the level of the federal state, we create a new explanatory variable and collect data for three additional outcome variables. First, we create the new variable *state mean bank relationships* that measures the average number of bank relationships across all firms in a given state-month combination. This becomes the main explanatory variable in the state-level regressions. We then retrieve information from *IBGE* about the industrial production, sales volume, and nominal revenue, which is available for each state on a monthly level. We then compute the mean number of employees across all firms for all state-month combinations. Finally, we estimate equation (3) by regressing these four state-level outcomes of real economic activity on *state mean bank relationships*. To saturate the model, we include month, state, and state-quarter fixed effects. Standard errors are clustered by month of observation. The number of observations is further reduced and is computed as the product of the number of observation months and the number of federal states for which we were able to obtain data.

Note that this analysis is different not only because of its higher aggregation level but also because of the monthly (and not yearly) data frequency. Table 10 presents the results.

(Insert Table 10 here)

All four coefficients of interest are positive and with the exception of the coefficient for the industrial production, which is only significant at the 10%-level, they are all highly statistically significant. The size of the coefficient for the mean number of employees suggests that the average firm across all states employs about 45 more workers when it has one more bank relationship. Given a mean number of employees across all states and firms of 27, this represents an increase of around 67%. Measured at their respective means, the coefficients for *Industrial Production*, *Sales Volume* and *Nominal Revenue* reflect increases of the index values between 5.6 percent (*Industrial Production*) and 28.5 percent (*Sales Volume*).

Overall, these results provide further evidence that the positive effects of bank relationships that we document at the micro level carry over to the municipality and state level. As we include state fixed effects, the latter findings are not driven by differences between states. This point deserves special attention because the south and southeast of Brazil are much more economically active than the west, north and northeast. The specification of our regression model accounts for these regional economic imbalances within Brazil. All the documented effects are highly statistically and economically significant.

5. Conclusion

In this study, we document that the number of firms' bank relationships has positive real effects. Firms with a higher number of bank relationships employ significantly more workers and incur higher payroll costs. An increase in the number of bank relationships entails the same

effects, while a decrease results in less workers and lower payroll costs. The finding that the number of bank relationships influences labor market outcomes is a novel result in the literature. We show that these positive real effects are due (but not limited) to higher credit availability and lower the cost of credit. Finally, we investigate whether these real effects at the firm level carry over to the municipality and state level and find consistent evidence that they do. We further document that firms' number of bank relationships positively influences monthly macroeconomic output at the state level such as industrial production, sales and revenues.

Our findings are consistent with earlier studies that show that firms improve their access to finance and their financing terms when they have multiple bank relationships or switch their bank relationships. Furthermore, they imply that firms realize additional gains beyond these "pure" financial effects. They employ more workers, which leads to an increase in their overall personnel expenses. This effect, in turn, stimulates the labor market and increases macroeconomic output. Furthermore, because more workers become formally employed, consumption and overall economic activity increases. Finally, our results provide a new view on the benefits and costs of bank competition as multiple bank relationships can only exist if there is at least some competition among banks.

Appendix A1: Variable descriptions and data sources

This table shows descriptions of all variables used in the regression analyses and the data sources. Panel A contains the variables used in the firm-level analyses and Panel B contains the variables used in the aggregate level analyses.

Variable name	Definition	Data Source
Panel A: Variables used in firm-level analyses		
Number of employees	Number of employees per firm as of December 31 per year	RAIS
Wages paid	Total amount of wages paid per firm as of December 31 per year	RAIS
Mean bank relationships	Number of bank relationships in each month / 12	SCR
Mean banks per municipality	Number of banks licensed and operational per municipality	UNICAD
Increase of bank relationships	Dummy variable that takes on the value of one if the number of bank relationships increases	SCR
Decrease of bank relationships	Dummy variable that takes on the value of one if the number of bank relationships decreases	SCR
Loan volume	Mean loan amount outstanding per firm and year	SCR
Loan volume^{Orthog}	Orthogonalized mean loan amount per firm and year, which the mean loan amount outstanding that is not explained by the mean number of bank relationships per firm and year	SCR
Loan rate	Mean loan rate per firm and year	SCR
Rating	Mean rating for all loans per firm and year	SCR
Panel B: Variables used in aggregate level analyses		
Municipality mean bank relationships	Municipality mean of the number of bank relationships in each month across all firms / 12	SCR, IBGE
State mean bank relationships	State mean of the number of bank relationships in each month across all firms / 12	SCR, IBGE
Industrial production	Index of industrial production in a given month and federal state; base value of 100 in 2012	IBGE
Sales volume	Index of sales volume in a given month and federal state; base value of 100 in 2011	IBGE
Nominal revenue	Index of nominal revenues in a given month and federal state; base value of 100 in 2011	IBGE

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Table 1: Summary statistics

This table shows descriptive statistics of our sample. Panel A displays characteristics on the firm level, Panel B displays characteristics of the outcome variables. All variable definitions shown in the Appendix A1. N indicates the number of observations per variable, St. Dev. the respective standard deviation.

Variable Name	N	Mean	St. Dev.	p5	Median	p95
Panel A: Variables used in firm-level analyses						
Number of employees	5,571,670	11.61	79.05	1	4	34
Wages paid (in Brazilian Real, BRL)	5,571,670	13,861	191,752	618	3,488	38,357
Mean bank relationships	5,571,670	1.111	0.842	0.083	1	2.833
Number of banks per municipality	5,472,700	23	34	2	8	118
Increase of bank relationships	5,571,670	0.057	0.231	0	0	1
Decrease of bank relationships	5,571,670	0.064	0.246	0	0	1
Loan volume	5,571,670	80,133	1,146,503	540	17,761	262,636
Loan rate	5,571,670	42.42	133.60	11	30.44	90
Rating	5,571,670	2.65	1.23	1.00	2.18	5.80
Panel B: Variables used in aggregate level analyses						
Municipality mean number of employees	50,803	7.93	15.47	1.50	5.78	42.28
Municipality mean wages paid	50,803	6,857	16,232	850	4,371	17,769
Municipality mean bank relationships	50,803	1.03	0.36	0.42	1.04	1.58
State mean number of employees	3,240	27.45	20.32	13.44	23.72	48.84
State mean bank relationships	3,240	1.97	0.22	1.62	1.95	2.40
Industrial production	1,596	97.55	12.20	75.80	98.60	116.00
Sales volume	3,240	89.80	23.84	54.50	89.10	131.20
Nominal revenue	3,240	88.31	32.73	45.05	83.95	143.75

Table 2: Baseline results for employment

This table shows OLS regression results with ln(number of employees) as the dependent variable. Variables are defined in Appendix A1. Fixed effects are included as indicated in the table. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. Standard errors clustered on the firm-level are shown in brackets.

	(1)	(2)	(3)	(4)
Mean bank relationships	0.08***	0.08***	0.09***	0.08***
	[0.00]	[0.00]	[0.00]	[0.00]
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Bank fixed effects	No	Yes	No	No
Industry-state fixed effects	No	No	Yes	No
Bank-year fixed effects	No	No	No	Yes
Number of observations	5,043,034	5,042,970	5,042,461	5,042,295
Adjusted R^2	0.831	0.832	0.831	0.832

Table 3: Baseline results for total wages paid

This table shows OLS regression results with ln(wages paid) as the dependent variable. Variables are defined in Appendix A1. Fixed effects are included as indicated in the table. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. Standard errors clustered on the firm-level are shown in brackets.

	(1)	(2)	(3)	(4)
Mean bank relationships	0.09***	0.09***	0.20***	0.09***
	[0.00]	[0.00]	[0.00]	[0.00]
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Bank fixed effects	No	Yes	No	No
Industry-state fixed effects	No	No	Yes	No
Bank-year fixed effects	No	No	No	Yes
Number of observations	5,043,034	5,042,970	5,042,461	5,042,295
Adjusted R^2	0.842	0.842	0.818	0.842

Table 4: Instrumental variable regression and Heckman Selection Model

This table shows results from an instrumental variable approach (Panel A) and from a Heckman Two-Stage Selection Model. Variables are defined in Appendix A1. Fixed effects are included as indicated in the table. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. Standard errors clustered on the firm-level are shown in brackets.

	(1) First stage result	(2) ln(Number of employees)	(3) ln(Wages paid)
Panel A: IV regressions			
Mean banks per municipality	0.003***		
	[0.000]		
Mean bank relationships		0.145**	0.411***
		[0.057]	[0.062]
Weak identification test			
Kleibergen-Paap rk Wald F-stat:	51.51***		
Number of observations	4,953,572	4,953,572	4,953,572
Adjusted R^2	0.520	0.831	0.820
Panel B: Heckman Selection Model			
Mean bank relationships	0.003***	0.081***	0.087***
	[0.000]	[0.001]	[0.001]
Inverse Mills Ratio		-0.111	-0.536***
		[0.097]	[0.105]
Firm fixed effects	Yes	Yes	Yes
Bank-year fixed effects	Yes	Yes	Yes
Number of observations	4,953,572	4,953,572	4,953,572
Adjusted R^2	0.520	0.832	0.842

Table 5: Results for changes in the number of bank relationships

This table shows OLS regressions results for the natural log of the number of employees in columns (1) and (2) and the natural log of the total annual wages paid in columns (3) and (4). Variables are defined in Appendix A1. Fixed effects are included as indicated in the table. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. Standard errors clustered on the firm-level are shown in brackets.

	ln(Number of employees)		ln(Wages paid)	
	(1)	(2)	(3)	(4)
Increase of bank relationships	0.02***		0.02***	
	[0.00]		[0.00]	
Decrease of bank relationships		-0.05***		-0.05***
		[0.00]		[0.00]
Firm fixed effects	Yes	Yes	Yes	Yes
Bank-year fixed effects	Yes	Yes	Yes	Yes
Number of observations	4,784,157	4,784,157	4,784,157	4,784,157
Adjusted R^2	0.834	0.834	0.845	0.845

Table 6: Results by firm size

This table shows OLS regression results for different firm size categories with the natural log of the number of employees and the natural log of the annual wages paid as dependent variables. Variables are defined in Appendix A1. Fixed effects are included as indicated in the table. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. Standard errors clustered on the firm-level are shown in brackets.

	ln(Number of employees)			ln(Wages paid)		
	(1)	(2)	(3)	(4)	(5)	(6)
	Small	Medium-sized	Large	Small	Medium-sized	Large
Mean bank relationships	0.053***	0.074***	0.105***	0.058***	0.080***	0.112***
	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	1,166,125	3,011,573	630,578	1,166,125	3,011,573	630,578
Adjusted R^2	0.779	0.794	0.842	0.786	0.805	0.852

Table 7: Credit volume, loan rates and the number of bank relationships

This table shows OLS regression results for the ln(loan volume) and the average loan rate as dependent variables, respectively. Variables are defined in Appendix A1. Fixed effects are included as indicated in the table. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. Standard errors clustered on the firm-level are shown in brackets.

	(1)	(2)	(3)	(4)
Dep. Var.:	ln(Loan volume)		Loan rate	
Mean bank relationships	1.384***	1.394***	-1.975***	-2.086***
	[0.002]	[0.002]	[0.127]	[0.128]
Mean rating		-0.235***		2.430
		[0.001]		[0.099]
Firm fixed effects	Yes	Yes	Yes	Yes
Bank-year fixed effects	Yes	Yes	Yes	Yes
Number of observations	5,042,363	5,042,363	5,042,363	5,042,363
Adjusted R^2	0.5888	0.5978	0.3532	0.3534

Table 8: Results for employment and total wages controlling for credit volume

This table shows OLS regression results with ln(number of employees) and ln(wages paid) as dependent variables. Variables are defined in Appendix A1. Fixed effects are included as indicated in the table. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. Standard errors clustered on the firm-level are shown in brackets.

	(1)	(2)	(3)	(4)
Dep. Var.:	ln(Number of employees)		ln(Wages paid)	
Mean bank relationships	0.036***	0.081***	0.039***	0.087***
	[0.001]	[0.001]	[0.001]	[0.001]
ln(Loan volume)	0.032***		0.035***	
	[0.000]		[0.000]	
ln(Loan volume)^{Orthog}		0.032***		0.035***
		[0.000]		[0.000]
Firm fixed effects	Yes	Yes	Yes	Yes
Bank-year fixed effects	Yes	Yes	Yes	Yes
Number of observations	5,042,363	5,042,363	5,042,363	5,042,363
Adjusted R^2	0.8332	0.8332	0.8437	0.8437

Table 9: Aggregate results at the municipality level

This table shows OLS regression results at the aggregate level of the municipality. Variables are defined in Appendix A1. Fixed effects are included as indicated in the table. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. Standard errors clustered at the municipality level are shown in brackets.

	(1) Mean Number of employees	(2) Mean Wages paid
Municipality mean bank relationships	3.00***	2,304***
	[0.68]	[697]
Municipality fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Number of observations	50,752	50,752
Number of municipalities	5,513	5,513
Adjusted R^2	0.424	0.439

Table 10: Aggregate results at the state level

This table shows OLS regression results on the aggregate level of the federal state in Panel B. Variables are defined in Appendix A1. Fixed effects are included as indicated in the table. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. Standard errors clustered at the month level are shown in brackets.

	(1) Mean Number of employees	(2) Industrial production	(3) Sales volume	(4) Nominal revenue
State mean bank relationships	44.66***	5.45*	25.61***	23.45***
	[2.74]	[3.13]	[1.87]	[1.92]
Month fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
State-quarter fixed effects	Yes	Yes	Yes	Yes
Number of observations	3,240	1,596	3,240	3,240
Adjusted R^2	0.522	0.671	0.932	0.967