Assessing Firms' Financing Constraints in Brazil

Stijn Claessens
Yaye Seynabou Sakho

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Abstract

Firm surveys often indicate that firms complain a lot about lack of access to financial services, but financing constraints are difficult to identify, given demand and supply considerations and with only surveys based on firms' perceptions. Specifically, it is difficult to separate demand for access to finance of viable firms with good growth opportunities from that of firms that are not creditworthy and should not deserve financing. In Brazil, one of the main constraints to finance is related to the high level of interest rates, which affects both bank funding costs as well as bank intermediation spreads and, as such, the cost of finance and hence the demand and supply of bank financing. This paper analyzes a unique loan level data set that covers almost a decade of monthly firm bank information from credit registry information that is not publicly available as well as two cross-sections of Brazil's Investment Climate Assessment surveys in 2004 and 2008 that provide detailed information on firms' micro characteristics as well as perceptions of credit. The data allow identification of how firms'

characteristics, banks' characteristics, and macro variables affect firms' demand for credit, banks' supply of credit, and access to credit. The paper finds first that access to finance for firms has improved over the decade for small firms, reflecting the deepening of the credit markets. However, access to credit depends strongly on information availability captured in the positive influence of collateral and credit history. Banks perceive that it is less risky to lend to firms that the banks know or that other banks know. Second, firms' loan demand is inelastic to the interest rate at the individual loan category level, possibly reflecting some screening and pricing; however, when the loans are aggregated, the effect of interest rates becomes significant and negative as expected. Third, firms' loan demand and loan supply are affected by the availability of collateral and, in the case of loan demand, longer maturity. Policy implications point to the importance of reducing asymmetric information between lenders and borrowers and on collateral to alleviate financing constraints for small firms.

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Assessing firms' financing constraints in Brazil

Stijn Claessens and Yaye Seynabou Sakho*

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1. Introduction and Motivation

Answering the question whether firms are constrained in their growth by a lack of external financing is a complex question. It requires one to differentiate access to and usage of external financing and requires one to consider both demand and supply side factors. Some firms may not want to borrow even when they have access, relying instead on internal financing (voluntarily excluded). Some firms may want to borrow, and would in principle be able to do so, but may lack access, for example, when there is no banking outlet nearby (involuntarily excluded). Financial institutions may not want to lend to some firms because of creditworthiness concerns (credit rationing). In principle, however, the identification of firms with financing constraints can be done using rich demand and supply side data. So far, this has been mainly done for developed countries and for some developing countries where rich data were available. The issue of financing constraints is of special relevance for Brazil given its still high interest rates for some classes of borrowers, which are argued to be a constraint for growth¹. However, it has been hard to separate here whether the high rates (high spreads) are due to the compensation for borrowers' risks and other weaknesses on the demand side, or due to supply constraints, at the level of individual financial institutions (e.g., lack of competition among banks), inefficiencies in financial intermediation (e.g., lack of credit information, financial taxation, etc.), a weak contracting environment due to judicial inefficiencies, or other factors.

Over the past decade Brazil has come a long way in terms of market deepening. Spreads have also come down significantly for households and considerably for firms. This paper presents a simple way to do financing constraint analysis of the impact of interest rates on the demand and supply of bank credit to micro, small and medium firms using a rich dataset including not publicly available firm level transaction data from the Credit Registry System of the Central bank, firm characteristics data from the ICA (Investment Climate Assessment) firm survey and banks characteristics data from the Central Bank. This survey provides detailed information on firms' characteristics as well as their perception of the business environment and is an important tool in World Bank business environment and financial intermediation analyses. The paper is able to reconcile at the firm level the ICA information with privately available credit registry data from the Central Bank for almost a decade allowing us to have a view at both the bank relationships of the firms at the system level over time as well as the very minute details of who they are at two specific points in time in 2004 and four years later in 2008. This is the first dataset to our knowledge that can have that detailed level of information on these different aspects. We are able to complete the database on the banks using publicly available bank information from the Central Bank over time. The ICA and the bank registry data have not been used for that purpose before to our knowledge, but we argue that by using the uniqueness of bank-firm lending relationships, they provide the ability to separate demand from supply factors.

Previous papers using bank registry data have focused only on the information provided to the bank. For instance, some have just focused on one type of credit instrument. Jimenez, Lopez, Saurina (2009) investigate the determinants of the usage of bank credit lines using a database of Spanish corporate credit lines and find that bank monitoring affects firm's usage of the line as firms with prior default access their credit lines less. Their paper investigates how the relationship between the use of collateral and the credit risk of the borrower plays out in different segments of the credit market (short term and long term loans, new and old borrowers). Khwaja and Mian (2005) use loan level data for the universe of corporate lending in Pakistan and find that politically connected firms have preferential access to public banks loans in Pakistan. Khwaja and Mian (2008) use data that allows them to follow how bank liquidity shocks are passed on to firms and how large firms can compensate for this loss through credit markets whereas small firms are unable to do so and face large drops in overall borrowing. Ioannidou, Ongena, Peydro (2009) use data from the Bolivian Credit Registry database (CIRC) to investigate the impact of monetary policy – as measured by an exogenous increase of the Fed funds rate in a fully dollarized banking system whose economy is not synchronized to the US economy – on bank risk

¹ See Haussman, Rodrik, and Velasco (2005) who argue that the Brazilian economy does not lack profitable investment opportunities but the high opportunity cost of capital means few new investments are profitable enough in order to overcome this hurdle.

taking and pricing. Degryse and Ongena (2002) use contract information of 15,000 bank loans from one bank to small firms in Belgium, including the distance between the borrower and the lending bank as well as the distance from the borrower to the competing banks, to study the importance of geographical distance in explaining the pricing and availability of loans to small firms. Petersen and Rajan (2002) use the 1993 National Survey of Small Business Finance, which provides financial information about the firm (balance sheet and income statement) as well as a documentation of the firm's relationship with financial institutions, to show that lenders are becoming more productive in using alternative sources of information which has eroded the importance of distance for monitoring purpose and increased access to finance for more distant firms.

This paper provides an application of the unique use of credit registry data and ICA data from Brazil to identify the determinants of firms' demand for external bank credit and to identify the classes of firms unduly rationed. The structure of paper is as follows. The first part of the paper briefly provides a conceptual framework and review relevant literature on the concepts of measuring financing constraints and access to financial services. The paper next presents the specific data we have for Brazil and provide some basic statistics. The paper then presents a methodology to address endogeneity issues that might arise in the analysis as well as the results. Finally, the paper concludes and offers some suggestions about where further data collection and research would be useful.

2. Conceptual Framework

Availability of external financing and the lack thereof—financing constraints—depend on demand and supply considerations. The start of the analysis is to differentiate between access and usage of financial services. Usage is the actual consumption of financial services, whereas access is the availability of the supply of financial services at a “reasonable cost”. Hence, there can be a difference between access and usage (Figure 1). While all users have access, it is not the case that all non-users do not have access. When a firm does not use financial services, it may have access but choose not to use it; or it may not have access and thus cannot use it. Furthermore, the reasons for not using financial services are multiple. As with other goods and services, demand for financial services may not exist even when access exists. Many firms in developed countries finance themselves internally and choose not to use bank financing. Or a firm may not have enough growth opportunities to justify external financing. So, while they likely have access, they may (appear) not be burdened by lack of use. There will also be firms that are voluntarily excluded, e.g., they think they will be rejected, but would actually have been accepted, and involuntarily excluded, e.g., firms that are discriminated against.

Equally important, and even in the best financial systems, financial service providers may not wish to supply financial services to all firms since it is not profitable or sustainable to do so. Financial institutions typically say it a too high-risk, high-cost proposition to cater to small firms. High transactions costs for small volumes, combined with difficulties in contract design and enforcement make for not conducive supply. Banks will not be able to profitably run branches in remote areas to cater to firms. This does not reflect any market failures, but rather indicates that finance, like other services, has its own supply forces.

Figure 1

DIFFERENCE BETWEEN ACCESS TO AND USAGE OF SERVICES

Source: Claessens (2005).

Especially for developing countries, often market structure, incentives and features of the institutional environment affect the willingness and ability of financial institutions to provide financial services to small firms. Supply factors then can constrain access to financial services, even when sustainable demand for external financing is there (in the sense that the firm would have gotten financing if it were placed in a better institutional environment). The importance of the effects of financial, legal and other institutional environment and reforms can best be analyzed in a cross-country context, where financing (constraints) can be compared, controlling for firm characteristics (see Beck, Demirguc-Kunt and Maksimovic (2008) for work along these lines). At the single country level, a study of financing constraints can help identify the type of firms most constrained and the forms of financing for which constraints are more binding. To resolve the identification problem and to investigate the importance of supply versus demand factors requires though some specific approaches and some specific data. We review the approaches used to date, and then present our approach.

Demand side, econometric techniques

Traditionally, financing constraints have been investigated from the demand side. The demand for sustainable external financing and the sensitivity of investment to the presence of internal funds, i.e., the degree of financing constraints, have been investigated using one of two approaches, each with their own strengths and shortcomings: investment-internal cash-flow regressions or Euler equations estimations. The first approach is based on the Q theory of investment suggested by Tobin (1969) and has been widely used in the finance literature after the influential paper of Fazzari et al. (1988). In the reduced form q-model, a measure of available internal funds (e.g., cash flows) is directly included as one of the independent variables. In order to investigate the presence of financing constraints, the sample is divided using a priori classifications of firms' financing constraints, and the investment-cash-flow sensitivities of the different sub-samples are then compared. Higher sensitivity for the samples of a priori more constrained classified firms is interpreted as evidence of tighter financing constraints.

The empirical investigation of the sensitivity between investments and internal funds based on the q-model has, however, several problems. The a priori classification of firms in different groups is often set arbitrarily and

often not made time-dependent (Kaplan and Zingales, 1997). Also, the average Tobin's Q may be an imprecise proxy for the unobservable marginal Tobin's Q (Hayashi, 1982). Internal funds could be a proxy for the profitability of investment and the positive sensitivity of investment to cash flow cannot solely be interpreted as capital and credit market imperfections but rather as firms with better liquidity also attaining superior investment possibilities (Hoshi et al., 1991; Schiantarelli, 1996).

An alternative approach to examine financing constraints is through estimating the Euler equation for the capital stock. The Euler equation uses a structural model to capture the influence of current expectations of future profitability on current investment decisions. Unlike the q-model, the Euler-equation approach measures how internal funds indirectly affect investment via a Lagrange multiplier and does not use the market value of q. The advantage of this is that future profitability, i.e. marginal q, does not need to be specified or observed. The major shortcoming of the Euler-equation approach is that it incorporates dynamics, which can complicate the estimation and adapt needs, and—like the q model of investment—it needs to make some assumptions, like a geometric depreciation rate and convex adjustment costs.

Overall, the aforementioned approaches rely on strong theoretical assumptions, which in the event they are not met, render the models misspecified. Econometric advances have provided some solutions. For instance, Erickson and Whited (2000, 2002) proposed a class of GMM estimators that alleviate the measurement problems associated with Tobin's q, by utilizing the information in the higher order moments of the regression variables. Also, in order to tackle the a priori classification of firms, Hansen (1999) introduces a threshold investment model based on a panel estimation method using a fixed-effects transformation where all parameters are determined simultaneously with the determination of the threshold value of the uncertainty measure. The main advantage of Hansen's model is that the estimates of the thresholds are conditional on the model specification as a whole.

Nevertheless, these advances do not overcome all limitations. Remaining limitations, as highlighted by recent findings by Altı (2003) and Gomes (2001), include that investment-cash-flow sensitivities can be positive even in the absence of financial frictions. These findings illustrate the need for alternative empirical methodologies in identifying financing constraints. One alternative method is used by Demirgüç-Kunt and Maksimovic (1998) who estimate the degree of financing constraints by using a financial planning model. They obtain the maximum growth rate that firms could attain without access to long-term financing and then compare these predicted rates to the actual growth rates. Another empirical method is to depart from the standard model of reversible investment and combine the literature on financing constraints and with the literature on investment uncertainty. In this way, one can take into account investment irreversibility and the possibility to postpone the investment decision.

Demand side, survey techniques

Even with these adjustments, such tests can typically only be done, however, for listed and large firms (since stock price data will be needed) and with much firm specific information (especially for the Euler equation models where a longer time series is needed). As a consequence, one is not able to do these studies for many developing countries (few have active stock markets) and definitely not for smaller firms. The approach for small (and large) firms has been to use surveys. This is also the typical approach used in developing countries. Enterprise surveys measure business perceptions of the investment climate, and can be used to analyze the link to job creation and productivity growth. Surveys provide quantitative indicators, also of financing constraints. A good example here is the World Business Environment Survey (WBES), administered to enterprises in 80 countries in late 1999 and early 2000, that utilized standard a core WBES survey in measuring constraints to access to finance, and has been extensive used to document the (lack of) financing constraints and the barriers to financing. In contrast, the Investment Climate Assessment (ICA), which has been conducted in 91 countries and is based on surveys of more than 58,000 firms, has not been much used for assessing financing constraints. This approach leads to statements such as “X percent of firms complain about lack of access to finance,” or

“financing is the second most important complaint firms state when asked about the constraints to higher growth opportunities.”

Endogeneity Issues

At the same time, when surveying firms on their ease of access to finance, one cannot avoid problems of endogeneity, ambiguity in the definition of access, and often the lack of good conceptual framework for the data being collected. First, dependent and independent variables in empirical analyses using data from survey responses often share a common parameter that is omitted in the survey and is usually the result of self-selection in survey participation. But these can suffer from biases. Specifically, firms that are better may not complain about their access to finance while worse firms, e.g., firms with weak growth opportunities and poor collateral, more likely will complain the most about lack of financing. As a consequence, complaints about access to finance cannot be used directly as independent variables to predict in turn firms' performance as a dependent variable. Financial and other data may also be biased or endogenous to external financing constraints. The interest rate the firm pays and the amount of financing it gets, for example, are not useful control measures, as they depend on firms' creditworthiness and degree of access. Also, the cross-sectional nature of most surveys does not allow the tackling of any simultaneity bias between survey responses that are used as dependent and independent variables, respectively. Furthermore, at times the perception of firms has been used as indicators of the business environment itself, which introduces another endogeneity (e.g., with many firms complaining, the business environment may be considered poor, but then it may also be that firms are weak themselves, and thus complain more).

Second, defining access to finance is not an easy task. Generally, access to finance refers to the availability of supply of quality financial services at reasonable costs, with a focus on whether investment is constrained. However, depending on what one considers 'quality' services and 'reasonable' costs, the measurement of access to finance may need to be altered accordingly. Measurement of access to finance is also influenced by the definition and priority of its various dimensions. For instance, one can distinguish the dimensions of reliability, convenience, continuity and flexibility, with each requiring a different measure. A related issue is that firms obtain various forms of external financing, e.g., short-term trade finance, working capital financing and investment financing. Each of these forms of financing may have different degree of financing constraints, e.g., a firm may not be constrained in trade finance but may not be able to get investment financing.

Third, a major problem with measuring and evaluating firms' access to finance is the absence of a unified conceptual framework for data collection. Somewhat surprisingly, theoretical models and empirical evidence on the topic of access to finance has not yet resulted in a commonly accepted framework for data collection. Thus, currently collected data are often of an ad-hoc nature, with varying definitions over time. As a result, the data are often not comparable across countries and do not necessarily yield appropriate variables for model testing. The data collected are rarely of the experimental form, where one controls for the firm characteristics by randomizing treatment. For instance, Duflo, Glennester and Kremer (2007) provide a practical guide to build in randomization as part of research design in the field. Randomization would allow solving selection bias to control for firms characteristics

Supply Side

Supply data can help with the identification of financing constraints, but have been little used to date. We know from theory (Rajan 1992) and confirmed empirically (Petersen and Rajan, 1994) that access, especially for smaller, more opaque firms can depend on their relationships with financial institutions. Banks may invest in information acquisition in the expectation of future returns, and then be able and willing to lend more to some classes of firms. Therefore, bank characteristics can relate to the degree of lending to some classes of firms (one can consider these clientele effects). Small banks, for example, may specialize in lending to smaller firms. Or banks with certain lending, technology and human resources management policies that allow for the use of

soft information in lending may do better with SME lending. Petersen and Rajan (1994), for example, show how ties between a firm and its creditors affect the availability and cost of funds to the firm.

This importance of bank characteristics and banking markets also applies over time. It means that changes in banks' and banking systems' characteristics can drive the degree of access over time. As such, a panel of firm data combined with banking system characteristics becomes a very powerful tool to analyze financing constraints. Petersen and Rajan (1995), for example, study the effects of changes in banking system structures in the U.S. on small firms' access to financing and find that the increase in competitiveness reduced the access to financing for small firms.

The Disequilibrium Approach

We use a disequilibrium approach to investigate the determinants of credit demand, credit supply, and access to finance for small and medium firms in Brazil from 2003 to 2009. Cunha, de Jesus and Sakho (2011) estimation of the determinants of credit in Brazil over the 2000 to 2010 decade at the aggregate level shows that indeed for firms throughout the decade, credit is driven purely by supply factors for long periods of time, indicating that such disequilibrium model might be the right instrument to use to look at credit in Brazil. In addition, the paper points throughout the decade to long episodes of credit shortages for firms, where credit shortages arise when under prevailing interest rate, the quantity of credit demanded by agents is larger the quantity supplied by financial institutions.

Such shortages can arise both in equilibrium and in disequilibrium and both temporarily and in the long term. Disequilibrium could arise temporarily; when an economy is hit by exogenous shocks and price stickiness delay adjustments, so that rationing occurs during the transition to a new equilibrium. However, it can also be a long term feature, when there are permanent restrictions to price or quantity adjustments. For instance, shocks in Brazil that could further cause shortages in disequilibrium are related to Price Stickiness – Mild (average price duration in services - including financial services- around 5 months; . Aith (1998) discusses as examples of the “non-standard behavior” by courts that in Rio Grande do Sul, local judges rule on “limiting interest rates for loan contracts by banks to 12% (as defined in the Constitution), even though the Supreme Federal Court has established such cap depends on regulating.”

Asymmetric information between borrowers and lenders can cause shortages in equilibrium, for instance in Stiglitz and Weiss (1981), the interest rate a bank charges may itself affect the riskiness of the pool of loans and the profit maximizing interest set by banks might differ from market clearing levels. In Brazil, asymmetric information is an issue. Until recently, public and private data banks used to contain only negative information (debtors in default) and there were no comprehensive credit record systems.(Beck 2000). In addition, Contract enforcement is another possible cause for shortages- Brazil's judicial system scores considerably below countries in the upper middle income group as evidenced by cross-country indicators of contract enforceability. World Bank (1999) shows that there are 3,129 cases pending per judge in Sao Paulo, compared to only 58 in Singapore and 244 in Hungary. Pinheiro and Cabral (1999), a judicial execution to recover a creditor claim can take between 1 and 10 years. More recent evidence from Arida, Bacha, and Lara-Resende (2004) further argue that jurisdictional uncertainty is the main culprit linking the inexistence of local long-term domestic credit to the persistence of high short-term interest rates in Brazil. In particular, uncertainties associated to the settlement of contracts in the Brazilian jurisdiction are to blame. Gonçalves, Holland and Spacov (2007) using panel data find positive correlation-albeit not significant- between jurisdictional uncertainty and the level of short term real interest rate. They use a concept of jurisdictional uncertainty defined as an anti-saver and anti-creditor bias, which manifests itself as "the risk of acts of changing the value of contracts before or at the moment of their execution, and as the risk of an unfavorable interpretation of the contracts in case of a court ruling.”

3. A Disequilibrium Approach

The problem of estimating markets in disequilibrium was introduced by Fair and Jaffee (1972). The problem is to estimate the parameters in the demand and supply equations in circumstances where the amounts demanded and supplied are not observed directly as such, but only their minimum, i.e. the (“shortest side”) of demand and supply determines the actual credit observed. Thus, by assumption of the model, simultaneity does not arise since the explanatory variable is not jointly determined with the dependent variable. Once the parameters have been estimated, this approach allows calculating the probability that an observation is demand or supply constrained. Different theoretical underpinnings support the occurrence of credit shortages arising from disequilibrium in credit markets. Temporary disequilibrium occurs when an economy is hit by exogenous shocks and there is some stickiness in the prices so that rationing occurs during the transition. On the other hand, long-term disequilibrium can be explained by governmental constraints such as usury laws. Finally, credit shortages can arise as a part of the market equilibrium when information is asymmetrically distributed between lenders and borrowers. As pointed out by Stiglitz and Weiss (1981), the interest rate a bank charges may itself affect the riskiness of the pool of loans. This effect occurs through adverse selection – safer projects, that offer lower expected returns, are not profitable when interest rates are high – or through changes in incentives – when interest rates rise borrowers prefer to invest in riskier projects. In this context, when banks cannot fully assess borrower’s risk, the profit maximizing loan rate can be below market clearing levels.

Several papers introduce the disequilibrium model using firm and bank level data to study credit markets. Hurlin and Kierzenkowski (2003) estimate a disequilibrium model with a standard maximum likelihood method using bank level data for the Polish credit market covering the period from 1994 to 2002. Atasanova and Wilson (2003, 2004) investigate the interaction of monetary policy, credit market conditions and corporate financing over the business cycle in the UK. It provides a simple test of the existence of a credit channel of monetary policy transmissions. Using individual firm data from 1989 to 1999, they estimate a disequilibrium model finding that during periods of tight money the proportion of bank-borrowing constrained firms’ increases.

Reyna and Waldron (2009) study the determinants of supply and demand for business credit in Colombia. They estimate a disequilibrium model that allows for credit rationing using firm level data from 1998 to 2008. They find that the demand for credit is positively related with firms’ level of activity, and that the level of collateral and firms’ riskiness have important impacts on the supply. Adair, Ammous and Fhima (2010) estimate a disequilibrium model using a panel data of Tunisian SMEs from 2001 to 2006. They find that these firms demand less credit every time their internal resources increase. The main borrowing constraint for SMEs is due to the excessive requirements from Tunisian banks that decide to grant credit according to means ensuring the loans’ payback. Shen (2002) test whether there is or not equilibrium credit rationing in Taiwan, China using banks’ loan transaction data. The results in this paper support three hypotheses: i) banks should have backward-bent loan supply curves to prove adverse selection and equilibrium credit rationing; ii) asymmetric information is expected to be more severe for bad companies than for good companies; and iii) asymmetric information is more severe in a bad year than in a good year.

The general form of a disequilibrium model includes a system of equations relating credit demand and supply and a “short-side rule” function.

$$D_t = X_{1t}\beta_1 + \varepsilon_{1t}, \text{ Unobservable credit demand} \quad (1)$$

$$S_t = X_{2t}\beta_2 + \varepsilon_{2t}, \text{ Unobservable credit supply} \quad (2)$$

$$C_t = \min(D_t, S_t), \text{ Short-side rule Function} \quad (3)$$

Where D_t denotes the quantity of credit demanded, S_t denotes the quantity of credit supplied and C_t is the actual credit observed in the market. X_{1t} and X_{2t} are the explanatory variables affecting credit demand and supply respectively, β_1 and β_2 are parameters.

Bayesian estimation method

We estimate the model using a Bayesian estimation approach. Simple MLE would thus lead to biases similar to the well-known linear model. It is also found that the correlation coefficients would be underestimated. This approach is computationally intensive, but allows to circumvent some of the shortcomings related to the numerical optimization problems faced by the Maximum Likelihood approach. The use of the Bayesian estimation method allows us to robustly solve the issues of endogeneity and simultaneity.² The Bayesian estimator is the one that minimizes the quadratic loss function which is the mean of the posterior distribution of the parameters (conditional distribution of the parameters given the sample). In order to obtain the posterior's mean we use the Metropolis-Hastings algorithm to obtain draws from the posterior distribution. With these draws at hand we average them getting our estimator. Bayesian estimation was originally proposed by Bauweans and Lubrano (2006). This approach uses the data augmentation principle to estimate the latent variables – credit demand and credit supply of our disequilibrium model – via Markov Chain Monte Carlo (MCMC) method. One advantage of this technique is that it provides the whole distribution of the parameters and latent variables (the posterior distribution).

The most important identifying characteristic is the interest rate at which the bank lends to a specific firm. This rate is related to this clientele effect, with banks that cater to SME lending, for example, lending at higher ex-ante rates, as transactions costs and risks of non-recovery are higher. Firms' characteristics allow us to control for those. The rate is also part of a broader terms set including, amount of the loan, collateral required, and maturity of the loan. In principle, other bank characteristics can play a role as well in financing. For example, we may expect banks that are more profitable, that intermediate more in general, and that are sounder to be more likely to grant loans to firms. We use these bank characteristics therefore as control variables in our regressions. Those characteristics would have further allowed us also to identify the supply equation compared to the demand equation, however the Bayesian estimation method takes care of the identification issue altogether.

4. Data

² The use of ML method to estimate disequilibrium models was first proposed by Maddala and Nelson (1974) in their seminal paper and has since been exploited in a number of studies testing the empirical significance of credit shortages (see, for example, Pazarbasioglu, 1996; Nehls and Schmidt, 2002; Baek, (200) Hurlin and Kierzenkowski, 2006, Laurence Allain and Nada Oulidi, 2009). A variety of estimators for models of this type have been proposed – see, e.g., Fair and Jaffee (1972), Fair and Kelejian (1974), Amemiya (1973), Maddala and Nelson (1974) ML estimation has the advantage of being relatively simple and well known in the literature. However, the method depends on the underlining assumption of stationary residuals. If the residuals are not stationary, then Maximum Likelihood estimation may provide biased parameters estimates. The existence of measurement error could be due to: (i) unobservable variables that are omitted from the estimation equations and are instead captured by the error term and (ii) a non-random selection process for credit observations, causes covariates to be contaminated by additive errors. Firstly, desired credit demanded by firms and desired supply by banks are latent (not observable); we only observe a value equal to the minimum between the two, a Leontief function. Secondly, selection issues arise as credit demand and supply are truncated from below at zero. Simple MLE would thus lead to biases similar to the well-known linear model. It is also found that the correlation coefficients would be underestimated. As this condition cannot be assured in some specifications of the model, we estimate the model using a Bayesian estimation approach.

The 2004 Brazil ICA survey data provide firm level information on 1,642 firms interviewed in 2003. The ICA sample is composed such that 20 percent of firms in the sample are micros (1 to 19 employees), 52 percent are small (20 to 99), 23 percent are medium (100 to 499), and 5 percent are large (above 500 employees)³. In other words, 95 percent of firms are micro or small and medium enterprises. This ratio is similar regardless of the definition by employees (95 percent) or sales (96 percent).⁴

The ICA questionnaire asks each firm whether it has a loan and whether it has applied for a loan. It also asks which bank is the firm's principal finance provider as well as the number of banks they does business with. Of all firms, 567 or 34.5 percent have a bank loan, and the remaining 1075 firms do not have bank loan. Many firms that decide not to apply for a bank loan report that they do not need a loan (431 firms), probably substituting other sources of finance for bank loan. Few firms report that their loan demand has been rejected by a bank (113 firms). The Brazil ICA survey also asks firms to rank potential obstacles to growth. High interest rates are the principal reason cited for not applying for a loan as reported by firms of all size. Application procedures and collateral requirement are next in importance, affecting especially micro and small firms. The cost of finance is reported to be the main obstacle to growth for 57 percent of all surveyed firms. Access to finance (and specifically collateral) is ranked seventh (34.5 percent of surveyed firms) in the obstacles to growth list, after cost of finance, tax rates corruption, economic and regulatory policy uncertainty, and macroeconomic instability. However, the ranking varies by firm size: access to finance and cost of credit are less binding obstacles for large than for smaller firms. Large firms are more likely to cite tax rates and corruption as their main constraint to growth than micro and small firms. Micro and small firms are charged higher interest rates on overdraft (around 5 percent per month) compared to medium and large firms (3 and 4 percent respectively per month). This analysis, which is typical in ICAs, shows some links between high lending interest rates and poor firm financing, and limited growth, but does not present causal evidence. In particular, the survey does not control for the endogeneity of firm responses.

The data also show that 45 percent of firms do business mainly with public banks, while domestic private banks cater to 42 percent of firms in the sample and foreign private banks cater to 12.7 percent of the sample firms. In particular, Banco de Brasil, a public bank is the principal bank for 593 firms or 36 percent of the sample; it is the main bank for small firms. The second most important Bank is Bradesco, a private domestic bank that cater to firms of all size. Micro firms mostly work with Caixa Economica Federal, a public bank. The firms in our sample tend to work with more banks on average as their size increase, with on average 2 banks for micro firms, 3 banks for small firms, 4.8 banks for medium firms, and 8.2 banks for large firms.

For 2003 and SCR, Table 1 shows various summary statistics for firms (1642 for 2003 and 694 for SCR) according to their size. Most of the firms in the sample are small (73%) (and 23% of medium size). Most of the small and medium firms are dedicated to the Garment Industry, and most of the large firms are in the Food Processing market. As expected, the larger the firm, the more it operates in the exterior, the more it sells abroad. Larger firms are older and employ more people (by construction). With respect to capital origin, the table shows that most capital for smaller firms comes from private and domestic sources, whereas larger firms have more access to private and foreign sources. Unsurprisingly, larger firms have larger equity and liability levels. These trends are similar for 2008, except for the fact that most small firms operate in the Furniture Industry, median firms in the Machinery business, and large firms in Auto Parts (Table 2).

Table 1. ICA data on Firms' Characteristics in 2003 and 2008 and SCR

³ The classification of firm by size (when size is defined according to the number of employees) is as defined by the Ministry of Industrial Development and External Trade.

⁴ The ICA dataset for Brazil has been well described by Kumar and Francisco (2005), most of the descriptive that follow draw on their analysis.

2003													
Firms' Size	Obs	Industry mode	% of firms operating in other countries	% of sales sold domestically		Foundation year				# Employees			
				Mean	Std. Dev.	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Small (<100 employees)	1191	Garments	7.74	95.99	14.93	1987	13.26	1882	2002	37	23.03	6	99
Medium (100 to 500 employees)	376	Garments	21.54	83.22	29.30	1978	20.10	1880	2002	205	97.69	100	498
Large (>500 employees)	75	Food processing	40	76.83	26.59	1961	26.26	1880	2002	1201	1231.74	500	7500
2008													
Firms' Size	Obs	Industry mode	% of firms operating in other countries	% of sales sold domestically		Foundation year				# Employees			
				Mean	Std. Dev.	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Small (<100 employees)	1432	Furniture		97.54	11.15	1990	13.22	1912	2008	28	22.00	1	98
Medium (100 to 500 employees)	272	Machinery	NA	91.38	20.62	1981	18.10	1894	2007	202	97.82	100	480
Large (>500 employees)	98	Auto Parts		85.58	24.27	1968	25.14	1880	2003	1761	1708.37	500	9716
SCR													
Firms' Size	Obs	Industry mode	% of firms operating in other countries	% of sales sold domestically		Foundation year				# Employees			
				Mean	Std. Dev.	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Small (<100 employees)	506	Garments	7.71	95.56	15.18	1991	12.15	1882	2002	40	23.28	6	99
Medium (100 to 500 employees)	158	Garments	19.62	85.99	27.44	1984	17.32	1901	2002	192	88.61	100	467
Large (>500 employees)	30	Food processing	33.33	77.43	28.00	1968	17.71	1934	2002	1249	853.39	560	3500

Table 2. ICA data on Firms' Capital Structure in 2003 and 2008 and SCR

2003														
Firms' Size	Capital Origin						Total equity in 2002 (millions)				Total liabilities in 2002 (millions)			
	%Private & Domestic		%Private & Foreign		%Government		Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.								
Small (<100 employees)	97.50	14.66	2.38	14.49	0.08	2.04	1.68	10.10	-23.50	259.00	3.95	27.50	0.00	741.00
Medium (100 to 500 employees)	91.47	26.69	8.21	26.27	0.31	5.21	13.90	74.20	-154.00	1,200.00	46.20	267.00	0.04	4,240.00
Large (>500 employees)	79.66	38.47	19.69	38.59	0.65	3.20	73.40	130.00	-157.00	813.00	192.00	306.00	0.22	1,570.00
2008														
Firms' Size	Capital Origin						Total equity in 2002 (millions)				Total liabilities in 2002 (millions)			
	%Private & Domestic		%Private & Foreign		%Government		Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.								
Small (<100 employees)	97.28	15.66	2.36	14.72	0.04	1.08								
Medium (100 to 500 employees)	90.19	27.98	9.16	27.47	0.00	0.00		NA				NA		
Large (>500 employees)	76.06	40.56	21.25	39.74	0.25	2.22								
SCR														
Firms' Size	Capital Origin						Total equity in 2002 (millions)				Total liabilities in 2002 (millions)			
	%Private & Domestic		%Private & Foreign		%Government		Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.								
Small (<100 employees)	96.21	17.70	3.52	17.39	0.20	3.12	1.30	5.28	-13.60	69.60	2.99	11.50	0.00	125.00
Medium (100 to 500 employees)	91.16	26.88	8.74	26.88	0.09	1.19	17.70	100.00	-22.20	1,200.00	33.30	144.00	0.00	1,670.00
Large (>500 employees)	77.50	39.25	21.40	39.45	1.10	4.19	93.50	116.00	3.81	525.00	205.00	260.00	9.03	1,250.00

Figure 2. ICA data on Firms' Financing by Capital Origin

Table 3 shows the main financing constraint of firms that declare to have been denied a loan request. The most important source of financial constraint is “Lack of collateral” (38%), followed by “Poor Credit History” (26%). Among the financially constrained firms, the majority are small firms (82%). For small firms, the problem of lack of collateral is even more binding, being the cause of 42% of the financial constraints. However, for medium and large firms this is not the case: the most important financial constraint is “Poor Credit History”. When looking at industry types of the financially constrained firms, the sectors most affected by this restriction are Garments (34%) and Furniture (32%). For both these industries, the main reason for the restriction was “Lack of collateral”.

Regarding the contribution of the various financial sources to new investments and working capital, for the former, most of the funding comes from internal sources; while for the latter most of the funding is from external sources. This could be in line with banks’ reluctance to fund riskier projects, accounted for under “New Investments”, rather than safer bets like “Working Capital” (cash, inventories, etc.). For both working capital and new investments, most of the external financing comes from Commercial Banks. However, for new investments, the picture is more even and Trade Credits and Investment Funds are also relevant actors in the funding scheme.

Table 3. Firms' Financing Constraints by Firm Size

Most important financing constraints (2003)	Freq.	Percent	Cum.
All Firms			
Lack of collateral	43	38.7	38.7
Poor credit history	29	26.1	64.9
Incompleteness of application	18	16.2	81.1
Perceived lack of feasibility of project	11	9.9	91.0
Other	10	9.0	100.0
Total	111	100.0	
Small Firms			
Lack of collateral	38	41.8	41.8
Poor credit history	21	23.1	64.8
Incompleteness of application	16	17.6	82.4
Other	9	9.9	92.3
Perceived lack of feasibility of projec	7	7.7	100.0
Total	91	100.0	
Medium Firms			
Poor credit history	7	38.9	38.9
Lack of collateral	4	22.2	61.1
Perceived lack of feasibility of projec	4	22.2	83.3
Incompleteness of application	2	11.1	94.4
Other	1	5.6	100.0
Total	18	100.0	
Large Firms			
Poor credit history	1	50.0	50.0
Lack of collateral	1	50.0	100.0
Total	2	100.0	

The data on the “banks side” cover all the banks that are lending to the firms in the data, and include bank specific characteristics from 2003 to 2009. They capture leverage (debt to equity ratio), profitability (net profit/net capital), size (assets are in the top 90 percentile of the banking system), risk (as measured by the Basel index), liquidity (immobilization index), intermediation (operation of credit/revenues from intermediation operations).

The data are complemented by information on the main partner bank from the Central Bank of Brazil's credit registry, the Central de Risco, on the bank's five most common types of lending products, the flows of lending by product, and the interest rates charged. The five most common corporate loan categories are: discount receivables, working capital, overdraft, goods acquisition finance, and vendor. Working Capital is a collateralized credit line that is geared towards meeting the cash-flows needs of a firm during its operational cycle. Overdraft is a line of credit that can be used without collateral by a firm until a certain credit limit is reached. Hence, overdraft commands the highest interest rates in our sample. Discount receivable is a type of loan based on an invoice that the firm will receive in the future. Vendor is a short term credit line (180 days or less in general) through which a company can finance their clients. It is highly collateralized, and has the lower interest rates in our sample. Finally acquisition of goods and services is a credit line for the purchase of goods. Collateral is required, usually the good itself but sometimes it could be a promissory note.⁵ The Central de Risco data is monthly from 2003 to 2009.

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- working capital [working capital]: credit lines characterized for a period exceeding 30 days, contract signing and presentation of specific guarantees, intended to finance the operational activities of enterprises;
- guaranteed account [overdrafts]: credit linked to the corporate bank account in which a limited resource is made available for use in accordance with customer convenience;
- discount bills and promissory notes [discountable]: advance of funds from the duplicates in collection or promissory notes, which

Different loan categories differ significantly in terms of maturity, interest rates, collateral, firms' outstanding debts, and loan value. For example, goods acquisition finance loans are of significantly longer maturity (averaging approx. 25 months) compared to the average of other categories (ranging between 2 and 5 months). Similarly, real interest rates charged on overdrafts are significantly higher than that charged on other loan types. Collaterals are most often used for these two before-mentioned loan categories. Firms which issue goods acquisition finance loans tend to be those with highest outstanding debts. Loans of largest value are issued through working capital and overdrafts. Examining these trends more closely helps us identify characteristics of each of the loan categories.

Lending rates vary widely among banks, even when considering specific lending products. Looking at real interest rates for each of the categories of loans, the minimum rates for all categories is approximately -14%. The standard deviations and maximum rates are indicators of lending rate variations. Overdrafts register the highest variability according to both indicators, with interest rates ranging between 34 percent and 167 percent. In contrast, rates are more stable for other types of loans. In decreasing order of interest rate volatility, as measured by the standard deviation, are working capital, vendor, discountable, and goods acquisition finance loans. Among banks, smaller banks tend to lend relatively more to small and medium firms, and to "Food Processing", "Garments" and "Furniture" industries. Larger banks lend more to smaller firms, and to the same industries. This is consistent with a better monitoring capacity of larger banks, which allows lending to smaller (and potentially riskier) firms. More profitable, stable, and liquid banks ($\text{lucro líquido/patrimônio líquido}$; $\text{basil index} < 15.15$; and $\text{imobilization index} < 2.259$) lend mostly to medium sized firms; and to "Food Processing", "Textiles" and "Garments" industries.

Considering the loan type distribution, most of the loans were in the form of "Discountables" (82%), followed by "Working Capital" (8%). The mean loan value for these two loan types is markedly different, of R\$32,000 and R\$190,000, respectively. This shows that banks grant many small loans in the form of "Discountables", but most of the amounts granted are concentrated in a few "Working Capital" operations. Most loan types have relatively short-term maturities, of around 3 months, except for "G&A", that has a mean maturity of 25 months. The higher real interest rates are charged on "Overdraft" loans, in contrast to those charged for "Vendor" loans (43% vs 2%). This pattern also applies to the mean number of collaterals associated with the loan: "Vendor" loans have the lowest number of collateral; meanwhile "Overdraft" (and "G&A" to a similar extent) has a higher number of collaterals associated. This could indicate that "Vendor" is a relatively safe loan for the bank.

constitute the very guarantees of operation;

- vendor, sales finance operation based on the principle of credit assignment, which allows a company to sell their product to run and receive the cash payment. The seller transfers its credit to the bank and this, in exchange for an intermediation fee, paid in cash and the seller finances the buyer;
- procurement of goods [goods acquisition]: traditional operations funding to individuals and companies in which the credit is tied to the acquisition of the asset that is almost always a guarantee of operation;

Table 4. Loan Summary Statistics by Loan Categories

	Vendor	Working Capital	Overdraft	G&A	Discountable
Obs	2040	3933	1867	1107	41755
Maturity (in months)					
Mean	2.2	5.3	3.3	25.5	1.9
Std Dev	1.3	6.2	1.6	15.5	1.2
Min	0.1	0.0	0.0	0.8	0.0
Max	12.2	48.8	17.6	146.2	36.8
Bank real interest rate					
Mean	1.8	17.4	43.4	14.0	18.4
Std Dev	12.0	18.8	32.6	8.1	9.2
Min	-14.7	-14.7	-14.7	-14.1	-14.6
Max	94.2	124.9	179.4	51.7	128.2
Number of collaterals associated with the loan					
Mean	0.02	0.39	0.75	0.73	0.17
Std Dev	0.16	0.57	0.55	0.52	0.40
Min	0.00	0.00	0.00	0.00	0.00
Max	2.00	4.00	3.00	4.00	4.00
Outstanding debt of a firm to one bank					
Mean	5,619,981	4,051,038	981,927	15,100,000	1,351,568
Std Dev	16,800,000	10,500,000	4,203,347	21,300,000	2,967,162
Min	10,109	10,036	11,615	6,359	10,163
Max	108,000,000	128,000,000	71,000,000	104,000,000	61,700,000
Loan Value (reais)					
Mean	45,697	186,573	166,879	84,844	31,504
Std Dev	210,464	1,213,142	1,344,528	264,060	137,288
Min	5,001	5,000	5,011	-	5,000
Max	3,881,290	68,200,000	23,200,000	5,953,071	5,616,909

The most important loan type is “working capital”, with an average amount of R\$ 677 million. Its importance has a peak in 2008, of R\$886 million and then wanes in 2009 (as do all other loan types, except for “G&A”). The second most important loan type is “Discountable”, with a peak in 2006 of R\$331 million, which then falls sharply to a minimum in 2009 of around R\$93.2 million. The overall pattern shows that all loan types but “G&A” have been declining in 2008 and 2009. Disaggregating these amounts of lending by firm size, it can be seen that most of the variation in the time trends comes from the medium size firm’s borrowing activity. For example, whereas the amounts lent to small and large firms of “Working capital” loans remains fairly stable at relatively low levels for the period analyzed, the trend for the medium firms is more volatile and reveals higher total amounts of borrowing than for the other two sizes of borrowing firms. This is consistent with the theory that the most dynamic sector of the loan market is made of medium sized firms. Smaller ones are not deemed reliable by banks, and large firms may have access to internal sources of funding.

Figure 3: Value of Loans by Firm Size

Figure 4: Value of Loans by Firm Sector

There are large differences in client bases between the banks, suggesting that knowing the bank can help resolve the demand versus supply identification problem. Large banks are shown to lend proportionately more to small and medium-sized firms (especially to small firms) than do small banks. In particular, small banks' bulk of lending is directed at medium firms, while that of large banks is directed at small ones. Interestingly, profitable stable and liquid banks all appear to have a similar profile of lending, targeting medium-sized firms even more than small banks do. Note that these breakdowns reflect the composition bias of our sample towards micro, small, and medium firms which represent over 95 percent of the total sample.

The industry clientele also varies across banks. For example, food processing is on average the largest category, yet accounts for a range from a minimum of 14% of loans by large banks to a maximum of 23.5% of loans by stable and liquid banks. Large banks lend relatively more to shoes and leather products whereas small banks lend much more to textiles.

Table 5. Bank Lending Relationship by Bank Type and Firm Size and Industry

	Small Banks			Large Banks			Profitable Banks			Stable Banks			Liquid Banks		
Loans granted by firm size	Freq.	Percent	Cum.	Freq.	Percent	Cum.	Freq.	Percent	Cum.	Freq.	Percent	Cum.	Freq.	Percent	Cum.
Small	29,915	41.7	41.7	6,786	62.7	62.7	963	38.2	38.2	7,661	37.9	37.9	7,778	38.4	38.4
Medium	32,274	45.0	86.7	3,151	29.1	91.8	1,352	53.7	91.9	10,346	51.1	89.0	10,259	50.6	89.0
Large	9504	13.3	100.0	884	8.2	100.0	204	8.1	100.0	2236	11.1	100.0	2222	11.0	100.0
Total	71,693	100		10,821	100		2,519	100		20,243	100		20,259	100	

	Small Banks			Large Banks			Profitable Banks			Stable Banks			Liquid Banks		
Loans granted by firm industry	Freq.	Percent	Cum.	Freq.	Percent	Cum.	Freq.	Percent	Cum.	Freq.	Percent	Cum.	Freq.	Percent	Cum.
Food processing	13,267	18.5	18.5	1,512	14.0	14.0	524	20.8	20.8	4,727	23.4	23.4	4,769	23.5	23.5
Textiles	8,349	11.7	30.2	673	6.2	20.2	405	16.1	36.9	2,970	14.7	38.0	3,526	17.4	40.9
Garments	8,340	11.6	41.8	1,543	14.3	34.5	319	12.7	49.5	2,493	12.3	50.3	2,938	14.5	55.5
Shoes and leather products	4,026	5.6	47.4	1,325	12.2	46.7	157	6.2	55.8	1,471	7.3	57.6	1,587	7.8	63.3
Chemicals	6,791	9.5	56.9	664	6.1	52.8	230	9.1	64.9	1,366	6.8	64.4	1,252	6.2	69.5
Machinery	7,440	10.4	67.3	1,272	11.8	64.6	182	7.2	72.1	2,401	11.9	76.2	1,924	9.5	79.0
Electronics	9,514	13.3	80.5	1,252	11.6	76.2	339	13.5	85.6	1,368	6.8	83.0	1,117	5.5	84.5
Auto-parts	3,617	5.1	85.6	863	8.0	84.1	68	2.7	88.3	1,125	5.6	88.5	856	4.2	88.7
Furniture	10,349	14.4	100.0	1,717	15.9	100.0	295	11.7	100.0	2,322	11.5	100.0	2,290	11.3	100.0
Total	71693	100		10821	100		2519	100		20243	100		20259	100	

5. Empirical Results

While the ICA-survey shows the problems of firms in accessing external financing relative to other constraints, they suffer from the endogeneity problems mentioned, e.g., we do not know the real reasons for the mentioned obstacles, including lack of external financing. It can be that the firm indeed has good growth opportunities, but banks are not interested in lending to firms in general. Or it can be that the banks make the right judgment in not lending as the firm has limited growth opportunities or is not creditworthy. We can now use the data to more formally assess the demand of the borrower and the supply of banks to provide financing as a function of the financing terms as well as various macro and micro variables including firms and bank characteristics. We estimate a disequilibrium model described in equations (1) to (8), where X_{1t} the set of explanatory variables for loan demand include the set of firm and loan characteristics, macro-economic variables such as measures of inflation and growth and X_{2t} represents a set of banks and loan characteristics and macroeconomic variables. The dependent variable is the value of the contracted loan. The coefficients (betas) represent by how much the amount of a loan increases by increasing one of the regressors. The estimates rely on the disequilibrium model as in Madalla (1974). Since we are estimating 2 equations (demand and supply), supply betas are the estimates for the supply coefficients and demand betas are the estimates for the demand coefficients. The estimation is Bayesian using a quadratic loss function and the posterior was calculated using the Metropolis Hasting's procedure. For each issue we first present the OLS estimates and then the disequilibrium results.

Determinants of Firms' Demand for Bank Financing

Table 6.A. shows the results of the OLS estimation of the demand for each type of loan and for all loans together. With respect to the loan demand, the lending rate has the expected negative sign in most of the estimations and is significant. The exceptions are working capital and vendor loans. However, the lending rates coefficients coming from the working capital estimations are not significant. The results show that the maturity of the loans has a positive and significant effect on loan demand overall. Also, firms that can provide collateral have a higher demand for credit. The table suggests that macroeconomics variables, such as inflation and GDP

growth rates, do not have a significant importance in the loan demand. With respect to firms' characteristics, big firms have a higher loan demand for G&A, overdraft and working capital loans, and a lower demand for the rest. Exporting firms have a significant higher demand for discountable, vendor and working capital loans. Moreover, we find that firms that are public listed have a higher demand for credit of all types. The same happens with firms that are managed by the owner, with the exception of vendor loans. Finally, the availability of internal sources of funding has an important negative effect on the demand for working capital and discountable loans.

Table 6.B. shows the results of the disequilibrium model estimation of the demand for each type of loan. The table shows that the bank real interest rate associated with the loan is not a significant variable in most of the estimations. The maturity of the loan has a positive and significant impact on the demand for discountable, overdraft and working capital loans. Furthermore, the availability of collateral is a significant variable in all the estimations. In particular, firms that can provide collateral exhibit a higher demand for overdraft, vendor and working capital loans; while a lower demand for discountable and G&A loans. Firms' size does not seem to affect the demand for discountable and overdraft loans. However, we observe that smaller firms' demand is higher for working capital loans and lower for vendor and G&A loans. Exporting capacity has a relevant and negative effect on the demand for discountable loans. Finally, access to BNDES loans has an important and negative impact in the demand for overdraft and G&A loans.

Table 7.A. shows the results of the OLS estimation of the supply for each type of loan and for all loans together. We find that the outstanding debt of a firm to one bank before the actual contracted was signed has a significant and positive impact on the supply for credit in all the estimations. Also, the supply of working capital, G&A and overdraft loans is higher for large firms while the opposite is true for discountable and vendor loans. There is also a larger supply of credit for exporting firms. With respect to banks' characteristics, we observe that size has a significant role. Large banks have a lower supply of working capital, overdraft, vendor and G&A loans, while a higher supply of discountable loans.

Table 7.B. shows the results of the disequilibrium model estimation of the supply for each type of loan. The table shows that the bank real interest rate associated with the loan has a positive and significant effect on the supply of overdraft, G&A and vendor loans, while it is not significant for discountable and working capital loans. We find that the supply of discountable and working capital loans increases for firms that can provide collateral. However, the availability of collateral is not a significant factor affecting the supply of other types of loans.

Estimating Access to Bank Credit

We investigate the determinants of firm access to credit. A firm from our sample with constrained access would not be able to get a credit even though it had a credit in the past. We use a COX equation estimation to define the probability that a firm receives a loan at a given period conditioned on the fact that the firm did not get any credit on the past T periods. Table 9. presents results on the COX equation estimation, which shows the probability that the firm receives a loan given that the firm has not had one in the past T periods. The coefficients indicate how a change in one of the explanatory variables changes the probability of getting a loan given that the firm has not gotten a loan for T periods, where T is defined as the date in which a new loan is originated minus the last date in which the firm has contracted a loan.

We find that for each type of loan, the lending rate is not a significant factor affecting the probability of a firm getting a loan. But, for the estimation of all loans aggregated, the lending rate becomes significant and has the negative sign that we would expect. This also happens with the variables firm's size and GDP growth: they are significant in the estimation for all loans but not for each type of loan independently. When aggregating all loans, the results show that big firms have a lower probability of getting a loan. This, again, is consistent with

the fact that larger firms use more internal sources of financing. Moreover, higher GDP growth rates increase the probability of getting a loan. An important factor affecting the probability of a firm getting a loan is the total number of loans that a firm had in the past. This variable has a positive sign and is significant in all the estimations. This may be reflecting the importance of having a credit history in order to get a new loan. The impact of the maturity of the loans is also negative and significant in most of the estimations.

The variables that matter the most for new firms to access bank credit are loan characteristics such as real bank interest rates and loan maturity, firm characteristics such as size (whether or not it is big), macroeconomic conditions such as GDP growth, inflation, and BNDES share in credit), and previous access to credit (number of loans per firm). While firm size seemed to matter a lot in the period 2003-06, this does not appear to be as important in the more recent sample (2007-09). We also observe the increased role of BNDES financing, but with a negative coefficient, a system of public directed crowding out private credit in the case of all loan types except overdraft and goods and acquisition loans. The impact of cyclical downturns appears to be mitigated, as signaled by the decreased significance of GDP growth, though the coefficient increased. This is in line with the small impact of the global financial crisis on credit access in 2009, when despite a contraction in GDP, directed credit growth through BNDES helped maintain credit market liquidity.

6. Conclusion

We investigate the determinants of small-firm access to credit over the past decade in Brazil. We find over the decade improved access to finance for small firms which reflects the deepening of the credit markets. While firm size mattered in the 2003-2006 period to get access to credit, firm size is not as important in the 2007-2009 sample. Loan characteristics such as real bank interest rates and loan maturity, macroeconomic conditions (such as GDP growth, inflation, and BNDES share in total credit), and previous access to credit (number of loans per firm) also matters for access to Bank credit. The latter finding points to the importance of information availability (less information asymmetry) to reduce risk and increase access, which is captured in the positive influence of collateral and credit history in the regression. Banks perceive it less risky to lend to firms that they know or that other Banks know. This is consistent with the spreads decomposition that indicates the importance of risk as one of the main component of spreads. This finding has policy implications on the role of credit registries in increasing access to credit for firms.

The loan demand and loan supply analysis points to the importance of collateral. The availability of collateral is a significant variable in all the estimations. In particular, firms that can provide collateral exhibit a higher demand for overdraft, vendor and working capital loans. We find that the supply of discountable and working capital loans increases for firms that can provide collateral. However, the availability of collateral is not a significant factor affecting the supply of other types of loans. Maturity matters for loan demand. The maturity of the loan has a positive and significant impact on the demand for discountables, overdraft and working capital loans indicating that though there have been improvements on increasing loan maturity, loans with longer maturity are wanted. Policy implication for increasing access to longer term loan maturity and on collateral would matter for small firm financing constraints. Finally, further research is needed to better understand the results on the elasticity of loan demand and loan supply to interest rates. We find some inelasticity of loan demand at the loan category level, maybe already reflecting some screening and pricing, however when the loans are aggregated, the effect of interest rates becomes significant and negative as expected. On the supply side, bank real interest rate associated is a positive and significant effect only in the supply of overdraft, G&A and vendor loans.

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Tables

Table 6.A. OLS Regression Results: Firms' demand for bank credit by type of lending

Whole Sample (2003-2009)	All Loans	Discountable	G&A	Overdraft	Vendor	Working Capital
VARIABLES	(1) carteira_ativa_real	(2) carteira_ativa_real	(3) carteira_ativa_real	(4) carteira_ativa_real	(5) carteira_ativa_real	(6) carteira_ativa_real
taxa_real	-1.989*** (0.107)	-0.880*** (0.0316)	0.434 (0.388)	-1.359*** (0.290)	0.616*** (0.217)	0.197 (0.506)
maturity	6.107*** (0.291)	1.516*** (0.218)	3.084*** (0.244)	-0.0906 (5.493)	2.257 (2.060)	2.299* (1.298)
has_collateral	117.8*** (12.33)	-8.513*** (3.126)	3.018 (14.34)	229.0*** (46.50)	-42.44 (68.45)	111.8** (55.26)
inflacao	6.451** (2.851)	-2.162*** (0.547)	6.976 (6.026)	1.242 (18.70)	4.115 (3.588)	-5.839 (15.71)
l_inflacao	-9.728*** (2.887)	1.595*** (0.553)	-4.852 (5.903)	-22.62 (18.85)	-3.559 (3.560)	-1.956 (16.14)
pibgrowth	-398.2*** (118.6)	-24.51 (22.40)	640.8*** (247.2)	-2,271*** (772.1)	263.4 (166.2)	-1,118* (669.2)
l_pibgrowth	330.1*** (113.2)	49.23** (21.29)	-686.7*** (238.8)	1,535** (724.2)	-198.9 (166.0)	1,249** (633.6)
big	55.96*** (5.517)	-32.03*** (1.287)	79.93*** (14.19)	1,323*** (72.39)	-9.030 (7.093)	206.9*** (34.37)
export	26.13*** (3.028)	15.43*** (0.595)	3.316 (6.893)	10.13 (18.82)	26.58*** (6.965)	46.04** (19.58)
young	32.29*** (5.083)	-5.134*** (1.153)	23.78** (10.77)	-30.07 (62.12)	-25.72* (14.48)	-9.413 (31.81)
num_loans_per_firm	-0.000254*** (3.58e-05)	-0.000108*** (6.27e-06)	0.000134 (0.000225)	-0.00372*** (0.00101)	0.000597* (0.000352)	-0.000483 (0.000763)
has_bndes_loan	10.38*** (3.073)	-16.46*** (0.618)	-19.78*** (6.932)	-45.36** (21.77)	16.74*** (5.522)	27.22* (16.17)
has_internal_funding	-20.29*** (4.566)	-1.859** (0.914)	21.05** (10.35)	78.63*** (30.01)	9.484 (9.069)	-96.65*** (21.76)
is_manager_educated	11.51** (4.892)	3.923*** (1.003)	8.641 (13.37)	45.55* (27.50)	19.59** (9.924)	40.32* (24.29)
is_public_listed	23.27*** (4.947)	45.13*** (0.955)	14.11 (16.57)	954.0*** (66.73)	151.2*** (11.76)	103.3 (64.18)
is_manager_owner	-2.072 (3.825)	2.449*** (0.799)	11.15 (8.711)	289.8*** (33.50)	-13.92 (9.236)	-29.68 (20.34)
has_collateral_x_selic	-1,045*** (131.1)	117.1*** (34.14)	-39.57 (147.1)	-2,407*** (482.7)	1,374* (808.8)	-599.4 (629.3)
Constant	63.36*** (7.646)	23.45*** (1.586)	-101.6*** (22.39)	129.2** (54.77)	-41.15*** (12.74)	80.39* (43.40)
Observations	59,408	41,755	1,107	1,867	2,040	3,933
R-squared	0.030	0.089	0.221	0.377	0.137	0.027
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1						

Table 6.B. Disequilibrium Model Results: Firms' demand for bank credit by type of lending

Dependent variable	Discountables		Overdraft		Working Capital		G&A		Vendor	
carteira_ativa_real										
Demand betas	Estimate	Std. Dev.	Estimate	Std. Dev.	Estimate	Std. Dev.	Estimate	Std. Dev.	Estimate	Std. Dev.
const	30.60***	24.44	559.31*	1704.96	-2684.11***	2150.75	-1061.69***	393.68	-892.20	859.33
taxa_real	1.04	1.18	2.22	23.79	36.06	42.53	0.86	14.50	-7.07	8.82
maturity	25.85***	8.90	729.26***	370.40	87.08***	25.54	5.70	13.40	-109.89	77.89
has_collateral	-488.69***	231.35	2266.35***	904.39	12192.33***	3513.26	-1490.73***	375.36	4435.03***	2184.78
small	-45.92	21.70	183.00	734.09	1195.53**	495.32	-652.68***	240.32	-980.07***	446.59
big	-50.41	42.53	-8105.76	5375.66	318.46	942.94	2663.31***	1595.91	-854.39***	552.52
export	-73.42***	21.75	-589.04	572.02	462.91	1322.71	-89.49	200.63	-272.80	249.72
young	73.03	49.98	-2713.14	2910.60	-527.96	1086.89	547.05	398.56	189.99	845.66
isgroup	12.10	41.80	-1447.64	1266.68	610.08	1249.14	706.42	587.65	-286.05*	164.81
has_bndes_loan	-21.96	15.28	-2615.91***	961.88	1113.36	973.92	-639.51*	325.72	297.66*	157.22
has_internal_funding	-33.85	25.92	2031.74*	1117.90	-544.84	471.80	-825.69*	528.55	495.96***	191.80
inflacao	3.58	1.77	-64.69	59.77	-48.76	72.35	66.37***	24.06	14.54	15.31
has_collateral_x_selic	-3534.67***	1124.34	115068.80***	37987.46	-1422.48	11036.35	-5434.65	4102.10	-24523.66	57555.82

Table 7.A. OLS Regression Results: Bank supply of credit to firms by type of lending

Whole Sample (2003-2009)	All Loans	Discountable	G&A	Overdraft	Vendor	Working Capital
VARIABLES	(1) carteira_ativa_real	(2) carteira_ativa_real	(3) carteira_ativa_real	(4) carteira_ativa_real	(5) carteira_ativa_real	(6) carteira_ativa_real
taxa_real	-1.563*** (0.105)	-0.814*** (0.0299)	1.128*** (0.390)	-0.232 (0.268)	1.390*** (0.230)	0.679 (0.498)
maturity	6.275*** (0.285)	-0.411** (0.200)	2.243*** (0.240)	12.68** (5.430)	2.436 (1.981)	3.861*** (1.335)
has_collateral	3.729 (3.320)	-2.867*** (0.716)	-8.479 (5.952)	10.36 (21.58)	75.49*** (14.19)	45.68*** (16.93)
total_debt_without_loan_real	0.0148*** (0.000279)	0.0216*** (0.000222)	0.00576*** (0.000632)	0.247*** (0.00880)	0.00118*** (0.000346)	0.0165*** (0.00210)
bndesrepper	18.88 (473.6)	335.1*** (85.39)	-703.3 (892.7)	-570.8 (2,897)	1,523** (743.0)	-1,560 (2,732)
ruperc	-115.1 (272.8)	182.0*** (49.74)	1,219** (532.4)	-645.2 (1,605)	-848.5** (409.9)	2,266 (1,494)
habperc	3,349*** (727.8)	-145.7 (131.4)	-361.4 (1,489)	4,705 (4,376)	-2,753** (1,327)	6,944 (4,501)
inflacao	-2.267 (3.376)	0.702 (0.607)	7.512 (6.077)	-0.589 (19.50)	1.030 (4.520)	-12.94 (18.71)
l_inflacao	-0.113 (3.221)	-0.274 (0.577)	-3.354 (5.921)	-9.735 (18.56)	-0.261 (4.220)	1.617 (17.83)
pibgrowth	-334.2* (182.3)	43.53 (32.33)	1,120*** (351.4)	-1,165 (1,204)	5.460 (311.6)	-1,279 (1,045)
l_pibgrowth	399.3** (183.4)	-45.01 (32.52)	-1,042*** (355.6)	797.6 (1,200)	52.04 (311.0)	1,309 (1,048)
big	55.99*** (4.901)	-18.92*** (1.005)	54.00*** (12.03)	603.4*** (73.27)	-10.84 (6.708)	198.8*** (32.80)
export	-0.430 (2.972)	7.445*** (0.532)	-10.61* (6.209)	-36.23** (16.90)	27.63*** (5.820)	42.93** (19.33)
young	-72.38*** (5.131)	-2.300** (0.987)	-12.29 (11.65)	-47.76 (58.19)	-22.65 (14.36)	-143.4*** (35.04)
basilindex_x_selic	6.703** (2.872)	14.65*** (0.520)	-8.196* (4.396)	-8.676 (18.06)	-24.80*** (5.959)	-0.0231 (26.81)
leverage_x_selic	0.840 (1.083)	0.180 (0.205)	-13.56*** (1.442)	5.007 (4.674)	3.893 (4.155)	-2.282 (5.372)
imobilization_x_selic	0.612 (1.319)	-8.764*** (0.259)	1.173 (3.032)	16.16 (10.36)	14.02*** (2.541)	-9.097 (8.595)
leverage	-0.203* (0.109)	-0.00735 (0.0203)	0.926*** (0.173)	-0.416 (0.505)	-0.107 (0.353)	0.292 (0.597)
profitability	7.028** (2.820)	-1.277** (0.525)	36.50*** (5.706)	-4.656 (16.37)	-19.24* (10.31)	-0.784 (14.52)
size	16.58*** (3.949)	10.11*** (0.856)	-16.03* (9.389)	-21.67 (36.18)	-36.81*** (10.38)	-32.62* (19.15)
basilindex	-0.978*** (0.260)	-1.169*** (0.0461)	0.145 (0.394)	0.845 (1.594)	1.708*** (0.480)	-2.068 (1.915)
Constant	-107.7*** (39.63)	-24.91*** (7.220)	-152.6* (83.39)	-63.93 (243.0)	82.69 (81.50)	-417.2* (236.2)
Observations	59,408	41,755	1,107	1,867	2,040	3,933
R-squared	0.073	0.237	0.364	0.491	0.067	0.040
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1						

Table 7.B. Disequilibrium Model Results: Bank supply of credit to firms by type of lending

Dependent variable	Discountables		Overdraft		Working Capital		G&A		Vendor	
carteira_ativa_real	Estimate	Std. Dev.	Estimate	Std. Dev.	Estimate	Std. Dev.	Estimate	Std. Dev.	Estimate	Std. Dev.
Supply betas										
const	789.34***	553.94	-34680.64*	15046.01	38471.27***	18899.82	10336.71***	1275.05	-777.73	5642.59
taxa_real	0.49	1.24	29.57**	12.50	-4.28	17.08	24.41***	15.36	19.49***	5.52
maturity	-4.90	5.60	207.13	312.68	-25.25	90.48	-13.78	11.02	-87.77	80.56
has_collateral	46.94**	25.39	-327.32	1006.67	1040.12*	540.12	-127.30	278.66	732.39	543.46
leverage	1.22***	0.37	-74.11	48.77	92.42***	31.89	-24.85***	8.54	-5.18	12.91
profitability	12.06	19.33	1635.05***	463.04	760.87*	503.02	288.10	159.14	-259.58	354.05
size	-42.61	37.10	-4198.82***	1666.96	175.58	724.85	602.47**	326.28	-581.28***	300.87
basilindex	-1.71	2.58	142.54***	67.03	722.89***	210.93	16.49*	8.64	-6.85	24.70
imobilizationindex	-8.28***	3.43	173.90	151.81	93.18	101.58	68.30	40.44	9.81	15.36
perc_intermed	0.08	2.49	132.34*	95.23	22.64	82.47	-81.42	76.32	-180.45***	91.12
small	-23.65	28.83	-2553.52***	1333.05	-677.67	665.21	-193.52	268.03	-19.49	148.66
big	65.05***	27.11	-1111.93	1749.29	-4032.59	2457.38	-543.09***	325.52	-68.86	301.63
export	-74.26***	40.12	-822.80	695.07	-1795.79**	563.57	-1226.87***	218.35	190.96	299.14
young	-71.55	76.04	346.89	2652.22	4049.35	2512.14	656.95	371.64	-977.31	806.81
isgroup	15.74	53.75	3891.68***	1295.10	2194.16	1155.50	-265.79	387.32	-485.69***	162.93
bndesperc	1917.67	1258.03	17502.83	18358.52	-57821.71***	23973.67	21635.12	16197.19	8531.17	15327.70
rupperc	1834.12*	929.41	179856.00*	133132.59	-39511.62	46596.45	-71851.48***	13104.17	-19403.50	24889.09
habperc	7248.65	5773.11	696258.62***	173831.56	-764128.83***	148429.61	-178663.20***	33442.92	36036.77	39997.10
inflacao	5.20	2.85	-421.52***	79.75	-340.27***	93.85	-40.17	54.11	71.66	46.57
basilindex_x_selic	-63.66***	19.18	-1938.17***	925.20	915.14	1121.03	-829.45***	179.16	69.98	354.80
leverage_x_selic	-4.45	3.37	-507.23***	287.42	-78.39	199.22	72.88**	36.94	33.90	127.46
imobilization_x_selic	11.88	32.45	4184.57***	2020.44	-101.92	1005.54	1203.71***	326.16	81.68	278.86

Table 8: HANSEN TIME VARIANCE TEST

carteira_a~l	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
leverage	-0.03479	0.044422	-0.78	0.434	-0.12186	0.0522803
size	42.87219	3.994507	10.73	0	35.04294	50.70144
basilindex	-0.00169	0.093325	-0.02	0.986	-0.18461	0.1812232
imobilizat~x	-1.18164	0.099086	-11.93	0	-1.37585	-0.9874327
perc_inter~d	1.361326	0.470372	2.89	0.004	0.439395	2.283256
has_bndes_~n	15.4541	3.124964	4.95	0	9.329161	21.57905
has_intern~g	-16.2932	4.822924	-3.38	0.001	-25.7462	-6.840249
is_manager~d	-4.62052	5.275389	-0.88	0.381	-14.9603	5.719261
is_public_~d	11.55667	9.759955	1.18	0.236	-7.57288	30.68622
is_tradabl~s	20.81002	10.38129	2	0.045	0.46265	41.1574
is_untrada~s	3.998027	8.724547	0.46	0.647	-13.1021	21.09817
is_private	-4.53135	13.52731	-0.33	0.738	-31.0449	21.98223
is_manager~r	4.246485	3.714336	1.14	0.253	-3.03363	11.5266
small	-21.6203	3.36214	-6.43	0	-28.2101	-15.03046
big	76.1516	5.651081	13.48	0	65.07545	87.22774
export	35.95689	3.191505	11.27	0	29.70153	42.21225
young	38.17678	5.083715	7.51	0	28.21268	48.14088
isgroup	44.06463	5.077433	8.68	0	34.11284	54.01642
profitabil~1	-0.06259	2.622789	-0.02	0.981	-5.20327	5.078083
profitabil~2	18.39829	4.874255	3.77	0	8.84473	27.95185
_cons	40.40065	10.97154	3.68	0	18.8964	61.90491

Source	SS	df	MS	Number of obs = 59524 F(20, 59233) = 58.04 Prob>F=0.0000 R-squared=0.0192 Adj R-squared = 0.0189 Root MSE = 325.26	Test `var_to_test'_t1 = `var_to_test'_t2 profitability_t1 - profitability_t2 = 0 F(1, 59233) = 16.04 Prob > F = 0.0001
Model	1.23E+08	20	6139586		
Residual	6.27E+09	59233	105790.9		
Total	6.39E+09	59253	107827.5		

Table 9. COX Estimation

All Loans COX				Working Capital COX				Vendor COX			
Dependent variable is T	20248	39160	59408	1174	2759	3933	472	1568	2040		
Num. of observations	2007-2009	2003-2006	Whole Sample	2007-2009	2003-2006	Whole Sample	2007-2009	2003-2006	Whole Sample		
Regressors	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.		
taxa_real	-0.0027504791***	-0.00117158*	-0.00180312***	-0.004466013	-0.002682999	-0.0024450099	-0.001712724	-0.0189081096**	-0.009109383		
maturity	-0.0207337666***	-0.0269511***	-0.02437773***	-0.024212265**	-0.027396274**	-0.028882101***	-0.245632762**	-0.015788686	-0.03642739		
total_debt_without_loan_real	-4E-07	-2.3E-06	-3E-07	0.0001319912***	3.99999E-06	1.69999E-05	-0.000121206	-7.20003E-06	-1.70001E-05		
has_collateral	-0.124362697	0.007355879	-0.068918124	-0.127726105	-0.385227026	-0.074052328	-1.765267501		-2.805968479		
Banks Charac.											
leverage	-6.95024E-05	-0.002946654	-0.000864974	-0.001193912	-0.005762366	-0.001436932	-0.015407691	-0.023282035	-0.001664484		
profitability	-0.07004464620*	0.037847656	-0.012114687	-0.129611429	0.061726133	-0.003588631	2.172713509	-0.604502255	-0.206670849		
size	-0.025210532	-0.107316292**	-0.06357707	-0.048550638	-0.2379005295**	-0.1416566679**	0.306342872	-0.015472678	-0.1139778656		
basilindex	-0.006682075	-0.002451903	-0.005324751	0.014897479	0.004994507	-0.004011937	-0.035417666	0.006986537	-0.036092467**		
inmobalizationindex	-0.014389966	-0.000591975	0.001577755	0.032272592	-0.015946777	0.001026473	-0.147806281	0.0484234302*	0.022899036		
perc_interned	-0.04532786	0.002446006	0.000837649	-0.082637649	-0.006765065	0.003554675	-0.152373277	-0.031194013	-0.030536942		
ICA											
has_bndes_loan	0.006470024	2.19998E-05	0.00211576	-0.035476515	0.081007473	0.047236577	0.700570558**	0.2043203	0.324946065		
has_intenal_funding	0.025819782	-0.037672896	-0.015906846	0.230063553	0.185776415	0.110643834	-0.570378549	-0.457106674	-0.6771868273**		
is_manager_educated	-0.0102645	-0.005218493	-0.017318402	0.000451898	-0.090373057	-0.059770599	0.734053012	-0.156507037	0.309730705		
is_public_listed	0.02739919	-0.118487972	-0.043045298	0.497783544	-0.432095623	-0.350800802		-0.231353032			
is_tradable_shares	0.062686495	-0.134542647	-0.086417517	1.0526346655*	-0.396430394	-0.119259438	1.489397506	-0.621200729	0.086745425		
is_untradable_shares	-0.054750461	-0.095004217	-0.051537956	1.0152190854*	-0.539101478	-0.186531044	0.356280466		-0.3978739		
is_private	0.057327899	-0.12143265	-0.065667799	1.1475141926*	-0.676012816	-0.173703067					
is_manager_owner	0.052041065	0.037338173	0.038601291	0.127915215	-0.034908265	0.06403058	2.132154952*	0.347928505	0.381395751		
small	0.017180565	0.048109933**	0.044623444	-0.090084786	0.265067090*	0.110173714	-0.002626145	-0.244315478	-0.031141502		
big	-0.13609547*	-0.16995829**	-0.146382530**	-0.038868477	0.073337819	0.069682767	-1.240566252	-0.257441432	-0.361520378		
export	-0.073845375*	-0.038500611	-0.038939289	-0.056877374	0.014313077	0.026795765	-0.793052381*	-0.13189787	-0.123510795		
young	0.017255268	0.000993247	-0.060000000	-0.111725548	-0.111725548	0.023747998	0.618518996	-0.18518996	0.842242423		
isgroup	-0.100373969	0.002763179	-0.031353938	-0.013100437	0.085139543	0.055241689		-0.406377624	-0.255326925		
Macro											
bndesperc	-14.21897766***	3.677040904*	1.119179983	-17.55358026	6.54705209	-0.758977416	-28.98194833	-6.606399914	-6.803305178		
rupperc	-7.035929618	-3.707133042	2.300065321	-8.377431249	-18.28965248	-3.040256948	-42.19307963	14.49162907	6.127518755		
habperc	13.4488202	5.63345836	8.291222147	46.39529116	15.76524183	16.59432983	64.09258524	98.17182931	45.04657991		
pbgrowth	1.7189163378*	0.5887362139**	0.956504413**	4.084657292	0.636604413**	1.8669244539**	5.634452761	1.740218776	1.677502273		
selc_real	1.235312812	1.603827604	1.760207913	8.264687511	3.480286045	-0.234747998	3.356677215	27.1050818*	2.428971899		
inflacoe	-0.2106035073**	0.024339379**	0.022823549**	-0.16438631	0.032864981	0.0390812803**	-0.324735898	0.025885072	0.0410779		
Var. that are functions of vars. from several sources.											
basilindex_x_selc	0.044785968	0.026231915	0.0444015	-0.330551996	-0.024851763	-0.02419823	0.297578441	-0.060417212	0.348812919		
leverage_x_selc	0.009047427	-0.030424672	0.009059835	0.039406237	-0.05641576	0.013882195	0.0224413	0.288324366	0.04072631		
has_collateral_x_selc	1.078633366	0.552745959	1.1439304	1.883617789	-2.27068613	2.404822136	29.23242686		40.08395384		
inmobalization_x_selc	-0.173620442	-0.021170625	-0.03657125	-0.330180054	0.226895703	0.060075765	0.975925499	-0.630218955*	-0.308920826		
num_loans_per_firm_bank	-3E-07	-0.00012200**	-0.00000260**	8.999959500E-06	1.09999E-05	3.99999E-06	3.19995E-05	5.30001E-06	1.29999E-05		
num_loans_per_firm	0.0004229105**	0.0015008731**	0.000666777**	0.002997502**	-0.0041852296**	-0.0030902203**	0.006546524**	-0.0025248099**	0.0026833964**		
Overdraft COX				Goods and Acquisition COX				Discountables COX			
Dependent variable is T	640	1227	1867	294	813	1107	14830	26925	41755		
Num. of observations	2007-2009	2003-2006	Whole Sample	2007-2009	2003-2006	Whole Sample	2007-2009	2003-2006	Whole Sample		
Regressors	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.		
taxa_real	-0.001721281	-0.001187295	3.699993E-05	-0.005991101	-0.002771738	-0.005444897	0.003242737	0.001922151	0.002116758		
maturity	-0.067041384*	0.05184929	-0.003890558	-0.008253063	-0.007153324	-0.010782725**	0.003161996	0.017470498	0.014793041		
total_debt_without_loan_real	2.29997E-05	0.000402918*	2.59997E-05	4.79988E-05	-0.000129936*	-0.00008399647**	0.000128991**	4.29991E-05	0.000059982**		
has_collateral	1.1024562246*	-0.341023498	0.151907022	-0.314906928	0.761413121	0.292125436	-0.263640468	-0.148457086	-0.148968796		
Banks Charac.											
leverage	0.002105781	0.005455094	-0.000878886	-0.004852856	-0.009122265	-0.000844757	-0.00067853	0.000751717	-0.00134941		
profitability	-0.210633998	0.070204937	-0.018221304	-0.067303834	0.025631684	-0.046880624	-0.038724924	0.042213346	0.014881716		
size	0.6074907034*	0.165177093	0.208467584	0.261448461	0.015998341	0.254289443	0.048158536	0.085903347	0.059062932		
basilindex	-0.019008828	-0.001884274	0.007295649	0.000250969	0.021594159	-0.003131498	-0.010133168	0.002197584	3.09995E-05		
inmobalizationindex	-0.036578303	-0.034296975	-0.013669098	0.056870761	0.00658825	0.015444123	-0.002708264	-0.00345175	-0.002173961		
perc_interned	-0.290479716	0.010067156	0.005091019	0.070549404	0.023073742	0.017750523	-0.09838755	0.003306527	0.002430045		
ICA											
has_bndes_loan	0.174531291	-0.120754057	0.043744121	0.3381322865*	0.032453637	0.121188785	-0.058718371	-0.035013791	-0.036372015		
has_intenal_funding	0.126108284	0.177025055	-0.105656472	0.262507235	-0.039538444	-0.034015524	0.08658587	-0.076030974	-0.012754595		
is_manager_educated	-0.098944365	0.042263195	-0.029571972	0.403049526	-0.187569865	0.07628674	-0.002994579	0.03668288	0.005657963		
is_public_listed	-0.269339727	-0.454308721	-0.233937598	-0.423933198	-0.394178937	0.106798481	0.152584597	0.030347811	0.124947531		
is_tradable_shares	-0.259644167	-0.675229859	-0.137145802	-0.268575292	-0.024872471	0.155680022	0.072032248	0.060071057	0.060444841		
is_untradable_shares	0.197387493	-0.41838957	0.022572318	0.7071132	-0.259571179	0.208198021	0.077343375	0.031612033	0.06285492		
is_private	-0.397124835	-0.58475997	-0.364218468	0.970897471	-0.333101843	0.267378595	-0.031557646	-0.114925672	-0.067663719		
is_manager_owner	0.128671101	0.268514026	0.225470757	0.370427739	0.025214827	0.054419054	-0.040523185	0.098708943	0.061194812		
small	-0.028160511	0.2345027901*	0.109115357	-0.473495318	-0.110625797	-0.2012591*	-0.006713888	-0.043746057	-0.027994207		
big	0.057311847	0.25522422	-0.001027528	-0.171540561	0.183875349	0.216666621	-0.473878005	0.2934988**	-0.222066366		
export	-0.186292832	-0.034592583	-0.010035791	-0.300641687	0.000921575	0.080121819	-0.039276835	0.003758926	0.000917921		
young	-0.350397687	0.133875958	0.116378494	-0.036555277	0.108443558	0.444603767	-0.061435819	-0.007248608	-0.015628491		
isgroup					-1.155064869**	0.060920108	-0.229548394	0.027328161	0.026999219		
Macro											
bndesperc	16.63091928	-2.293363741	4.5522657	19.22715661	-12.31812215	-6.455754007	-14.95494484*	3.792711853	1.79348864		
rupperc	30.59112621	20.40855509	10.28658264	23.95407023	-0.072296214	-0.037108274	-16.48915933	-8.944173331	-0.866720634		
habperc	39.07030004	55.73204586	-4.905874769	140.4137388	128.47795646**	76.328897*	-15.81061095	-7.959865734	-3.284886921		
pbgrowth	9.2054215946**	0.945897301	7.27286403	9.43866471	1.601883248	2.433153**	0.625507322	0.245825168	0.577114924		
selc_real	-21.96459443	6.72739891	2.831868911	-1.869001054	15.94661065	4.8474275	-8.877445957	-3.13947794	-0.678124587		
inflacoe	-0.098896563	0.054304456	0.0431495237**	0.261551627	0.064143130*	0.06998957**	-0.250070216**	0.013522162	0.016704696		
Var. that are functions of vars. from several sources.											
basilindex_x_selc	0.359374397	0.019497275	0.095363815	0.017869387	-0.18304762	0.082844625	0.118182956	-0.038510709	-0.026363688		
leverage_x_selc	0.023936229	-0.056880982	0.008646511	0.100310385	-0.073511996	0.024126599	0.012335601	-0.010521558	0.011371103		
has_collateral_x_selc	-14.98669354	7.606537055	1.462375617	8.108128713	-2.33						

VARIABLE NAME	VARIABLE DESCRIPTION
MACRO VARIABLES (Base Macro Variables)	
SDirHab	7518 - Operações de crédito do sistema financeiro - Recursos dire
SDirRurBanc	12131 - Operações de crédito do sistema financeiro com recursos
SDirRurCoop	12132 - Operações de crédito do sistema financeiro com recursos
SDirRur	7519 - Operações de crédito do sistema financeiro - Recursos dire
SDirBNDES	7520 - Operações de crédito do sistema financeiro - Recursos dire
SDirRepBNDES	7521 - Operações de crédito do sistema financeiro - Recursos dire
SDirRepasse	7523 - Operações de crédito do sistema financeiro - Recursos dire
SLiv	Total Crédito Livre
Pib	4191 - PIB acumulado dos últimos 12 meses - Valorizado pelo IGP-
BC (SCR) 2003-2009	
carteira_ativa	Loan Value
taxa	Bank interest rates
mod_cod	Loan modality code
mod_ds	Description of loan modality
dt_ven_oper	Terminal date of the loan
yearid	Year of the transaction
dateid	Month and Year of the transaction
index_cod	Code describing details of the interest rates associated with the loa
index_cd	index_cod's description
num_garantias	Number of collaterals associated with the loan
maturity	Time to maturity (dt_ven_coper - dateid)
total_debt	Outstanding debt of a firm to one bank
has_collateral	Dummy indicating if num_garantias>0
is_unique	Indicates whether the firm has relationships with more than one ba
cnae_cod	Firm's economic activity
cnae_ds	Firm's economic activity description
isvendedor	Dummy = 1 if vendor type loan (mod_cod = 207,404)
isworkingcapital	Dummy = 1 if working capital type loan (mod_cod = 202,203,204,2
isoverdraft	Dummy = 1 if overdraft type loan (mod_cod = 207,404)
isgoodacqfin	Dummy = 1 if good acquisition type loan (mod_cod = 290,401,402,
isdiscountable	Dummy = 1 if discountable type loan (mod_cod = 301,302,303,399
BC (50 Maiores) 2003-2009	
leverage	Bank leverage (debt to equity ratio) for 2002. (Ativos -pat. Liq)/pa
profitability	Bank profitability (Lucro líquido/ Patrimônio líquido).
size	Dummy indicating whether the bank is big. Big means to have asse
basilindex	Basil index (proxy for risk)
imobilizationindex	Imobilization index (proxy for liquidity)
perc_intermed	Bank intermediation (op. credito/ receitas de operações de interme
ICA 2002	
p99_1a	% sales change in 2002
p99_2a	% sales change in 2001
p99_3a	% sales change in 2000
p103b_e	% of BNDES credit in new investment
p103a_e	% of BNDES credit in working capital
p116a_2	% of sales that are directly exported
p116a_3	% of sales that are indirectly exported
p141a_7	Total equity in 2002
p141a_9	Total liabilities in 2002
p103b_a	% of internal funding in new investment
p103a_a	% of internal funding in working capital
small	Indicates whether the form is small (p14<100)
medium	Indicates whether the form is small (100<=p14<500)
big	Indicates whether the form is big (p14>=500)
export	Dummy indicating whether a firm exports (p116a_2 + p116a_3 >0)
young	yearid-p1<5
p8	Group membership dummy (1 yes, 2 no)
p114_b	Percentage of inputs bought on credit