
UNIVERSIDADE D
COIMBRA

José Valente de Lima Filho

# Essays on Debt Contracts

## Determinants and Perspectives for Contract Design and Borrower Behavior

**Tese no âmbito do Doutoramento em Gestão de Empresas, orientada pelo Professor Doutor Mário Augusto e pelo Professor Doutor José Murteira e apresentada à Faculdade de Economia da Universidade de Coimbra**

Abril de 2022

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*To Valentina and Bernardo*

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*“What does not kill you makes you stronger”*

**Friedrich Nietzsche**

# Resumo

O objetivo desta Tese é investigar contratos financeiros – especificamente, contratos de empréstimo – procurando entender i. quais são os determinantes de seu formato; ii. o que guia seu processo de renegociação; iii. como seu formato influencia o comportamento das partes contratantes. Baseado na literatura subjacente, esta pesquisa está organizada num conjunto de três artigos.

O primeiro artigo aborda o desenho dos contratos de empréstimo estudando os determinantes do spread de taxa de juros (um dos principais componentes do acordo de empréstimo). Estudos anteriores têm abordado o assunto como se os bancos tivessem apenas um único produto, isto é, como se o impacto dos determinantes do spread bancário fosse uniforme entre as diferentes categorias de empréstimo. O artigo analisa se o impacto dos determinantes do spread bancário varia conforme a categoria de empréstimo. Os principais resultados mostram que os spreads das três categorias de empréstimo investigadas – cheque especial, empréstimos consignados e empréstimos ao consumo – são influenciados em diferentes graus por diferentes atributos.

O segundo artigo aborda o processo de renegociação do contrato de empréstimo investigando o que determina a frequência com que pequenos empréstimos direcionados a pequenas e médias empresas (PME) são renegociados, bem como o que determina o resultado dessa renegociação. Descobrimos que esses pequenos empréstimos são renegociados muito menos frequentemente do que grandes empréstimos. Argumenta-se que a ausência de contingências *ex-ante* no desenho do contrato – como *covenants*, comuns em grandes empréstimos – influencia essa baixa frequência, à medida que reduz os incentivos para os bancos monitorarem a situação financeira do mutuário durante a vigência do acordo. Por isso, o único sinal recebido pelo banco de que a situação do mutuário se deteriorou é um pagamento não realizado, o que reduz a frequência de renegociações iniciadas pelo banco. O estudo mostra que o poder de barganha das partes contratantes é um determinante importante não somente da frequência, mas também do resultado do processo de renegociação desses pequenos empréstimos.

O terceiro paper usa o microcrédito para investigar como o formato desse tipo de contrato influencia o comportamento de uma das partes contratantes, o mutuário. O estudo

analisa se o monitoramento presencial dos mutuários realizado pelos agentes de crédito tem alguma influência na pontualidade dos pagamentos. Os principais resultados mostram que os mutuários que não são monitorados presencialmente pelos agentes de crédito incorrem num número de dias de atraso no pagamento de microempréstimos 17,5% superiores ao número de dias de atrasos que seria incorrido por esses mesmos mutuários caso eles tivessem recebido a visita presencial do agente de crédito. O estudo mostra a importância dos agentes de crédito para a manutenção da qualidade da carteira de crédito das instituições de microfinanças (IMF).

De uma forma geral, a presente tese preenche algumas lacunas na literatura sobre contratos financeiros, contribuindo para seu enriquecimento. Também fornece a reguladores e formuladores de políticas públicas insights sobre como melhor gerenciar aspectos de contratos financeiros que influenciam a gestão de empresas e o nível de desenvolvimento da sociedade.

**Palavras-chave:** determinantes; desenho; renegociação; comportamento do mutuário; contratos financeiros

# Abstract

The objective of this Thesis is to investigate financial contracts – specifically, loan agreements – seeking to understand i. what the determinants of their design are; ii. what drives the process of their renegotiation; iii. how their design influences the behavior of contracting parties. Based on the underlying literature, this research is organized into a set of three articles.

The first article addresses the design of loan contracts studying the determinants of the interest rate spread (one of the main components of the loan agreement). Previous literature has approached the subject considering as if banks had one single product, that is, as if the impact of the determinants of banking spreads was uniform across the different loan categories. The paper analyzes whether the impact of bank spread determinants vary depending on the category of loan. Main findings show that the spreads of the three investigated loan categories – revolving credit, payroll-linked loans, and consumer loans – are influenced to different degrees by different attributes.

The second paper addresses the loan contract renegotiation process by investigating what determines the frequency with which small loans targeted at small and medium-sized (SME) firms are renegotiated, as well as what determines the outcome of this renegotiation. We found that these small loans are renegotiated much less frequently than large loans. It is argued that the absence of *ex-ante* contingencies in the contract design – such as covenants, common in large loans – influences this lower frequency, as it reduces the incentives for banks to monitor the borrower's financial situation during the term of the agreement. Thus, the only signal received by the bank that the borrower's situation has deteriorated is a missed payment, which reduces the frequency of renegotiations prompted by the bank. The study shows that the bargaining power of the contracting parties is a major determinant not only of the frequency, but also of the outcome of the renegotiation process of these small loans.

The third paper uses microcredit to investigate how the format of this type of contract influences the behavior of one of the contracting parties, the borrower. The study analyzes whether the face-to-face monitoring of borrowers carried out by loan officers has any influence on the timeliness of payments. The main results show that borrowers who are not monitored face-to-face by loan officers incur a number of days of arrears in the payment of microloans 17.5% higher than the number of days of arrears that would have been incurred

by these same borrowers if they had received the face-to-face visit by the loan officer. The study shows the importance of loan officers for maintaining the quality of the credit portfolio of microfinance institutions (MFIs).

In general, this Thesis fills some gaps in the literature on financial contracting, contributing to its enrichment. It also provides regulators and public policymakers with insights into how to better manage aspects of financial contracts that influence the management of firms and the level of development of society.

**Keywords:** determinants; design; renegotiation; borrower behavior; financial contracting

# List of acronyms and abbreviations

| | |
|---|---|
| **ATT** | Average Treatment Effect on the Treated |
| **GMM** | Generalized Method of Moments |
| **GDP** | Gross Domestic Product |
| **IBGE** | *Instituto Brasileiro de Geografia e Estatística* |
| **IPCA** | *Índice de Preços ao Consumidor Amplo* |
| **LSDV** | Least Square Dummy Variable |
| **MFI** | Microfinance Institution |
| **NIM** | Net Interest Margin |
| **PSM** | Propensity Score Matching |
| **R$** | Brazilian Real |
| **SME** | Small and Medium Enterprise |
| **TBF** | *Taxa Básica Financeira* |
| **US$** | US dóllar |

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# General Introduction

In discussing the rationale behind the incentives involved in corporate finance, the agency theory of Jensen and Meckling (1976) refers to the firm as a set of contracts. Based on their study, a growing literature on contractual relationships has developed investigating various types of contracts between firms and their investors. This literature, frequently referred to as financial contracting, has produced research related to issues as comprehensive as the determinants of the design of debt contracts, the process of renegotiating these contracts, and the impact of the format of these agreements on the behavior of the contracting parties.

The present thesis intends to contribute to the enrichment of this literature by investigating a specific type of financial contract, the bank loan. In this kind of agreement, the firm is the borrower, and the investor is the bank (lender). The three fundamental aspects of the loan contract mentioned above – its initial design, its renegotiation process, and the impact of the contractual relationship on the behavior of the parties involved – are investigated throughout the three chapters that make up this thesis.

The design of a loan agreement involves many terms, for example, the interest rate charged by the bank, amount, maturity, guarantees, and contingencies (covenants, pricing grids etc.). We draw on the history of high interest rates practiced in the Brazilian financial market to focus our research related to the design of bank loans on the determinants of the banking spread. Despite the context of low interest rates experienced in Europe and other developed markets, high interest rates are still practiced in emerging countries, representing obstacles to their economic development. Brazil, in particular, provides an interesting dataset for this investigation given the size of its economy and the persistently high banking spread charged by banks, one of the largest in the world.

The contract renegotiation process, in turn, has long puzzled researchers because of an apparent paradox: if the rules set out in a contract can be renegotiated later, why bother committing to those rules in an original contract? Much of the literature on the subject has been concerned with designing renegotiation-proof contracts or trying to understand this phenomenon that is common in the practice of contractual relationships. Our focus here is

on the loan renegotiation process, a strand of literature that has only recently gained more attention from researchers, especially regarding the practice of renegotiation outside of bankruptcy contexts.

The impact that the design of financial contracts has on the contracting parties has received attention of researchers due to the moral hazard involved in the relationship. In a financial contract, the investor (creditor) has two main concerns: i. the correct application of the funds by the borrower in the financed investment project and ii. the return (repayment) of the invested funds. In a traditional loan agreement, these two concerns are alleviated by using collateral. But what about microloans to borrowers who do not have collateral to pledge? Our contribution related to the impact that the format of financial agreements has on contracting parties is focused on a specific mechanism used by microfinance institutions (MFIs) to guarantee loan repayment: the loan officer.

The purpose of studying the design of the loan contract, its renegotiation process, and the impact that its format has on the borrower is carried out through three specific research questions, formulated as follows:

**RQ1:** Does the impact of bank spread determinants differ by loan category?

**RQ2:** What are the determinants of the process of renegotiating small loans for small and medium-sized (SME) firms?

**RQ3:** Does the monitoring work performed by the loan officer influence the borrower's repayment?

Following the present introductory section, the proposed text comprises three central chapters, representing three papers to by published by indexed journals. Each of chapters aims to answer one of the above research questions.

Chapter 1 addresses a specific and paramount component of loan contract design: the interest rate spread. It analyzes the determinants of the bank spread, trying to answer the following research question: Does the impact of bank spread determinants vary depending on the type of loan? The literature on banking spreads is based on the seminal work of Ho and Saunders (1981), who developed a theoretical model for explaining the behavior of spreads. The model has the limitation of assuming that banks offer only one kind of loan, which does not correspond to the reality of the banking industry. Allen (1988) extended the model so that it took into account the portfolio effect resulting from the variety of loan

products made available by the financial institution. However, this variety was not considered by the empirical literature that was based on Ho and Saunders' (1981) model to estimate the impact of the banking spread determinants (e.g., Entrop et al., 2015; Jarmuzek & Lybek, 2020; Lavezzolo, 2020). This is probably due to the difficulty in obtaining individualized spread data by loan type. As a consequence, previous empirical work considered that each bank distributed only one type of loan.

The first paper of this thesis makes use of a database provided by the Central Bank of Brazil that informs the interest rates charged by different banks in the country for different types of loans. This allows testing the hypothesis formulated based on Allen's (1988) model, that is, that the determinants of the banking spread vary according to the loan category. A panel with three types of personal loans and 13 banks is built. The generalized method of moments (GMM) is used for estimating a dynamic model, and a static model is estimated by fixed-effects. The results support the main hypothesis of the study. We find that revolving credit loans are influenced by some attributes that do not impact the spreads of payroll-linked loans and consumer loans. There are some common attributes influencing the spreads of the first two categories, but to different degrees.

Chapter 2 advances the literature on financial contracting, specifically, the literature regarding the renegotiation of small loan agreements for SMEs. It proposes to answer the following research question: What are the determinants of the process of renegotiating small loans to SMEs? The empirical literature on loan renegotiation outside the context of bankruptcy is relatively recent, and has been concerned with large loans granted to large companies (e.g., Dou 2020; Godlewski 2019; Nikolaev 2018). This paper argues that small loans have different incentives related to the renegotiation process, as they lack the traditional *ex-ante* contingencies that make up the design of large loans, such as covenants. This changes the dynamics of shifts in control rights during the term of the contract and, consequently, also alters the renegotiation process. Particularly, it changes the frequency and outcomes of renegotiation. The lack of *ex-ante* contingencies should reduce the bank's incentive to monitor the borrower. This means that perhaps the single change of the state of the world that leads to a transfer of control to the bank – and, consequently, to a renegotiation – is a failure to repay the debt.

Hypotheses are formulated and tested based on this reasoning and on a strand of theoretical literature that suggests that the bargaining power of the contracting parties governs the renegotiation process of small loans. In this sense, the paper differs from

previous studies on the subject, which had not properly tested the contracting parties' bargaining power as a main determinant of renegotiation. A large Brazilian bank provided the database used in this paper, consisting of loans granted to SMEs. Three *probit* models are estimated highlighting the impact of bargaining power on the probability of renegotiation and on the probability of a borrower-friendly outcome. The results show that indeed the frequency of renegotiation of these small loans is lower compared to large loans (M. R. Roberts & Sufi, 2009). In addition, the results support the hypotheses that bargaining power of contracting parties explains both the frequency and the outcomes of the renegotiation process of small loan contracts.

Chapter 3 closes the central part of the thesis with an analysis of the importance of monitoring carried out by the loan officer in the behavior of microcredit borrowers. It deals with a different type of debt contract, a group lending arrangement, used in microcredit agreements. In this kind of loan, a single contract is signed with many borrowers, who are jointly liable for the debt. The focus is on the effect that the structure of this contractual relationship has on the borrower's behavior, particularly the effect of the loan officer monitoring task on the microcredit repayment. The theoretical literature has highlighted the role of peer monitoring as a major determinant of the high repayment rates observed in microcredit loans (e.g., Besley & Coate, 1995; Ghatak, 1999, 2000; Stiglitz, 1990), suggesting a negligible contribution of the loan officer to this performance. From this point of view, the loan officer could be laid off, reducing operating expenses and boosting the MFIs bottom line. Conversely, some empirical findings suggest that loan officers indeed help explain microcredit repayment rates (e.g., Inekwe, 2019; Van den Berg et al., 2015).

The paper aims to answer the following research question: Does the loan officer's monitoring have any impact on the timeliness of microcredit repayments? The question is inspired by the constant need of MFIs to remain financially sustainable. Among the biggest operating expenses of MFIs is personnel expenses, especially with loan officers. The paper attempts to provide a measure of the loan officer's contribution to the MFI's financial performance. To answer the research question, the study uses a proprietary database of a large Brazilian microcredit bank. The database provides information on the meetings between loan officers and borrowers in the borrower's business location. This kind of active monitoring data, which is associated with substantial costs, is one of the main contributions of the paper to the literature. The methodology uses a treatment effects approach. The database is divided into treatment and control groups, with borrowers that did not receive

the loan officer's monitoring and borrowers who were visited, respectively. A propensity score is used for matching individuals in both groups in order to establish a causal relationship. The results suggest that the lack of monitoring by the loan officer significantly affects the timeliness of loan payments, thus increasing the potential delay. Specifically, borrowers who were not visited by the loan officer on the scheduled visit date exhibited arrears 17.5% higher than the arrears they would have exhibited had they been monitored by the loan officer as expected.

After the three chapters mentioned, a conclusion presents a summary of the main findings of the papers, their theoretical and practical implications, their limitations, as well as suggests some points for future research.

It should be noted that each of the three main chapters of this thesis correspond to a paper submitted for publications in an international journal recognized by the scientific community, expecting decisions of the editors. The first paper is under review by *The International Review of Economics and Finance*. The second paper is under review by *Annals of Finance*. The third paper is submitted to *Journal of International Development*.

# Chapter 1: Differentiated Impact of Spread Determinants by Personal Loan Category: Evidence from the Brazilian Banking Sector

**Abstract**

Using a dataset of interest spreads charged on different categories of personal loans in Brazil, this study provides evidence that the determinants of banking spreads are different according to the loan category. Particularly, we find that: i. the prior period spread, credit risk, inflation rate, interest risk, market interest rate, economic growth, and bank state-ownership influence revolving credit loans spreads; ii. market interest rate, economic growth, and state-ownership of banks also influence payroll-linked loans spreads, albeit to a lesser extent than revolving credit spreads; iii. consumer loans spreads are driven by implicit interest payments. These findings suggest that regulators should observe the composition of banks' loans portfolios when writing policies aiming at banking spread reduction.

**Keywords**: Banking spread; determinants; personal loans; financial sector.

## 1.1. Introduction

Financial intermediation efficiency can directly influence economic growth (Levine, 1997). Banking interest spreads – that is, the difference between the lending interest rate and the deposit interest rate –, in turn, are viewed by the World Bank (2005), as a quantitative measure of financial intermediation efficiency, especially in developing countries, where commercial banks are the main source of financing for individuals and firms. This efficiency refers to the ability of the financial sector to provide high-quality products and services at the lowest possible cost. Accordingly, more efficient banking markets exhibit narrower spreads (World Bank, 2005).

Several studies have tried to explain the behavior of banking spreads to provide policymakers with insights about how to tame the interest margins and boost economic growth (e.g., Almeida & Divino, 2015; Hanzlík & Teplý, 2020; Lavezzolo, 2020). The theoretical milestone of this literature is the original model developed by Ho and Saunders (1981), who adapted a bid-ask market price-setting model for bonds to explain banking spread behavior. The authors found the spread to be a function of four variables: i. variability of interest rates, ii. degree of managerial risk aversion, iii. competition within the bank's

market, and iv. average transactions size. They also showed that, even in a scenario of highly competitive banking markets, there must be an interest margin due to the uncertainty generated by asynchronous deposit supplies and loan demands. They called this margin "pure spread".

One limitation of Ho and Saunders (1981) model is that they assumed that the financial intermediaries offer just one kind of loan, something not found in the real world. The Authors themselves draw attention to this limitation, stating that "extending the model from a structure with one kind of loan and deposit to loans and deposits with many maturities should lead to further interesting insights into margin determination especially as 'portfolio' effects may become apparent" (p. 598). Allen (1988) extended the theoretical model incorporating the loan heterogeneity that can be observed in banks' portfolios. The Author demonstrated that pure interest spreads may be reduced when the portfolio effect is considered. The rationale is that banks diversify their risk inventory exposure by controlling the relative rate spreads across product types.

Numerous empirical studies have investigated the determinants of commercial bank interest spreads based on the theoretical model of Ho and Saunders (1981), some using multi-country panel data (e.g., Entrop et al., 2015; Jarmuzek & Lybek, 2020; Lavezzolo, 2020), others in a country specific approach (e.g., Almeida & Divino, 2015; Damane, 2020; Maudos & Solís, 2009). However, all of these studies have considered the banks as single product intermediaries, disregarding the portfolio effect demonstrated by Allen (1988). If there is indeed a portfolio effect in determining the banking spreads, then the impact of the determinants must vary among the spreads of the different loan types.

To address this gap, the main objective of this study is to investigate the determinants of banking spreads across several loan categories to ascertain whether they have a differentiated impact according the loan type, as can be expected considering the portfolio effect demonstrated by Allen (1988). This is done by estimating the impact of the determinants of spreads using a panel of interest rates charged by three personal loan categories (revolving credit, consumer loan, and payroll-linked loan) in 13 Brazilian banks. The dataset is rather informative as the Brazilian banking sector maintains one of the world's largest interest rate spreads (interest rate charged on loans minus interest rate paid on deposits). For example, in 2018, the country's average spread was 32.21%, while the world average was 5.34%. [(1)]

[(1)] International Monetary Fund, International Financial Statistics, and data files, available on http://data.worldbank.org/indicator/FR.INR.LNDP?view=map (Accessed November 2021).

The contribution of this study to the extant literature is fourfold. Firstly, to the best of our knowledge, this is the first study to address and estimate the effect of the determinants of banking spreads considering different kinds of loans. In doing so, we provide an empirical test of the hypothesis of portfolio effect in banking spreads suggested by Allen (1988). According to best of our knowledge, no previous study has considered the potential heterogeneity that exists among loans' interest spreads when estimating the impact of their determinants. The main reason for this practice is that, in most cases, banks' statements do not detail interest rates charged on loans (Brock & Suarez, 2000). Thus, spreads are computed based on accounting information, resulting in an average interest rate margin (or an average spread). The proxy commonly chosen is the net interest margin (NIM), defined as the ratio of the difference between total interest income and total interest expense, to the interest-bearing assets [(2)].

Secondly, to the best of our knowledge, no previous study had estimated the impact of the determinants of the spreads of revolving credit, consumer loans or payroll-linked loans. This study provides evidence regarding these specific categories of loans. We are able to analyze how the possibly unique characteristics of these types of loans impact their interest spread. Thirdly, it offers evidence regarding the determinants of banking spreads using actual interest rates in the computation of the dependent variable rather than proxies computed by averages taken from financial statements. Estimation results using spreads computed by means of actual interest rates may differ from the results of estimations using spreads computed by means of accounting data (e.g., Brock & Franken, 2003). Spreads computed using loan and deposit rates are arguably a better measure of banking efficiency than NIM (Agapova & McNulty, 2016). This is only possible with disaggregated data, obtained in the present case from the Central Bank of Brazil. Fourthly, it sheds additional light on the factors influencing the spreads of Brazil. Previous studies focusing the country have used a single proxy for the banking spreads (Afanasieff et al., 2002; Almeida & Divino, 2015). By using different types of loans, we provide additional information on the behavior of interest margins in the country.

The remainder of the paper is organized as follows. The next section surveys the theoretical and empirical literature on the determinants of banking spread. The subsequent section presents an overview of the Brazilian economy and its importance for studying the

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(2) Examples of studies using NIM as a proxy for the spread are provided by Cruz-García and Fernández de Guevara (2020), Hanzlík and Teplý (2020), and Kusi et al. (2020).

determinants of banking spread. Then, we detail the variables, data, and econometric model used in the study. The sections that follow present estimation results, discussion of results, robustness checks, conclusions, and suggestions for future research.

## 1.2. Background

The theoretical background used in the study of banking spreads was first established by Ho and Saunders (1981). Building on the literature regarding the determinants of the purchase price of securities, these Authors formulated a model in which the bank is considered a dealer in the credit market, exclusively engaged in financial intermediation activities (deposit-taking and lending). [3] In this model, both the supply of deposits and the demand for loans follow a random pattern, so that the time of entry and exit of funds cannot be predicted by the bank. Due to this uncertainty, the bank, which is viewed as a risk-averse entity, is encouraged to seek compensation for the risk of having a depositor claiming his funds before a borrower repays the loan. This compensation is the difference between the interest rate charged from loans and the interest rate paid on deposits. The model shows that four factors explain interest spreads: i. the degree of risk aversion; ii. the market structure in which the bank operates; iii. the average size of bank transactions; iv. the variance of interest rates. The degree of risk aversion, the average size of bank transactions, and the variance of interest rates show a positive relationship with bank margins, whereas the more competitive the structure of the banking market, the lower the spreads. It is also shown that the margin of interest must exist even in a scenario of intense competition, due to the uncertainty in the transactions; this margin is called "pure spread". In the dealership model of Ho and Saunders (1981), the bank is a supplier of only one type of loan. In an extension of this model, Allen (1988) introduced the heterogeneity of loans that exists in the real world of banking industry. The Author showed that banks can manipulate the arrival of transactions demands through control over relative interest rate spreads across different product categories, for which the demands are interdependent. This portfolio effect generates diversification benefits, as the bank is better able to manage its inventory risk exposure. The upshot is that pure spread may be reduced when cross-elasticities of demand between bank products are considered.

Several studies subsequently extended the dealership model adding new factors that influence the behavior of pure spread, like credit risk (Angbazo, 1997), operating costs

[3] Regarding this literature, see also Ho and Stoll (1980), Ho and Stoll (1981), and Stoll (1978).

(Maudos & Fernández de Guevara, 2004), maturity transformation (Entrop et al., 2015), and capital requirements (Cruz-García & Fernández de Guevara, 2020). Furthermore, numerous empirical studies have tested a multitude of bank-specific covariates, macroeconomic environment proxies, and variables related to the market structure of the banking sector as potential determinants of bank interest margins. Most of these empirical studies are based on the dealership model, which is flexible enough to allow changes in covariates without modifying its fundamental characteristics. Among the most tested bank-specific variables are credit risk (e.g., Hanzlík & Teplý, 2020; Jarmuzek & Lybek, 2020; Kusi et al., 2020), liquidity risk (e.g., Agoraki & Kouretas, 2019; Demirguç-Kunt et al., 2004; Lin et al., 2012), risk aversion (e.g., Cruz-García & Fernández de Guevara, 2020; Hanzlík & Teplý, 2020; Nguyen, 2012), operating costs (e.g., Jarmuzek & Lybek, 2020; Lepetit et al., 2008; Peria & Mody, 2004), implicit interest payments (e.g., Agoraki & Kouretas, 2019; Hawtrey & Liang, 2008; Kasman et al., 2010), opportunity cost of non-interest bearing reserves (e.g., Gelos, 2009; Lavezzolo, 2020; Maudos & Solís, 2009), and management efficiency (e.g., Agoraki & Kouretas, 2019; Almeida & Divino, 2015; Lin et al., 2012). The impact of the macroeconomic environment variables on the bank spreads is usually tested using inflation (e.g., Chortareas et al., 2012; Claeys & Vander Vennet, 2008; Lavezzolo, 2020), the basic interest rate (e.g., Almeida & Divino, 2015; Hanzlík & Teplý, 2020), interest risk (e.g., Cruz-García & Fernández de Guevara, 2020; Hawtrey & Liang, 2008; Saunders & Schumacher, 2000), and Gross Domestic Product (GDP) growth (e.g., Jarmuzek & Lybek, 2020; Kusi et al., 2020; Carbó-Valverde & Rodríguez-Fernández, 2007) as explanatory variables. The influence of market structure is usually captured using market power (e.g., Agoraki & Kouretas, 2019; Chortareas et al., 2012; Cruz-García & Fernández de Guevara, 2020) and state ownership (e.g., Claeys & Vennet, 2008; Demirguç-Kunt et al., 2004).

However, all those empirical studies use NIM as an average spread, which implies that the impact of the determinants of bank interest rate margins is uniform across the entire bank's loan portfolio. Allen's (1988) theoretical extension of the dealership model suggests that this may not be true. The hypothesized existence of a portfolio effect indicates that the impact of spread determinants varies according to the loan. The lack of informative data explains the apparent neglect of ignoring this possible variability: since banks do not usually disclose interest rates by type of loan, estimating the impact of determinants of interest margins by bank product is impractical. Nonetheless, considering loan heterogeneity when estimating spreads' determinants appears as a crucial issue. As the demand for different financial products is interdependent, raising the interest rate on one type of loan implies a

decrease in the demand for it and an increase in the demand for substitute loans. This diversification among several products allows the bank to better manage its risk exposure and, consequently, enables a reduction of spreads. It also supports the hypothesis of a differentiated impact of spread determinants according to the loan type.

Another argument in favor of computing spread using the interest rates charged is that obtaining an average interest margin (or an average interest spread) can be problematic for two main reasons. Firstly, spreads behave differently according to whether they are computed based on accounting data or on the difference between the lending interest rate and the deposit interest rate. For example, Afanasieff *et al*. (2002) argue that actual interest rates are more likely to be influenced by changes in the economic environment than by interest, income, and expenses. Almeida and Divino (2015), in turn, distinguish the spread computed by means of actual interest rates (termed "*ex-ante*" spread) from the spread computed by means of accounting data (termed "*ex-post*" spread). According to these Authors, the former is more volatile because it reflects the expectations of the banks with respect to the granting of credit before it is effectively granted. The *ex-post* spread tends to be more stable since it supposedly represents the effective result of the financial intermediation activity. Secondly, estimation results may differ substantially if the interest spreads are computed based on accounting data or on disaggregated data (e.g., Brock & Franken, 2003). Those are additional elements suggesting the hypothesis that the impact of spread determinants vary according to the loan type and begs the question of what factors explain the behavior of interest rate spreads for different loan categories.

The study of the determinants of spread by loan type makes it possible to analyze individual characteristics of these categories, allowing the design of specific regulatory policies targeting the spread of each one. For example, revolving credit shows an average spread much higher than the average spread of payroll-linked loans, possibly due to its different liquidity and credit risk profile. These features may help to understand the possible differentiated impact of some factors on the spread of these categories and allow policymakers to act accordingly.

## 1.3. Overview of Brazilian banking sector

Brazil has the 12th largest economy in the world and the largest in Latin America, with a nominal GDP of $ 1.44 trillion.[4] The country is also a founding member of the Southern Common Market (Mercosul). In June 2021, the Brazillian financial sector comprised 162 commercial banks, with total assets worth R$ 9,6 trillion. The Brazilian banking industry is the primary distributor of financial products and services in the country. It is also heavily concentrated, with only five banks accounting for 70% of the outstanding commercial loans by the end of June 2021.

High interest rates charged on loans contribute to keep the country's average bank spread among the highest in the world, despite the sharp decline observed after the economic stabilization program called Real Plan, launched in June 1994. The program ended a long period of hyperinflation in the country, and the banks were subjected to a profound restructuring process, given the loss of easy gains coming from the inflationary process. The average banking spread of the country dropped from 53.8% in 1997 to 39.7% in 2001. The uncertainties arising from the 2002 electoral process raised again the average spread to 45.1% in 2003. Another drop followed the maintenance of the economic stability scenario, and in 2007, the average banking spread was 33.1%.

Another spike followed the 2008 financial crisis, but, in 2012, the Brazilian government launched a strategy to reduce interest rates charged by using state-owned banks, through the increase of their loan portfolios. As a result, the share of credit in the economy increased from 43.7% in January 2011 to 50.1% in August 2013. The average banking spread, in turn, reached one of its lowest levels ever, dropping from 32.9%, in 2011, to 19.6% in 2013. However, inflation, which had been under control, returned to high levels, forcing the Central Bank to raise the basic interest rate again. Between mid-2014 and 2016, the country plunged into the most intense economic recession in its history, and Brazil's economy shrank 7% in the 2015-16 biennium. In 2016, the country's average banking spread had again doubled to 39.6% according to the World Bank. A new credit crunch followed the economic crisis, with the share of credit in the economy falling to 45.6% in July 2019. The subsequent drop in inflation allowed for a new cycle of reduction in the basic interest rate, which reached is lowest level in August 2020. In 2020, the average banking spread of the country was 26.8%, still one of the highest in the world. Combined with a persistent low

[4] World Bank database, available on https://databank.worldbank.org/data/download/GDP.pdf (Accessed November 2021).

credit to GDP ratio, the high spreads have been subject of studies and target of government regulators given their negative effects on Brazil's economic growth.

The size of the Brazilian economy and its long history of high interest rate spreads charged in its banking sector make the country an appropriate context for studying the determinants of spreads by loan category. The Brazilian economy is highly representative in the Latin American economy, which means that Brazilian regulatory policies have an impact in other countries in the region. The high level of interest rates charged in the country, in turn, makes it possible to more accurately capture the variations in the impact of factors that influence the behavior of the banking spread.

## 1.4. Data and econometric model

### 1.4.1. Data and variables

To test the hypothesis of a differentiated impact of spread determinants across different loan categories, this study uses data from the Central Bank of Brazil. The dataset is composed of interest rates charged by 13 Brazilian banks in three categories of loans targeted at individuals, from January 2012 to June 2021 on a semiannual basis (nineteen semesters). [(5)] The sample is representative of the Brazilian financial sector, as these 13 banks account for 70% of the total assets and 74% of the outstanding credit operations held by commercial institutions in the country in June 2021. [(6)] Seven of the 13 banks are state-owned and one is a foreign bank with operations in Brazil.

The three loan categories analyzed are: i. revolving credit (i.e., credit available in deposit accounts allowing for the loan amount to be withdrawn or transferred, repaid, and redrawn again whenever and as often as the borrower wishes, without a fixed number of payments until the arrangement expires); ii. payroll-linked loans for civil servants (i.e., loans whose instalments are directly debited in the civil servant's monthly paycheck); iii. consumer loans (i.e., credit granted to individuals for personal, family or household expenses with monthly payments). The semiannual basis is obtained by averages computed from the weekly data released. The resulting sample comprises 57 observations (19 semesters for each

[(5)] The banks included in our sample are: Banco Bradesco, Banco Santanter do Brasil, Banco do Estado do Rio Grande do Sul, Caixa Econômica Federal, Banco do Brasil, Itaú Unibanco, Banco Daycoval, Banco do Estado do Espírito Santo, Banco Mercantil do Brasil, Banco do Estado de Sergipe, Banco do Estado do Pará, Banco de Brasília, and Banco Safra.

[(6)] Data available at https://www.bcb.gov.br/estabilidadefinanceira/balancetesbalancospatrimo-niais (Accessed November 2021).

of the three loan categories) for each of the 13 banks, with an overall total of 741 observations.

The dependent variable in the study is the interest rate spread, computed as the difference between the average interest rate charged on each loan category and the Financial Basic Interest Rate (TBF). The TBF is computed by the Central Bank of Brazil using a sample comprising the 30 biggest banks in the country. It is based on the average deposit rate for certificates or bank deposits receipts. While the lending rates are available on a bank-specific basis, the deposit interest rates are not, so a proxy – the TBF – is used for the latter. Nevertheless, this should not be a cause for concern since the TBF is considered by the Central Bank of Brazil as the proxy for the deposit interest rate offered by the national banking sector.[7] The set of covariates includes the main vectors used in empirical literature, that is i. bank-specific characteristics; ii. macroeconomic factors; iii. the structure of the financial industry.

The first vector of covariates includes credit risk, liquidity risk, risk aversion, operating costs, implicit interest payments, and opportunity cost of non-interest-bearing reserves. Credit risk (*CrtRsk*) is measured as the provision for loan operations to gross credit operations. Liquidity risk (*LqtRsk*) is computed as the ratio of liquid to total assets. Liquid assets include cash and deposit balances in other banks. Risk aversion (*RskAvs*) is proxied by the ratio of equity to total assets. Operating costs (*OprCst*) are measured as administrative expenses to total assets. Implicit interest payments (*ImpInt*) are computed as the difference between non-interest expense and non-interest income to earning assets. Earning assets refer to assets that generate income like interest or dividends. [8] The opportunity cost of holding reserves (*OppRsv*) is measured as the ratio of cash balances to total assets.

The macroeconomic variables include the inflation rate, the basic interest rate, interest risk, and GDP growth. Inflation rate (*Infl*) is the half-yearly inflation rate as measured by the Consumer Price Index (IPCA). The basic interest rate (*Selic*) is the average interbank goal rate released by the Central Bank in the last semester. Interest risk (*IntRsk*) is captured by the moving standard-deviation of the basic interest rate, considering the last four

[7] Deposit rates offered by banks show low variability. Banks do not provide interest rates paid on deposits on their websites, but on a survey carried out on 03/09/2021 on the websites of two of the country's main financial distributors (www.xpi.com.br and www.btgpactual.com.br), the average deposit rate offered by 25 banks was 5.53% per year, with a standard deviation of 0.48%. This variation was partly due to the difference in maturities. If considered only six months maturities, the average deposit rate was 6.09%, with an even smaller standard deviation of 0.28%.

[8] Loans and securities are the main examples of bank earning assets, among others, like leased or rented buildings that earn income.

semesters. GDP growth (*GDPg*) is the half-yearly GDP growth rate. The market structure variable is represented by market power and state ownership. Market share (*MktSh*) captures the market power of the bank and is measured as the ratio of the bank's credit operations to the total credit operations of the Brazilian banking sector. The state ownership (*SttOwn*) is a dummy variable that takes the value 1 if the bank is state-owned and 0 otherwise. Table 1.1 presents the study's a priori expectations regarding the sign of the explanatory variables, refers to the main studies supporting the a priori expectations and presents a summary of how the variables were obtained.

Table 1.1

*A priori expectations and operationalization of the variables*

| Variable | Computation | Expected sign | Rationale | References |
|---|---|---|---|---|
| CrtRsk | $\frac{Provision\ for\ loan\ operations}{Revenue\ from\ credit\ operations}$ | Positive | Banks with riskier loans should charge higher spreads to make up for default losses. | Agoraki & Kouretas (2019); Hanzlík & Teplý (2020); Kusi et al. (2020) |
| LqtRsk | $\frac{Liquid\ assets}{Total\ assets}$ | Positive/ Negative | Positive: high liquidity ratios come at a cost since banks must forgo higher yielding assets, leading to higher interest spreads. Negative: the higher the proportion of liquid funds, the lower the liquidity risk, leading to lower liquidity premium in the interest spread. | Agoraki & Kouretas (2019); Angbazo (1997); Demirguç-Kunt et al. (2004); Nguyen (2012); Peria & Mody (2004) |
| *RskAvs* | $\frac{Equity}{Total\ assets}$ | Positive | The higher the ratio between equity and total assets, the higher the risk aversion of the managerial team, leading to higher risk premium in the spread. | Brock & Suarez (2000); Hanzlík & Teplý (2020); Saunders & Schumacher (2000) |
| *OprCst* | $\frac{Administrative\ expenses}{Total\ assets}$ | Positive | Banks with higher operating costs should charge higher spreads to make up for higher administrative expenses. | Cruz-García & Fernández de Guevara (2020); Peria & Mody (2004); Carbó-Valverde & Rodríguez-Fernández (2007) |
| *ImpInt* | $\frac{Noninterest\ expenses - noninterest\ revenues}{Earning\ assets}$ | Positive | Banks should charge higher spreads to compensate higher implicit interest payments. | Agoraki & Kouretas (2019); Entrop et al. (2015); Lin et al. (2012) |
| *OppRsv* | $\frac{Cash\ balances}{Total\ assets}$ | Positive | The higher the proportion of funds invested in no-interest bearing reserves, the higher the compensation requested by the bank and the higher the interest spread. | Hawtrey & Liang (2008); Lavezzolo (2020); Maudos & Fernández de Guevara (2004) |

| Variable | Computation | Expected sign | Rationale | References |
|---|---|---|---|---|
| *Infl* | *Half-yearly inflation rate as measured by the consumer price index (IPCA)* | Positive | Inflation rate is considered a component of the cost of doing business. Higher levels of inflation should lead to higher interest spreads. | Entrop et al. (2015); Lavezzolo (2020); López-Espinosa et al. (2011) |
| *Selic* | *Selic interest rate* | Positive | The basic interest rate is the main cost of money. A higher cost of money should encourage banks to charge higher interest spreads. | Gelos (2009); Hanzlík & Teplý (2020); Lepetit et al. (2008) |
| *IntRsk* | *Moving standard-deviation of the Selic rate, considering the last four semesters* | Positive | Greater volatility of the basic market interest rate should encourage banks to include a higher market risk premium into the interest spreads. | Entrop et al. (2015); López-Espinosa et al. (2011); Maudos & Solís (2009) |
| *GDPg* | *Half-yearly real GDP* | Positive/ Negative | Positive: an economic growth scenario signals a greater ability to pay interest, encouraging banks to charge higher spreads. Negative: an economic growth scenario also signals a lower risk of default by borrowers, leading banks to charge lower spreads. | Chortareas et al. (2012); Entrop et al. (2015); Hanzlík & Teplý (2020); Kasman et al. (2010); Kusi et al. (2020) |
| *MktSh* | $\frac{Credit\ operations}{Total\ credit\ operations\ of\ the\ Brazilian\ banking\ system}$ | Positive | A more concentrated banking system, with less competition, makes it easier for banks to charge higher interest spreads. | Almeida & Divino (2015); Maudos & Fernández de Guevara (2004); Peria & Mody (2004) |
| *SttOwn* | *Dummy variable taking the value 1 if a state-owned bank and 0 otherwise* | Negative | State-owned banks are more subject to political pressures to reduce interest spreads. | Demirguç-Kunt et al. (2004) |

The data used to compute bank-specific variables were extracted from half-yearly financial statements reported to the Central Bank of Brazil by the financial institutions through Document 4010. (9) Information regarding each financial institution, rather than the financial conglomerate, was used because the present focus is solely on credit operations. Since financial conglomerates may include data related to brokers, investment banks, foreign branches, etc., banks with an active loan portfolio seem more adequate for this empirical analysis. The data used in the computation of macroeconomic variables were collected from

(9) Document 4010 is a form containing information on the financial institution's balance sheet and income statement. Data available at http://www4.bcb.gov.br/fis/cosif/balancetes.asp (Accessed November 2021).

the Brazilian Institute of Geography and Statistics (IBGE) and from the Central Bank of Brazil's website. [10]

Table 1.2 displays descriptive statistics for all variables. The heterogeneity among loans' spreads is rather high: spreads vary from a minimum of 8.5%, for payroll-linked loans for civil servants, to a maximum of 856%, for consumer loans. Revolving credit exhibits a notoriously high average spread of 202.8%. By comparison, the average spread of consumer loans is considerably smaller, but this category still has a high average of 89.5%. Spreads are smallest for payroll-linked loans: 16.2%, on average. A possible explanation for the disparity across the spreads of the three categories is the risk level of each. Clearly, the default risk for revolving credit loans and consumer loans is greater than the default risk for payroll-linked loans given that the payroll-linked loans installments are directly debited from the civil servants' monthly salary. Revolving credit also presents greater liquidity risk compared to the other two categories, as there is no predefined date for withdrawal or repayment in this loan category: the borrower is free to take the money and return it whenever he wants, as long as he pays interest.

Two bank-specific variables exhibit a high degree of variation, reflecting the heterogeneity of the 13 banks included into the sample. For example, *MtkSh* has a maximum value of 26.4%, 377 times higher than its minimum of .07%, which shows the disparity in the market power of the banks in the sample. The difference between maximum and minimum values in *OppRsv* also shows that the efficiency in the management of banking reserves varied considerably within the panel. The remaining bank-specific variables *LqtRsk*, *ImpInt*, *OprCst*, *RskAvs*, and *CrtRsk* also show substantial – though smaller – variation. As for macroeconomic attributes, variables suggest that the Brazilian economy experienced a roller coaster-type movement during the considered time span, with inflation rate varying from 0.10% in the most stable semester to 6.17% in the most troubled one; the interbank base interest rate ranged from a minimum of 1.95% to a maximum of 14.15%; the economy experienced a tumble of -2.91% and an increase of 3.22% throughout the period.

[10] Data available at https://www.bcb.gov.br/?SERIESTEMP (Accessed November 2021).

Table 1.2

*Descriptive Statistics*

| Variable | Mean | Median | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| *Spread* (%) | | | | | |
| Revolving credit | 202.75 | 169.15 | 105.82 | 53.36 | 533.73 |
| Consumer loans | 89.54 | 58.18 | 117.16 | 18.72 | 856.00 |
| Payroll-linked loans (civil servants) | 16.21 | 15.70 | 3.65 | 8.51 | 29.25 |
| *CrtRsk* | 6.47 | 6.03 | 2.37 | 2.18 | 13.06 |
| *LqtRsk* | 20.61 | 19.41 | 9.36 | 1.33 | 52.20 |
| *RskAvs* | 7.85 | 7.75 | 2.79 | 2.02 | 17.23 |
| *OprCst* | 2.08 | 1.43 | 1.28 | 0.58 | 5.50 |
| *ImpInt* | 0.97 | 0.33 | 1.94 | -3.20 | 8.05 |
| *OppRsv* | 1.44 | 1.09 | 1.54 | 0.12 | 13.33 |
| *Infl* | 2.83 | 2.60 | 1.44 | 0.10 | 6.17 |
| *Selic* | 8.59 | 8.35 | 3.79 | 1.95 | 14.15 |
| *IntRsk* | 1.61 | 1.54 | 0.71 | 0.48 | 3.36 |
| *GDPg* | 0.11 | 0.67 | 1.57 | -2.91 | 3.22 |
| *MktSh* | 5.49 | 1.05 | 7.74 | 0.07 | 26.36 |
| *SttOwn* | 0.54 | 1.00 | 0.50 | .00 | 1.00 |

*Note*. All the variables are expressed as a percentage, except SttOwn (dummy variable). Check Table 1.1 for description of variables.

### 1.4.2. Econometric Model

A standard methodology for panel data is employed in this study. Dynamic specifications are commonly preferred in lieu of the static (no lagged dependent variable) approaches in the literature regarding spread determinants (e.g., Cruz-García & Fernández de Guevara, 2020; Kusi et al., 2020) in view of the persistence of bank interest margins over time (Berger et al., 2000). Thus, a dynamic setup is the main econometric model estimated in this study. Nonetheless, a static model is also used as a robustness check of the hypothesis that the impact of the banking spread determinants differs according to the loan category. The basic dynamic estimated model is as follows:

$$Spread_{it} = \alpha_i + \tag{1}$$
$$\xi_1 Spread_{i,t-1} + \xi_2(Spread_{i,t-1} \times Cons_i) + \xi_3(Spread_{i,t-1} \times Payroll_i) +$$
$$\beta_1 CrtRsk_{it} + \beta_2(CrtRsk_{it} \times Cons_i) + \beta_3(CrtRsk_{it} \times Payroll_i) +$$
$$\gamma_1 LqtRsk_{it} + \gamma_2(LqtRsk_{it} \times Cons_i) + \gamma_3(LqtRsk_{it} \times Payroll_i) +$$
$$\delta_1 RskAvs_{it} + \delta_2(RskAvs_{it} \times Cons_i) + \delta_3(RskAvs_{it} \times Payroll_i) +$$
$$\epsilon_1 OprCst_{it} + \epsilon_2(OprCst_{it} \times Cons_i) + \epsilon_3(OprCst_{it} \times Payroll_i) +$$

$$\zeta_1 SzeOpr_{it} + \zeta_2(SzeOpr_{it} \times Cons_i) + \ \zeta_3(SzeOpr_{it} \times Payroll_i) +$$
$$\eta_1 ImpInt_{it} + \eta_2(ImpInt_{it} \times Cons_i) + \ \eta_3(ImpInt_{it} \times Payroll_i) +$$
$$\theta_1 OppRsv_{it} + \theta_2(OppRsv_{it} \times Cons_i) + \ \theta_3(OppRsv_{it} \times Payroll_i) +$$
$$\kappa_1 MktSh_{it} + \kappa_2(MktSh_{it} \times Cons_i) + \ \kappa_3(MktSh_{it} \times Payroll_i) +$$
$$\omega_1 Infl_i + \omega_2(Infl_i \times Cons_i) + \ \omega_3(Infl_i \times Payroll_i) +$$
$$\lambda_1 Selic_i + \lambda_2(Selic_i \times Cons_i) + \ \lambda_3(Selic_i \times Payroll_i) +$$
$$\mu_1 IntRsk_i + \mu_2(IntRsk_i \times Cons_i) + \ \mu_3(IntRsk_i \times Payroll_i) +$$
$$\nu_1 GDPg_i + \nu_2(GDPg_i \times Cons_i) + \ \nu_3(GDPg_i \times Payroll_i) +$$
$$\varphi_1 SttOwn_i + \varphi_2(SttOwn_i \times Cons_i) + \ \varphi_3(SttOwn_i \times Payroll_i) +$$
$$+ c_i + u_{it}.$$

In this equation, *Spread* represents banking spread and covariates' acronyms are as defined at the previous section (see Table 1.1). The base loan category is revolving credit, for which the dummy variables *Cons* and *Payroll* are both null; $Cons$ is equal to one if the loan is a consumer loan (*Cons* = 0, otherwise); the dummy variable *Payroll* equals one if the loan is a payroll-linked loan for civil servants (*Payroll* = 0, otherwise). The use of these two dummies naturally allows for three possibly distinct sub-regressions, underlying (the lengthy) equation $(1)$:

i. Regression for the loan base category—revolving credit (*Cons* = *Payroll* = 0),

$$Spread_{it} = \ \alpha_i + \xi_1 Spread_{i,t-1} + \beta_1 CrtRsk_{it} + \cdots + \varphi_1 SttOwn_i + u_{it};$$

ii. Regression for consumer loans ($Cons = 1$, $Payroll = 0$),

$$Spread_{it} = \ \alpha_i + (\xi_1 + \xi_2) Spread_{i,t-1} + (\beta_1 + \beta_2) CrtRsk_{it} + \cdots +$$
$$(\varphi_1 + \varphi_2) SttOwn_i + u_{it};$$

iii. Regression for payroll-linked loans ($Cons = 0$, $Payroll = 1$),

$$Spread_{it} = \ \alpha_i + (\xi_1 + \xi_3) Spread_{i,t-1} + (\beta_1 + \beta_3) CrtRsk_{it} + \cdots +$$
$$(\varphi_1 + \varphi_3) SttOwn_i + u_{it}.$$

As usual, Greek letters denote unknown parameters to be estimated. It is clear that the coefficients with indices 2 and 3 ($\xi_2$, $\xi_3$, …, $\varphi_2$ and $\varphi_3$), associated with, respectively, consumer and payroll-linked loans, represent differences of partial effects with respect to those same effects for the base loan category. The indices $(i, t)$ refer, respectively, to each

pair bank/loan type (index *i*), and semester (index *t*).[11] The unobserved terms, $\alpha_i$ and $u_{it}$, denote, respectively, an individual effect (time-invariant, $\alpha_{it} = \alpha_i, \ \forall t$), which can be correlated with explanatory variables, and the random error, uncorrelated with both $\alpha_i$ and the model's covariates.

Due to the presence of the time-invariant effect, $\alpha_i$, the model error term, $\alpha_i + u_{it}$, is obviously correlated with the lagged dependent variable across different periods. For this reason, a sound fixed effects approach requires a more sophisticated estimation method, than, *e.g.*, the simpler Within/LSDV estimator, appropriate only for panel data static models. In particular, two GMM-type methods were considered for estimation: the difference GMM, proposed by Arellano and Bond (1991), and system GMM, developed by Arellano and Bover (1995) and Blundell and Bond (1998). The difference GMM differences all variables and instruments the differenced variables with all their available lags in levels. The system GMM adds an equation in levels, increasing the number of instruments to be used and thus improving efficiency. Both are designed for dynamic models with independent variables that are correlated with past and possibly current realizations of the error (i.e., not strictly exogenous) and fixed individual effects. System GMM is the main method of estimation used in this study in view of its greater efficiency and the impossibility of using dummy variables in difference GMM (which allows us to estimate the model only in first differences).

Some care must be taken, however, to ensure the consistency of the estimates, given that system GMM relies on the assumption of mean stationarity of the panel. This consistency also depends on the orthogonality of the instruments. For this reason, we carry out the Hansen overidentification test, to verify whether the instruments, as a group, are exogenous. The test is robust to heteroskedasticity and autocorrelation. One must also avoid the usage of many instruments because this can overfit endogenous variables and weaken the Hansen test. To minimize this problem, the number of instruments is set so that it does not outnumber individual units (Roodman, 2009). In addition, the model will be adjusted in case of multicollinearity issues in the explanatory variables.

To assess the presence of autocorrelation, the test proposed by Arellano and Bond (1991), applied to the residuals in differences, is performed. Usually, the null hypothesis of

(11) The consideration of the pair bank/loan type as the basic cross-sectional unit (rather than solely the bank) enables the specification of a univariate regression model easily addressed with current econometrics packages (such as, *e.g.*, Stata). Otherwise, one would have to specify a multivariate regression model for panel data, with three dependent variables (three interests' spreads) for each cross-sectional unit (bank) in each period.

no first order autocorrelation, AR(1), is rejected because $\Delta u_{i,t} = u_{i,t} - u_{i,t-1}$ is mathematically related to $\Delta u_{i,t-1} = u_{i,t-1} - u_{i,t-2}$, given that both share the common term $u_{i,t-1}$. Therefore, to check for first-order serial correlation in levels, the second order correlation in differences is considered (Roodman, 2009). If the null hypothesis is not rejected in this case, the moment conditions are deemed valid.

A general-to-specific modelling strategy is adopted from Eq. (1) to identify the relevant variables that explain the behaviour of banking spreads, by excluding one variable at a time based on t-statistics. This means that, to be kept in the model, the variable should be statistically significant at least at 10% significance level. The Stata command *xtabond2* developed in Roodman (2009) is used for estimation. This command provides the option to use the two-step GMM estimation technique, which controls and correct for both heteroscedasticity and autocorrelation (Windmeijer, 2005). It also provides Windmeijer's (2005) correction, without which the standard errors computed in two-step results would be severely downward biased.

## 1.5. Empirical Results

Given the assumption of stationarity of the variables, required for consistency of the system GMM estimator, in the first step of the empirical analysis we performed unit root tests proposed by Levin, Lin, and Chu (2002) and by Im, Pesaran, and Shin (2003) – shortly labelled as LLC and IPS, respectively. These are panel data generalizations of the univariate Dickey-Fuller procedure. IPS allows for heterogeneity in the first-order autoregressive parameter under the alternative hypothesis and, in this sense, is comparatively less restrictive than LLC. Table 1.3 presents the results of data unit root tests. The deterministic terms listed in the table are used in the test equations. The cross-sectional averages are subtracted from the series to reduce the impact of cross-sectional dependence (Levin et al., 2002) in three out of four tests. To address the potential problem of serial correlation in the model, the test equations are augmented with 2 lags, in accordance with the half-yearly frequency of the variables.

Table 1.3
*Panel data unit root tests*

| Variable | LLC<br>No const | LLC<br>Const | IPS<br>Const | IPS<br>Nodemean |
|---|---|---|---|---|
| *CrtRsk* | -2.83*** | -.83 | -1.06 | -2.12** |
| *LqtRsk* | -4.10*** | 1.59 | -1.59* | -1.69** |
| *RskAvs* | -5.71*** | -3.90*** | .64 | 1.24 |

| Variable | LLC No const | LLC Const | IPS Const | IPS Nodemean |
|---|---|---|---|---|
| *OprCst* | -1.02 | -1.39* | .65 | 2.62 |
| *ImpInt* | -3.50*** | .30 | -1.43* | -1.32* |
| *OppRsv* | 1.30 | 4.82 | 3.90 | -.14 |
| *MktSh* | 1.01 | -2.38*** | -1.80** | 4.78 |

*Note*. *** The null hypothesis of unit root is rejected at the 1% significance level. ** The null hypothesis of unit root is rejected at the 5% significance level. * The null hypothesis of unit root is rejected at the 10% significance level. Check Table 1.1 for description of variables.

*OppRsv* presents some concern since the null hypothesis of unit root is not rejected at the standard 10% significance level in any of the four estimated models. *OprCst* is also worrisome given the rejection in only one model. The stationarity of the time series is evaluated by the test proposed by Elliott et al. (1996) using the Stata command *dfgls*. The test is performed after transforming the time series via a generalized least squares (GLS) regression and uses the modified Akaike information criteria for selecting the autoregressive order of the truncation lag term in the test equation. The test corresponds to $MADF^{GLS}$, having smaller size distortion and higher statistical power than the original ADF test. The results are reported in Table 1.4, including the deterministic terms used in the test equation.

Table 1.4
*Time series unit root tests*

| Variable | Lags | Trend | | No trend | |
|---|---|---|---|---|---|
| | | t-Stat | 5% C.V. | t-Stat | 5% C.V. |
| *Infl* | 1 | -2.06 | -3.50 | -1.93 | -2.57 |
| *Selic* | 2 | -1.64 | -3.35 | -0.98 | -2.51 |
| *IntRsk* | 2 | -2.17 | -3.50 | -2.12 | -2.51 |
| *GDPg* | 2 | -2.08 | -3.35 | -1.95 | -2.51 |

*Note*. Null hypothesis: presence of unit root. Check Table 1.1 for description of variables.

One can see that the null hypothesis of unit root is not rejected in any of the estimated models. Given that the Brazilian time series usually present structural breaks that can affect the performance of unit root tests, the test by Zivot & Andrews (1992) is used, allowing for a structural break in intercept and/or trend. The fraction of data range to skip at either end when examining possible break points can be set between 0% and 25%. The Akaike information criteria minimizing value is used for deciding the number of additional lags. Table 1.5 presents mixed results. After accounting for the presence of structural break in the intercept, the null hypothesis of unit root is rejected in all models. But when accounting for the presence of structural break in both intercept and trend, the null hypothesis cannot be rejected in any model.

Table 1.5

*Time series unit root tests – structural break*

| Variable | Lag | Fraction of data range: 5% | | | | Fraction of data range: 20% | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Intercept | | Intercept/Trend | | Intercept | | Intercept/Trend | |
| | | T-stat | 5% C.V. | T-stat | 5% C.V. | T-stat | 5% C.V. | T-stat | 5% C.V. |
| *Infl* | 0 | -5.21 | -4.80 | -4.93 | -5.08 | -5.21 | -4.80 | -4.93 | -5.08 |
| *Selic* | 1 | -4.95 | -4.80 | -4.80 | -5.08 | -4.95 | -4.80 | -4.80 | -5.08 |
| *IntRsk* | 1 | -6.65 | -4.80 | -8.02 | -5.08 | -6.65 | -4.80 | -8.02 | -5.08 |
| *GDPg* | 1 | -3.46 | -4.80 | -3.87 | -5.08 | -3.46 | -4.80 | -3.87 | -5.08 |

*Note*. Null hypothesis: presence of unit root. Check table 1.1 for description of variables.

In addition to the stationarity of the panel, another concern relates to the possible presence of multicollinearity. The Pearson's correlation matrix was used to exclude variables with correlational value exceeding 0.7, which are deemed multicollinear following Kennedy (2008). The interactions between the dummy variables *Cons* and *Payroll* and the variables $Spread_{t-1}$, *CrtRsk*, *LqtRsk*, *RskAvs*, *Infl*, and *IntRsk* were excluded from the model in this process. [12] This means that it was not possible to test the hypothesis of differential impact of these determinants on consumer loans and payroll-linked loans spreads comparatively to revolving credit spreads. The variables *OprCst*, *SzeOpr*, and their interactions with the dummies *Cons* and *Payroll* were also excluded given the correlational value above 0.7. The final estimated model was then as follows:

$$
\begin{aligned}
Spread_{it} = \ & \alpha_i + \\
& \xi_1 Spread_{i,t-1} + \beta_1 CrtRsk_{it} + \gamma_1 LqtRsk_{it} + \delta_1 RskAvs_{it} + \\
& \eta_1 ImpInt_{it} + \eta_2 (ImpInt_{it} \times Cons_i) + \ \eta_3 (ImpInt_{it} \times Payroll_i) + \\
& \theta_1 OppRsv_{it} + \theta_2 (OppRsv_{it} \times Cons_i) + \ \theta_3 (OppRsv_{it} \times Payroll_i) + \\
& \kappa_1 MktSh_{it} + \kappa_2 (MktSh_{it} \times Cons_i) + \ \kappa_3 (MktSh_{it} \times Payroll_i) + \\
& \omega_1 Infl_i + \\
& \lambda_1 Selic_i + \lambda_2 (Selic_i \times Cons_i) + \ \lambda_3 (Selic_i \times Payroll_i) + \\
& \mu_1 IntRsk_i + \\
& \nu_1 GDPg_i + \nu_2 (GDPg_i \times Cons_i) + \ \nu_3 (GDPg_i \times Payroll_i) + \\
& \varphi_1 SttOwn_i + \varphi_2 (SttOwn_i \times Cons_i) + \ \varphi_3 (SttOwn_i \times Payroll_i) + \\
& + u_{it}.
\end{aligned}
\tag{2}
$$

[12] The correlation matrix is omitted for space saving purposes. It is available upon request.

To alleviate concerns regarding the non-stationarity of the panel and time series used in the estimation, the results of the difference GMM are presented in addition to the results of system GMM, which relies on the mean stationarity assumption for the estimator to be consistent. A general-to-specific modeling strategy was applied, excluding those variables that were not statistically significant at the 10% significance level, one at a time. Table 1.6 presents the results.

Table 1.6

*Determinants of Interest Rate Spreads – Estimation Results*

| Variable | System GMM | Difference GMM |
|---|---|---|
| $Spread_{i,t-1}$ | .81*** | .47*** |
| $CrtRsk_{it}$ | | 6.06*** |
| $ImpInt_{it} \times Cons_i$ | 3.15** | |
| $Infl_i$ | 1.34*** | |
| $Selic_i$ | 5.61*** | 9.79*** |
| $Selic_i \times Cons_i$ | -3.20*** | -5.80*** |
| $Selic_i \times Payroll_i$ | -5.72*** | -9.31*** |
| $IntRsk_i$ | | 4.96*** |
| $GDPg_i$ | 6.21*** | 9.20*** |
| $GDPg_i \times Payroll_i$ | -6.54*** | -8.61*** |
| $SttOwn_i$ | -19.68*** | |
| $SttOwn_i \times Payroll_i$ | 19.81*** | |

*Note*. The two-step System and Difference GMM estimators with robust errors are used. */**/***: statistical significance at 10%/5%/1%, respectively. System GMM: Arellano-Bond AR (1) p-value = .083; Arellano-Bond AR (2) p-value = .482. Hansen overidentification test: p-value = .111. GMM set of instruments: 3rd lag of spread. Total number of instruments used: 39. Difference GMM: Arellano-Bond AR (1) p-value = .106; Arellano-Bond AR (2) p-value = .401. Hansen overidentification test: p-value = .138. GMM set of instruments: 2nd and 3rd lags of spread. Total number of instruments used: 38. Check table 1.1 for description of variables.

## 1.6. Discussion

### 1.6.1. System GMM

As expected, some of the covariates – and the constant term – were removed because they were not statistically significant under system GMM. In the final model, the estimated coefficient of the lagged dependent variable suggests that 81% of the current spread of revolving credit loans is explained by the last period spread of this loan category. This inertial effect was also found by previous studies that use net interest margin (NIM) as

a proxy of banking spread (e.g., Cruz-García & Fernández de Guevara, 2020; Hanzlík & Teplý, 2020; Kusi et al., 2020). The single bank-specific variable to present statistical significance was the interaction between *ImpInt* and *Cons*, with a positive sign, suggesting that implicit interest payments costs are passed on to borrowers of consumer loans, but not to borrowers of revolving credit or payroll-linked loans.[13] This can be explained by the restriction established by the Central Bank of Brazil on charging fees for revolving credit and by the preference of banks to concentrate fee collection on consumer loans. The positive coefficient of this variable is supported by previous studies using NIM, like Agoraki and Kouretas (2019), Lin et al. (2012) and Kasman et al. (2010). The macroeconomic variables *Infl*, *Selic*, and *GDPg* showed statistically significant coefficients with the expected signs. The positive relationship between *Infl* and spread indicates that inflationary costs are also passed on to borrowers of revolving credit loans. This result is in line with by previous studies using NIM, like Hanzlík & Teplý (2020) and Lavezzolo (2020). *Selic* and its interactions were also statistically significant. The expected positive sign of *Selic* suggests that the higher the basic interbank interest rate, the higher the spread of revolving credit, in line with previous findings using NIM (e.g., Gelos, 2009; Hanzlík & Teplý, 2020; Lepetit et al., 2008).

In order to interpret the impact of the basic interest rate on the spreads of the other two loan categories, one must add the coefficients of the interactions to the coefficient of the reference loan category. In view of the fact that, by adding the coefficients of $Selic$ and of *Selic x Cons* one still obtains a positive estimate, the same positive relationship is observed between the basic interbank rate and the spread of consumer loans, although the impact is lower than the impact observed on the spread of revolving credit. When adding the negative coefficient of *Selic x Payroll* to the positive coefficient of *Selic*, one obtains a slightly negative result, suggesting a minor negative impact of *Selic* on the spread of payroll-linked loans comparatively to the impact of the same variable on the spread of revolving credit. However, the economic magnitude of the resulting sum of the coefficients is indicative that the impact of the interbank interest rate on the spread of payroll-linked loans is roughly zero. The concern with not passing on market interest rate costs to payroll-linked loan costumers is an indication that banks prefer to preserve clients in the loan category with the lowest credit and liquidity risks.

[13] The results of the full model are omitted for space saving purposes. They are available upon request.

The positive sign of *GDPg* suggests that economic growth periods stimulate banks to charge higher spreads in revolving credit loans. A positive relationship between economic growth and banking spreads had already been found by previous studies using NIM, like, Kusi et al. (2020) and Almeida & Divino (2015). The lack of statistical significance of *GDPg x Cons*, on the other hand, is indicative that, differently from revolving credit loans, economic growth does not influence the spread of consumer loans at all. The negative coefficient of *GDPg x Payroll*, in turn, means that the economic environment has some influence on the spread of payroll-linked loans, but when one adds this coefficient to the coefficient of *GDPg*, the resulting sum indicates that the economic magnitude of this influence is roughly null comparatively to the influence of GDP growth on the spread of revolving credit. The concentration of the impact of economic growth on the spread of revolving credit suggests that banks assess costumers of this loan type as those with more room to improve their repayment ability in periods of economic bonanza. In fact, revolving credit has the least bureaucratic access in the Brazilian banking market, which can have an impact on the rapid increase in its demand during periods of growth.

Finally, the negative coefficient of *SttOwn* suggests that state-owned banks tend to charge lower spreads in revolving credit loans. This result is also in line with previous literature claiming that state-owned banks are more subject to political pressures to reduce spreads (e.g., Demirguç-Kunt et al., 2004). The lack of statistical significance of *SttOwn x Cons* is indicative that consumer loan spreads are not influenced by this variable. The resulting sum of the *SttOwn* and *SttOwn x Payroll* coefficients, in turn, suggests that the impact of the state ownership of the bank on the payroll-linked loan spread is practically nil. A possible explanation for the difference in the impact of this variable across the spreads of the three categories is the high average of revolving credit spreads. This makes this loan type the one that offers more room for state-owned banks to give in to political pressure to reduce spreads.

The model is well specified according to the diagnostic tests on the estimated residuals for dynamic panel data. According to the Arellano-Bond AR(1) and AR(2) tests, there is no evidence of first or second order autocorrelation in the residuals at the standard 5% significance level. The Hansen test of over-identifying restrictions, which tests the overall validity of the instruments, indicates that the set of instruments are orthogonal to the estimated residuals.

### 1.6.2. Difference GMM

The dummy variable *SttOwn* was naturally dropped from the estimation using difference GMM due to the limitation of using only first differences in this method. The change in the estimated model and in the method of estimation used brought some changes to the results. Differently from system GMM, the coefficient of *CrtRsk* is positive and statistically significant, suggesting that the higher the bank's credit risk, the higher the spread of revolving credit loans. This result is in line with previous studies that found a positive relationship between NIM and credit risk (e.g., Entrop et al., 2015; Jarmuzek & Lybek, 2020). *IntRsk* presented a statistically significant coefficient in this estimation, whereas it was not significant in system GMM. The positive sign suggests that banks pass on to borrowers of revolving credit loans the volatility of the market interest rates. This result is also supported by previous studies that use NIM in lieu of actual interest rate spreads (e.g., Entrop et al., 2015; Jarmuzek & Lybek, 2020; López-Espinosa et al., 2011). Another difference is that *ImpInt x Cons* and *Infl* does not show statistical significance under this estimation method.

Some similarities remain. The first one is that the lagged dependent variable also explains a high percentage of the behavior of revolving credit spreads, although the coefficient is substantially smaller than the one estimated using system GMM. In this case, only 47% of the current spread of revolving credit loans is explained by the last period spread of this loan category. The results obtained with difference GMM also suggest that the market interest rate influences the spread of the three loan categories. Again, the influence is positive on the spread of revolving credit loans, smaller but still positive on the spread of consumer loans and roughly null (but still positive) on the spread of payroll-linked loans. Economic growth is positively related to the spreads of both revolving credit and – in a much smaller magnitude – payroll linked loans, but it does not have influence on the spread of consumer loans.

As with system GMM, the model appears to be correctly specified according to the diagnostic tests. The Arellano-Bond AR(1) and AR(2) tests show no evidence of first or second order autocorrelation in the residuals at the standard 5% significance level. The overall validity of the instruments verified through the Hansen test of over-identifying restrictions also indicates that the set of instruments are orthogonal to the estimated residuals.

### 1.6.3. Comparison between system GMM and difference GMM

The differences in the results of system and difference GMM is not unusual, given the changes in the estimated dynamic model due to the impossibility of using the time invariant variable *SttOwn* and its interaction with *Payroll* in difference GMM. Those two variables proved to be relevant for explaining the behavior of the spreads of revolving credit loans and payroll-linked loans, respectively. However, the results of both estimation methods support the main hypothesis of this study, that is, the impact of banking spread determinants differs according to the loan category.

For instance, in both system and difference GMM, the impact of the interbank interest rate is higher on the spread of revolving credit loans than on the spread of consumer loans, and the impact of this variable on the spread of payroll-linked loans is the lowest of all. This is explained by the portfolio effect demonstrated by Allen (1988), which allows the banks to better manage their inventory risk exposure by controlling relative rate spreads across product types. One of the corollaries of this reasoning is that riskier loan categories should be more impacted by some of the bank's costs to compensate for their higher risk. Among the three categories, revolving credit loans is the riskiest: the costumers can withdraw all the funds (or part of them) available in a deposit account whenever they want, and there is no scheduled date for paying it back. As soon as the debt is paid, the costumer can withdraw it again. Consumer loans, on the other hand, have well-defined monthly installments, which makes the repayment more predictable. There is also a well-defined date for making the funds available to the client. This predictability makes the liquidity risk of this loan category smaller comparatively to revolving credit loans. Payroll-linked loans are the least risky category among the three because, in addition to the more predictable withdrawals and repayments, the instalments are directly debited in the civil servant's monthly paycheck, diminishing the default risk. The most part of interbank interest rate costs is passed on to borrowers of the riskiest loan category (revolving credit), a small part is passed on to the middle risky category (consumer loans) and the smallest part (according to difference GMM) is passed on to borrowers of the least risky category (payroll-linked loans). This result is also in line with the portfolio effect theory.

The impact of economic growth on the spread is also different depending on the type of loan in both difference and system GMM. The positive and higher impact on the spread of revolving credit comparatively to the impact on the spread of payroll-linked loans – and the absence of statistical significance for the impact of this variable on the spread of

consumer loans – can be explained by the fact that, in periods of economic expansion, costumers of revolving credit lines (riskier borrowers) are more willing to take more risk and therefore pay higher spreads than costumers of the other two loan types (less risky borrowers). Conversely, in downturn periods the banks are more prone to waive income through a larger reduction in the spreads of revolving credit lines due to the greater financial distress, that pushes the most the riskier borrowers.

## 1.7. Robustness check

As a robustness check to confirm the hypothesis that the impact of spread determinants differs according to the loan category, we also performed the estimation of a static model (without lagged dependent variable), as follows.

$$
\begin{aligned}
Spread_{it} = \ & \alpha_i + \\
& \beta_1 CrtRsk_{it} + \gamma_1 LqtRsk_{it} + \delta_1 RskAvs_{it} + \\
& \eta_1 ImpInt_{it} + \eta_2 (ImpInt_{it} \times Cons_i) + \ \eta_3 (ImpInt_{it} \times Payroll_i) + \\
& \theta_1 OppRsv_{it} + \theta_2 (OppRsv_{it} \times Cons_i) + \ \theta_3 (OppRsv_{it} \times Payroll_i) + \\
& \kappa_1 MktSh_{it} + \kappa_2 (MktSh_{it} \times Cons_i) + \ \kappa_3 (MktSh_{it} \times Payroll_i) + \\
& \omega_1 Infl_i + \\
& \lambda_1 Selic_i + \lambda_2 (Selic_i \times Cons_i) + \ \lambda_3 (Selic_i \times Payroll_i) + \\
& \mu_1 IntRsk_i + \\
& \nu_1 GDPg_i + \nu_2 (GDPg_i \times Cons_i) + \ \nu_3 (GDPg_i \times Payroll_i) + \\
& \varphi_1 SttOwn_i + \varphi_2 (SttOwn_i \times Cons_i) + \ \varphi_3 (SttOwn_i \times Payroll_i) + \\
& + u_{it}.
\end{aligned}
\tag{3}
$$

Eq. (3) was estimated by fixed-effects because the Hausman test exhibited a *p-value* = .0001, rejecting the null hypothesis of random effects. Table 1.7 presents the results. The absence of the lagged dependent variable brought some changes to the results from system and difference GMM. The positive and statistically significant coefficient of *OppRsv x Cons* suggests that the higher the proportion of cash maintained by the bank, the higher the spread of consumer loans. This result suggests that non-interest-bearing reserves are an important source of funds for consumer loans, whereas the lack of statistical significance for *OppRsv* and *OppRsv x Payroll* is indicative that revolving credit and payroll-linked loans have other funding sources. The positive relationship between non-interest bearing reserves and banking spreads is supported by previous studies using NIM (e.g., Lavezzolo, 2020; Lin et

al., 2012). The positive sign of *GDPg x Cons*, in turn, suggests that the economic growth has a positive relationship with the spreads of consumer loans. This variable had not presented any statistical significance in system or difference GMM. In addition, the variables *GDPg* and *GDPg x Payroll*, which had proved relevant for explaining the behavior of the spreads of revolving credit loans and payroll-linked loans in system GMM and difference GMM estimations no longer show any relevance in the fixed-effects estimation. Although apparently contradictory, the result reinforces the existing difference in the influence of this variable on the spreads of the three loan categories.

As for the similarities, *CrtRsk* also presented the expected positive sign indicating a positive relationship between the bank's credit risk and the spread of revolving credit, as in difference GMM. In addition, *Selic* confirmed the positive sign exhibited in system GMM estimation, and the same goes for the negative coefficient of *Selic x Payroll*, which is low enough to make the relationship between the market interest rate and the spread of payroll-linked loans moderately negative. This reinforces the idea that banks choose not to pass on the costs of increases in market interest rates to borrowers for fear of compromising demand for a low-risk loan category such as payroll-linked loans. Differently from system and difference GMM, *Selic x Cons* did not show statistical significance, suggesting that the market interest rate does not influence the spread of consumer loans. Finally, *IntRsk* showed the positive coefficient already exhibited in difference GMM.

The differences in the statistical significance of some variables in the estimation of the static model do not compromise the overall conclusion of the study. The evidence of differential impact given by the variables *OppRsv x Cons*, *Selic*, *Selic x Payroll*, and *GDPg x Cons* in the estimation adds robustness to support the main hypothesis of this study.

A cautionary note must be made regarding the diagnostic tests. The Wooldridge AR(1) test reported a *p-value* = 0.0000, rejecting the null hypothesis of no serial correlation. In addition, the modified Wald statistic for groupwise heteroskedasticity also reported a p-value of 0.0000, rejecting the null hypothesis of homoskedasticity. To address these issues, robust standard errors are computed in the variance-covariance matrix of estimators presented in Table 1.7. These standard errors are identical to those obtained by clustering on the panel variable, producing an estimator of the VCE that is robust to cross-sectional heteroskedasticity and within-panel (serial) correlation (Wooldridge, 2020).

Table 1.7

*Determinants of Interest Rate Spreads – Estimation Results – Fixed Effects*

| Variable | Coefficient |
|---|---|
| $CrtRsk_{it}$ | 12.02** |
| $OppRsv_{it}x\ Cons_i$ | 15.34*** |
| $Selic_i$ | 3.55** |
| $Selic_i \times Payroll_i$ | -4.37*** |
| $IntRsk_i$ | 4.76** |
| $GDPg_i \times Cons_i$ | 6.95** |
| *Constant* | -3.81 |

F (6,38) = 16.72. *p-value*: 0.0000. VCE estimators robust to cross-sectional heteroskedasticity and within-panel (serial) correlation are used. */**/***: statistical significance at 10%/5%/1%, respectively. Check table 1.1 for description of variables.

## 1.8. Concluding Remarks

Previous studies on banking spreads use one single interest margin per bank to measure the impact of its determinants, usually the net interest margin (NIM) derived from accounting statements. The present study claims that the attributes that influence the behavior of banking spreads can have a specific impact according to the loan category. Therefore, when studying the behavior of banking spreads, the diversity of interest rates existing in a bank's loan portfolio should be considered.

Bearing in mind the theoretical model proposed by Ho and Saunders (1981) and some of its extensions this study analyses the impact of the determinants of banking spread for three types of personal loans in the context of the Brazilian banking sector: revolving credit, consumer loans, and payroll-linked loans to civil servants. In particular, the paper assesses the hypothesis derived from the study by Allen (1988), who extended the dealership model incorporating the loan heterogeneity in banks' portfolios. The author demonstrated that banks diversify their risk inventory exposure by controlling the relative rate spreads across product types. This suggests the hypothesis that the determinants of banking spreads are different according to the loan category.

The results confirmed the expected differential effect of some determinants on the spread of the three distinct loan categories analyzed. Under both system and difference GMM estimations, the marginal effects of, respectively, the market interest rate and economic growth on the spreads of revolving credit, consumer loans, and payroll-linked loans differ significantly among the three loan categories. In addition, under system GMM,

implicit interest payments have significant marginal impact on the spread of consumer loans, but not on the spreads of the other two categories. Also, under system GMM, the marginal effect of the banks' state-ownership on the spread of revolving credit differs significantly from the corresponding marginal effect on the spread of payroll-linked loans, and it does not influence the spread of consumer loans at all. All in all, the covariates with statistical significance in the three estimations confirmed the expected relationships with banking spreads, as supported by previous empirical literature using NIM instead of actual interest rates for computing spreads. Nevertheless, the lack of statistical significance in many variables is suggestive of how banking spreads can behave differently when computed using actual interest rates. The vector of microeconomic variables is computed from accounting data, which have a hindsight profile, while spreads computed by actual interest rates (instead of NIM) have a foresight behavior. This may explain the lack of statistical significance of most of the bank-specific covariates.

The study of the determinants of spreads should consider the heterogeneity existing in a bank's loan portfolio, especially in a context of high spreads like that of the Brazilian banking sector. Data gathered from financial statements only provide averages of the spreads charged in many loan categories, which naturally limits the investigation and precludes the design of policies addressing specific characteristics of credit lines. Central banks and governments should observe the composition of banks' loans portfolio when writing their regulations. For instance, in view of the evidence that the market interest rate impacts differently the spread of different loan categories, regulative authorities could stablish some cap to modifications in the spreads of the categories where this relationship is most relevant to curb excessive spreads in these categories whenever the basic interest rate is increased. Policies could be written specifically targeting loan categories sensitive to certain factors. For example, in periods of economic boom, regulative authorities could reduce reserve requirements in exchange for lowering revolving credit spreads, since this is the type of loan whose spreads banks are most likely to increase in periods of economic growth.

In addition to providing evidence for the hypothesis of differentiated impact of spread determinants according to the loan type, this study contributes to the related literature offering evidence of the factors that influence the spread of three specific loan categories for individuals: revolving credit, consumer loans, and payroll-linked loans. Particularly, it shows that: i. revolving credit spreads are driven mainly by the spread of the previous period, credit risk, the inflation rate, the interest risk, the market interest rate, the economic growth, and the state-ownership of the bank; ii. consumer loans spreads are driven by implicit interest

rates; iii. payroll-linked loans spreads are also driven by the market interest rate, GDP growth, and the bank's state-ownership, although in a lesser extent than revolving credit spreads. Another contribution to the literature regards the way spreads should be computed when investigating their determinants. The prominence of macroeconomic variables like *Selic* and *GDPg* in explaining the spread behavior of revolving credit and payroll-linked loans is more in line with the study by Afanasieff *et al*. (2002) than with the study by Almeida and Divino (2015). Both studies investigate the spreads in Brazil, but the former uses actual interest rates – like the present study – in the computation of banking spread, whereas the latter uses NIM as a proxy for the banking spread. In the study by Afanasieff *et al*. (2002) – as in the present study – the macroeconomic attributes have more prominence than the microeconomic ones in explaining the behavior of the spread, while in the study by Almeida and Divino (2015) the opposite occurs. This study confirms that different results can be obtained according to the way spreads are computed, and regulators and scholars should keep this in mind.

Naturally, the present study is not without limitations. The first limitation is related to the restriction of the sample to Brazil. Unfortunately, it was not possible to include other countries in the study, given that, to our knowledge, the disclosure of interest rates charged per loan category is not available on any international database. The second limitation regards the number of banks and loan categories analyzed, which is explained by the availability of data. Although the Central Bank of Brazil collects data related to interest rates charged by a greater number of financial institutions on personal loans, most of the smaller banks do not report observations for most of the loan categories. To obtain a completely balanced panel of interest rate spreads, the banks without observations in one or more of the nineteen semesters comprising the timeline were dropped from the sample. Loan categories for which the remaining banks did not report interest rates for all 19 semesters of the sample were also removed. In addition, due to multicollinearity issues, it was not possible to test the hypothesis of differential impact on the spread according to the loan category for some determinants that proved relevant for explaining the behavior of the spreads of revolving credit loans, like credit risk and interest rate risk (under difference GMM), and the lagged spread (under both system and difference GMM). Another limitation lies in the lack of information about the relative weight of the loan categories analyzed, within the total operations directed to individuals. This issue hinders more compelling suggestions regarding a cross-subsidization effect that may exist among loan categories. These are limitations that, in any event, may foster subsequent research on the determinants of banking spreads.

# Chapter 2: Bargaining power and renegotiation of small private debt contracts

**Abstract**

The present study is focused on the renegotiation of small debt contracts for small and medium-sized enterprises (SMEs). We use a proprietary database from a Brazilian bank and find that, when compared to large loans, the frequency of renegotiation of small loans is much lower. We argue that this is a result of the lack of *ex-ante* contingencies in this kind of loan, which reduces the transfer of control to the lender in situations in which the borrower is not in financial distress, and the lower bargaining power of SMEs in relation to large public companies. We find that borrower delinquency events and borrower bargaining power proxies are positively related to the frequency of small loan renegotiation. We also find that delinquency events reduce the probability of borrower-friendly outcomes and the number of key contractual terms renegotiated favorably to the borrower. Further, we find that the borrower's bargaining power increases the likelihood that the borrower will obtain a favorable outcome and a greater number of favorable key contractual terms on the outcome of the renegotiation.

**Keywords**: Loan renegotiation; control rights; bargaining power; small debt contracts.

## 2.1. Introduction

A large body of theoretical literature on financial contracting has been devoted to study renegotiation, given its implications for the efficiency olf contracts and welfare of contracting parties (see, for example, Hart and Moore 1988, 1998; Huberman and Kahn 1988a, 1988b; Aghion and Bolton 1992; Bester 1994; Gorton and Kahn 2000; Gârleanu and Zwiebel 2009). This literature has been mainly concerned with the allocation of control rights at the inception of the agreement and the shifts of bargaining power until maturity (e.g., Aghion and Bolton 1992; Hart and Moore 1998). In this sense, the related empirical literature is mostly focused on large companies with large debt contracts, publicly or privately placed, in which the allocation of control rights is usually specified through the presence of ex-ante contingencies like pricing grids, borrowing bases, and covenants (e.g., Dou 2020; Godlewski 2019; Nikolaev 2018). Prior empirical evidence showed that renegotiation of these large debt contracts is triggered even in the absence of default by ex-

post changes in the firm's financial health, which are monitorable by means of those ex-ante contingencies (e.g., Roberts 2015; Roberts and Sufi 2009a). The objective of this study is to analyze the drivers of the renegotiation process and its outcomes, but unlike previous empirical works, we focus on small private debt contracts with small and medium-sized firms (SME). This type of contract generally does not include pricing grids, borrowing bases, or covenants due to the high ex-post verification costs of the state of the world. Specifically, we hypothesize that, in the absence of traditional ex-ante contingencies in the design of debt contract, the renegotiation process and its outcomes are mainly driven by the contracting parties' relative bargaining power.

Theoretically, renegotiation is triggered by changes in the existing environment at the time of signing the contract. It would be the result of Pareto improvements motivated by inefficient ex-post outcomes, not foreseen at the contracting date (Maskin and Moore 1999). In corporate debt contracts, financial covenants are a device frequently used by creditors to monitor ex-post changes in borrowers' financial performance (Rajan and Winton 1995). In this sense, they are an important driver of renegotiation of those contracts. Considering that creditors rarely exercise the right to accelerate the debt whenever borrowers fail to meet covenant obligations, a renegotiation process is triggered as a result, usually with stronger contractual restrictions on the borrower (Nini et al. 2012). Thus, they are also a primary mechanism for allocating control rights and specifying in the original contract the ex-post shift of bargaining power that will determine the outcome of the renegotiation process (Gârleanu and Zwiebel 2009; Prilmeier 2017).

Conversely, many small private debt contracts with SME waive covenants and other ex-ante contingencies in their design. This is the case of the dataset employed in the present study, which includes loans with average value of $ 63,990 and firms with average assets of $ 1.2 million. One possible explanation for the lender to waive covenants and other ex-ante contingencies in the design of these debt contracts is the relatively high cost associated with monitoring small loans to SME comparatively to large debt contracts with big companies. In the absence of a contractual mechanism to incentive the monitoring of ex-post changes in the borrower's financial performance, the only signal available to the bank that something changed in the firm's situation after the contracting date is a missing payment.[14] Therefore, delinquency must be a primary determinant of renegotiation

[14] Theoretically, collateral also provides an incentive for the bank to monitor loans (Rajan and Winton 1995). However, as will be shown, collateral is used only in a minor part of the contracts present in our sample, which reduces the incentive for the bank to monitor this kind of loan.

frequency of small private debt contracts. Naturally, a missing payment strengthens the lender's bargaining power in a renegotiation process, possibly leading to stricter conditions for the borrower compared to the original agreement. In this study, we use a sample of small private loans from a large Brazilian bank to show that renegotiation of these contracts also takes place in contexts where there are no missing payments. As there are no contractual contingencies that encourage the bank to monitor the financial performance of the firm ex-post in order to increase its control even without a missing payment, this indicates that firms also initiate the process and suggests the borrower's bargaining power as another relevant driver of renegotiation of small private loans. Therefore, it should be the bargaining power of the contracting parties that determines the renegotiation process for small private loans and its outcomes – with delinquency events clearly shifting the control towards the lender and thus increasing its bargaining power.

By addressing these issues, this study intends to make the following contributions to the financial contracting literature. Firstly, the study focuses on the influence of bargaining power on renegotiation, including its frequency and outcomes. The idea of renegotiation as an exogenous game driven by the relative bargaining powers of the contracting parties is pervasive in the financial contracting literature (Roberts and Sufi 2009b). Surprisingly, previous empirical studies have not properly addressed this issue. We had access to data regarding the borrowers' alternative sources of financing, which, according to theoretical literature, is crucial for determining the relative bargaining power and ultimate outcome of renegotiation (Rajan 1992).

Secondly, to the best of our knowledge, this is the first study to investigate how the renegotiation dynamics takes place in a context in which there are no ex-ante contingencies to specify the distribution of control rights. The ex-post allocation of control rights is one of the main objectives of renegotiation but, so far empirical studies have only addressed financial contracts with covenants and other ex-ante contingency provisions (Denis and Wang 2014; Roberts 2015), which are important instruments for distributing control rights. So, there is a gap to be filled by investigating the renegotiation process in a context in which there are no ex-ante contractual contingencies. Finally, this study focuses on small unlisted firms located in a middle-income country, which are exposed to more information asymmetries than large companies and with fewer financing alternatives than firms located in the US or Europe. In this sense, it sheds light on the dynamics of renegotiation in an underdeveloped market.

The remainder of the chapter is organized as follows. The next section presents the theoretical motivation for this study and formulate the hypotheses to be tested. Section 3 describes the variables, data, and econometric model employed. Section 4 reports and comments on empirical results. Section 5 concludes the paper with some implications related to the findings.

## 2.2. Theoretical motivation and hypotheses formulation

The classic view on renegotiation sees it as a phenomenon that destroys contractual efficiency: It could only harm the parties involved in a contractual relationship, as it compromises the incentives to comply with the clauses initially established (Bolton 1990; Maskin and Moore 1999). Indeed, if there is any possibility that the contract, and occasional penalties for deviations therefrom, are modified over the relationship, why bother to meet the original terms? In general, this stream of the literature considers that both parties have unbounded rationality, that is, they are able to foresee all future contingencies that may impact the interests involved and to describe them in detail in the original contract (Hart and Moore 1988). If, hypothetically, contracts are potentially complete, then any modification in the original clauses can never benefit the agents involved in the relationship – for if the renegotiation outcome were of any use it would simply be written in the initial agreement (Dewatripont and Maskin 1990). Therefore, a contract will only be efficient if it is renegotiation-proof.

Renegotiations are frequent in practice (Bolton 1990; Roberts 2015; Roberts and Sufi 2009a), which suggests that they may be better explained by an alternative line of thought – the 'incomplete contracts' theory. According to this literature, specifying the precise actions each party must take in every alternative future event involves a prohibitive cost, especially when one considers that the writing of such a large number of contingencies would have to be intelligible to an outside legal authority capable of enforcing the agreement (Hart and Moore 1988). In other words, even if the parties have unbounded rationality and conceive all possible contingencies, their detailed specification is very expensive, making it economically advantageous to have a mechanism that allows for the modification of the initial terms (as both parties receive information about costs and benefits). The upshot of this reasoning is that contracts are naturally incomplete and that renegotiation helps increase their efficiency by completing the initial agreement (Tirole 1999).

Aghion and Bolton (1992) argue that one way to overcome contracts' natural incompleteness is to establish in the contract who has the right to make decisions after the agreement is signed. They formulate a model in which an entrepreneur requires financing for an investment opportunity and claim that the optimal contract allocates control rights in a state-contingent way: When things go nicely and smoothly for the entrepreneur, he keeps control over the project financed. If things go sideways, the control is shifted towards the investor – which, in the case of debt contracts, could be a bank. In their model, the signal that things have gone wrong can be as diverse as a change in the project's net worth or profitability. This means that control rights can shift to creditors even in the absence of a missed payment. This is a fundamental difference from the Hart and Moore's (1998) model, in which the non-payment of debt is essential for creditors to take control of the assets. In other words, in the Aghion and Bolton contract, shifts in control depend on the confirmation of a verifiable state of the world – not a missed debt payment –, whereas in the Hart and Moore contract, a failure to pay is what triggers the shift in control towards creditors.

This makes Hart and Moore's (1998) model more suitable for explaining the process of renegotiating small loans. Large and medium debt contracts usually include ex-ante provisions like pricing grids, borrowing bases, and financial covenants (Roberts and Sufi 2009a). Small loans, on the other hand, may waive such contingencies. Pricing grids makes the loan interest spread contingent on some specification about the borrower, for instance, credit ratings or financial ratios. Thus, a typical pricing grid may determine an increase in the loan spread should the firm's rating falls below some predefined threshold. Borrowing bases relate the amount of credit available to the borrower to the value of the collateral. Financial covenants are more common and usually specify balance sheet ratios or figures with which the borrower must comply throughout the contract. These three kinds of contractual provisions require some monitoring by the bank after the contract is signed and, in the event of a change in the conditions outlined in these contingencies, control may be transferred to the creditor. Covenants are central to the study of control rights outside the context of bankruptcy: As they accelerate the loan in case of violations, they increase the scope for renegotiation (Aghion et al. 1994; Demerjian 2017; Freudenberg et al. 2017). Empirical evidence has supported the idea that most renegotiations of debt contracts that include covenants take place outside financial difficulties (Roberts and Sufi 2009a). This is not the case of small loans, for which ex-post state of the world verification can be expensive and, as a result, ex-ante contingencies – like covenants – may be waived. For this type of loan, missed payments should represent a major – and indeed almost exclusive – signal

received by the creditor that something has gone wrong, and, in this sense, it should be a significant variable to explain renegotiation frequency of small debt contracts. A priori, borrower delinquency shifts control to the bank and should lead it to confiscate the assets pledged as collateral for the loan. However, the lender is usually a less efficient business manager than the borrower (Huberman and Kahn 1988a). Thus, renegotiation emerges naturally as a preferable alternative to bankruptcy, which may prove ex-post inefficient (Bester 1994) because it is more expensive for the bank than the renegotiation process (Ikeda and Igarashi 2016).15 This rationale leads to the formulation of the following hypothesis:

**H1:** Borrower delinquency is positively related to the frequency of renegotiation of small debt contracts.

One concept closely related to the contractual allocation of control rights is the relative bargaining power of the contracting parties. For example, a debt contract may establish that, in the event of default, the bank has the right to seize the assets of the financed project or other assets. Even if the threat to take the borrower's assets is not met by the bank, the default transfers control to the bank, increasing its bargaining power and ultimately influencing the outcome of a possible renegotiation (Huberman and Kahn 1988a). In general, the idea that the bargaining power of contracting parties governs the renegotiation process permeates much of the financial contracting literature. Berger and Udell (1990) model renegotiation as a bargaining game between debtholders and shareholder-oriented management, in which managers credibly threatens to compromise firm assets to force concessions from the lenders. Aghion et al. (1994) formulate a model in which bargaining power is controlled contractually. The model is based on a buyer-seller relationship with observable but unverifiable investments. The Authors show that the underinvestment problem can be overcome by including into the original contract the rules that will govern the future renegotiation process. In their model, all bargaining power is allocated to either contracting party. Similarly, Harris and Raviv (1995) propose that contracts specify the rules that govern the behavior of contract parties in determining outcomes and the allocations resulting from these outcomes. Gorton and Kahn (2000) claim that the initial terms of debt contracts are not set to price default risk, but to efficiently balance bargaining power in a later renegotiation that always occurs. In Moraux and Silaghi's (2014) model, the optimal

[15] As will be shown in the next Section, most debt contracts in our sample are unsecured. In such cases, the remaining alternative for the bank to enforce payment is to register the borrower in national credit restriction databases. This makes renegotiation an even more attractive alternative for the bank in the event of missed payments, as it is often the only way for the lender to recover the funds granted.

number of debt renegotiations, the size and the dynamics of the coupon reductions depend critically on the bargaining power of the contracting parties.

These models suggest bargaining power as one of the main drivers of debt contract renegotiation. In the case of small debt contracts, the borrower's relative bargaining power should be even more important as a trigger for renegotiation, given the lack of ex-ante contingencies that provide for shifts in control rights to the creditor. For example, pricing grids shifts the relative bargaining power to the creditor by increasing interest rates in case the borrower's credit quality deteriorates. Covenants play a similar role of implicitly allocating bargaining power in a state-contingent manner, providing debt acceleration in the event of borrower's financial distress (Gârleanu and Zwiebel 2009). In this sense, covenants can increase the bank's bargaining power even in the absence of borrower's failure to pay (for example, in case the firm's earnings fall below some predetermined threshold). For small loans that waive such contingencies, the only contractual device that provides for the increase in the bank's bargaining power over the life of the loan is collateral, and only in cases of missed payments. In other contexts, the borrower's relative bargaining power remains intact. This rationale suggests the second hypothesis:

**H2:** The borrower's bargaining power is positively related to the frequency of renegotiation of small debt contracts.

The relative bargaining power of contracting parties explains not only the frequency with which debt contracts are renegotiated, but also the outcome of renegotiation (e.g., Aghion et al. 1994; Hart and Moore 1988, 1998; Huberman and Kahn 1988a; Rajan and Winton 1995). For example, if the financial situation of a borrower improves and he has alternative sources of financing, he can credibly threaten to leave the current lender in order to obtain more favorable loan conditions in a renegotiation (Rajan 1992). The influence of the borrower's greater bargaining power can manifest itself not only in the higher frequency with which favorable loan conditions are obtained in a renegotiation process, but also in "more" favorable conditions, that is, in the larger number of contract terms that are renegotiated in a way that favors the borrower with relative greater bargaining power. The next two hypotheses are derived from this reasoning:

**H3:** Borrowers with higher bargaining power more often obtain a favorable outcome in the renegotiation of small debt contracts.

**H4:** Borrowers with higher bargaining power obtain a larger number of terms renegotiated to their advantage in small debt contracts.

However, if, as predicted Hart and Moore's (1998) model, borrower delinquency shifts contractual control towards the lender, the firm's bargaining power should lose strength in the event of any delay in debt payment. Consequently, the renegotiation outcome will not be as favorable to the borrower as it would be if there were no delinquency event. This logic leads to the formulation of the following hypotheses:

**H5:** Borrower delinquency reduces the frequency of borrower-friendly outcomes in the renegotiation of small debt contracts.

**H6:** Borrower delinquency reduces the number of terms renegotiated favorably to the borrower in small debt contracts.

By means of the six hypotheses above, the present study tries to test theoretical predictions that point to the contracting parties' bargaining power as one of the main drivers of the renegotiation of small debt contracts. The empirical literature concerned with testing the drivers of the renegotiation process is still at an early stage. Related previous studies have not assessed the explanatory power of contracting parties' bargaining power, despite the theoretical importance of this attribute in the renegotiation literature. This literature has in common the study of large debt contracts of large companies and the testing of initial loan terms and changes in borrowers' financial health as potential drivers of the renegotiation process.

Roberts and Sufi (2009a) pioneered the empirical literature on debt renegotiation outside of bankruptcy situations, showing that over 90% of long-term private credit agreements in the US are renegotiated prior to their stated maturity, most of them outside default. New information regarding the borrower's credit quality, investment opportunities, and collateral, as well as macroeconomic fluctuations in credit and equity market conditions are found to be major determinants of renegotiation and its outcomes in their study. Denis and Wang (2014) focus on covenant renegotiations. They find that, even in the absence of any covenant violation, debt covenants are frequently renegotiated. Changes in firm's financial statements' numbers, macroeconomic factors and lender leverage are reported as significant attributes explaining covenants renegotiation. Roberts (2015) studies the timing of renegotiation and finds that this timing is driven by the contracting parties' financial health and uncertainty related to borrowers' credit quality. Godlewski (2015) also investigates the

timing of renegotiations, reporting initial loan terms, banking pool features, and the legal framework significantly impact the time gap between renegotiations of syndicated loans. Freudenberg et al. (2017) investigate if covenant violations in prior contracts influence renegotiation probability in subsequent new loans. They find that violating covenants in one debt contract results in tighter loan agreement terms for the borrower in the next one, increasing the scope for renegotiation. Nikolaev (2018) shows evidence that monitoring demand proxies and contractual monitoring mechanisms, like covenants, relate positively with renegotiation intensity. Godlewski (2019) examines the design of debt contracts after renegotiation and reports that the number of amendments increases with longer maturities and creditors friendly environments and decreases with collateral and bank reputation. Dou (2020) finds that financial covenants are less likely to be renegotiated the higher is the debt-contracting value of borrower's accounting numbers.

## 2.3. Materials and methods

### 2.3.1. Data profile

The proprietary database used in this study, provided by a Brazilian bank, mainly comprises small loans to SME seeking to finance working capital or capital expenditures of an investment project. The sample is composed by a total of 11,491 original loans with an average amount of $ 64,000 granted to distinct firms with average assets of $ 1.2 million between January 2007 and December 2016. Most of the loans (74.6%) are unsecured in the sense that they do not include collateral. Those without collateral include a personal guarantee instead of collateral. If the borrower fails to repay the loan, the bank has the option of seizing the collateral or, in the case of loans with a personal guarantee only, registering the firm and individuals involved in national credit restriction databases. We did not have access to information on the loans taken at loss, but testimonies provided by the bank's staff inform that it is part of the institution's policy to renegotiate the loan in the event of default. This policy is in line with theoretical predictions and stylized facts showing that banks prefer to renegotiate loans rather than seizing assets or registering the borrower in credit restriction databases.

All loans in the sample were fully repaid or renegotiated – prior or after stated maturity. The bank considers a loan to be renegotiated if it is terminated without being fully repaid and replaced by a new debt contract with any change to one or more of the four main terms of the original agreement: i. interest rate spread, ii. guarantee (whether collateral or

personal guarantee), iii. loan amount, and/or iv. maturity. The database includes a flag informing whether the loan was renegotiated. It also includes information regarding the four main terms of the subsequent new loan, which allows us to discern between favorable and not favorable renegotiation outcomes for borrowers. The bank labeled 9,960 (86.7%) of the loans as fully repaid, whereas 1,531 (13.3%) were labeled as renegotiated. Maturity is the most renegotiated item, being changed in 80% of the renegotiated loans, always extending the original stated maturity. The interest rate spread also changes frequently: 74% of the renegotiated loans had the spread changed, the majority (74%) increasing the original loan spread, while a smaller portion (26%) decreased it. Guarantees are changed in 44% of the contracts, with the majority (88%) increasing the initial collateral requirements. 35% of renegotiated loans increased the original loan amount. No renegotiated contract showed a reduction in the amount originally granted. Table 2.1 gives an overview of the small loan renegotiation profile for SMEs.

Table 2.1
*Small loan renegotiation profile*

| Loan performance | Change type | Spread | Collateral | Maturity | Amount |
|---|---|---|---|---|---|
| Delinquent loans | Increase | 651 | 394 | 701 | 127 |
| | Decrease | 88 | 34 | 0 | 0 |
| Non-delinquent loans | Increase | 193 | 208 | 523 | 410 |
| | Decrease | 207 | 45 | 0 | 0 |
| Total | | 1,139 | 681 | 1,224 | 537 |

*Note*. Overview of the outcomes for the 1,531 loans renegotiated. Increase or decrease in the four main contractual terms compared with the original agreement. Delinquent loans are loans that had any delay or lack of payment after contract inception.

The low proportion of renegotiated loans is in contrast with that found by Roberts and Sufi (2009a), who report that over 90% of private credit agreements between U.S. publicly traded firms and financial institutions are renegotiated prior to their stated maturity. A flag in the database informs that 37.4% of the contracts of the sample experienced some delay in the payment of installments or the respective borrowers missed at least one debt payment during the term of the loan. 22.6% of the loans that registered any kind of delinquency were renegotiated. This percentage is almost three times higher than the 7.8% of renegotiated contracts found among loans that were timely repaid.

Taken together, these findings indicate that – differently from large corporate loans, which are frequently renegotiated outside of financial distress – delinquency is a major driver of renegotiation of small debt contracts. It is also in line with our rationale that, in the absence of ex-ante contingencies that encourage ex-post bank monitoring, the signal that things have gone wrong with the borrower is commonly limited to delinquency events. The 7.8% of

renegotiated loans without delinquency suggests that either the bank noticed something wrong with the contract before maturity or the borrower took the initiative to renegotiate the loan. However, given that the incentive for bank monitoring is scarcer in the case of small loans, we postulate that the borrower's bargaining power explain the renegotiation of these contracts, as exposed in our second hypothesis. The information regarding the subsequent new loan that replaced the renegotiated one allows us to distinguish between borrower favorable and not favorable renegotiation outcomes, as explained in the next subsection. This distinction is necessary to test our third and fourth hypotheses, respectively.

### 2.3.2. Variables operationalization

As explained in the next subsection, we use three regressions to test the six hypotheses of this study. The first one, used for estimating the relation between renegotiation frequency and borrower's delinquency (H1) and bargaining power (H2), has *Reneg* as its dependent variable, which informs whether the loan was renegotiated or not. The second regression, employed to test the third (H3) and fourth (H4) hypothesis, uses a dichotomous variable, *Favorable*, informing whether the loan was renegotiated under favorable conditions to the borrower. We label the renegotiation as favorable to the borrower in each of the situations listed in Table 2.2. The situations listed refer to the conditions of the renegotiated loan compared to the original one.

Table 2.2
*Possible outcomes of borrower favorable renegotiations*

| Interest spread | Collateral | Maturity | Amount | Number of observations |
|---|---|---|---|---|
| Decreases | Unchanged | Unchanged | Unchanged | 0 |
| Decreases | Unchanged | Unchanged | Increases | 0 |
| Decreases | Unchanged | Increases | Unchanged | 62 |
| Decreases | Unchanged | Increases | Increases | 109 |
| Decreases | Decreases | Unchanged | Unchanged | 0 |
| Decreases | Decreases | Unchanged | Increases | 0 |
| Decreases | Decreases | Increases | Unchanged | 0 |
| Decreases | Decreases | Increases | Increases | 26 |
| Unchanged | Unchanged | Unchanged | Increases | 0 |
| Unchanged | Unchanged | Increases | Unchanged | 177 |
| Unchanged | Unchanged | Increases | Increases | 80 |
| Unchanged | Decreases | Unchanged | Unchanged | 0 |
| Unchanged | Decreases | Unchanged | Increases | 0 |
| Unchanged | Decreases | Increases | Unchanged | 5 |
| Unchanged | Decreases | Increases | Increases | 2 |
| | | Total | | 461 |

We recognize that this classification is quite subjective. For example, borrowers may bargain for an interest rate reduction in exchange for additional collateral. This outcome

may be in his best interest and therefore this renegotiation could be labeled as borrower favorable. Nevertheless, we choose to remove as much ambiguity as possible from the analysis by adopting a conservative approach. As Table 2.2 shows, this classification results in 461 borrower-friendly outcomes, equivalent to 30.1% of renegotiations. Seven out of 15 possible borrower friendly outcomes are observed in the sample. The most common borrower-friendly outcome is one in which only the maturity of the original contract is extended upon renegotiation, while the spread, collateral requirements, and original loan amount remain unchanged. The less common borrower-friendly outcome is one in which the collateral requirements of the original contract are reduced, and the maturity and loan amount increase on renegotiation, while the spread remains unchanged.

The third regression, used to test the fifth (H5) and sixth (H6) hypotheses of this study, uses a discrete variable, *Nr_Favorable*, ranging from 0 to 4, to establish the number of amendments made in favor of the borrower in the renegotiated loan. Besides delinquency, captured by a dummy variable (*Delinquency*), informing whether the loan registered a delayed or missing payment before maturity or renegotiation, our main variable of interest is the borrower's bargaining power. We use three proxies for capturing a borrower's bargaining power: i. the natural logarithm of the firm's total assets (*Log Assets*), ii. the number of active loans on behalf of the borrower in the Brazilian financial system (*Outside options*), and iii. the relationship time between the borrower and the bank (*Relationship*). Total assets measure the size of a firm, and firm size has been positively associated with its bargaining power in the financial contracting literature (Cenni et al. 2015; Uchida 2011). The number of active loans on behalf of the firm in the financial system is indicative of alternative sources of financing at its disposal. Theoretically, these outside options are crucial for a firm to credibly threaten to leave its current lender and thereby increase its bargaining power (Rajan 1992). Therefore, the more numerous the firm's financing alternatives, the greater its bargaining power. A longer borrower-lender relationship, in turn, has been traditionally associated with reduced information asymmetry, especially in case of SME, that usually present more informational opacity (Grunert and Norden 2012; Petersen and Rajan 1994). A priori, the information asymmetry reduction should provide the borrower with greater bargaining power (Godlewski 2019). Thus, the duration of the borrower-lender relationship is positively linked to the borrower's bargaining power.

The empirical literature on debt renegotiation has tested the initial terms of the contract as well as measures of the borrower's financial health as potential determinants of

the frequency and outcomes of renegotiation (e.g., Dou 2020; Nikolaev 2018; Roberts and Sufi 2009a). We use these two vectors as control variables. We also control for year and industry fixed effects. Table 2.3 displays a brief description of the computation of each variable.

Table 2.3
*Variables operationalization*

| Variable | Computation |
|---|---|
| Dependent variables | |
| *Reneg* | = 1, if the loan was renegotiated, 0 otherwise |
| *Favorable* | = 1, if the loan was renegotiated on terms favorable to the borrower, 0 otherwise |
| *Nr Favorable* | Number of contract terms renegotiated favorably to the borrower, ranging from 0 to 4. |
| Variables of interest | |
| *Delinquency* | = 1, if the firm registered any delayed or missed payment before maturity or renegotiation, 0 otherwise |
| *Log Assets* | Natural logarithm of total assets |
| *Relationship* | Number of months of borrower-lender relationship |
| *Outside options* | Number of active loans with other banks |
| Control variables | |
| *Spread* | Loan interest rate – Brazilian market interest rate |
| *Collateral* | = 1, if the loan has collateral attached, 0 otherwise |
| *Maturity* | Number of months between loan inception and stated maturity date |
| *Log Amount* | Natural logarithm of loan amount |
| *Log Sales* | Natural logarithm of total sales |
| *Book leverage* | Total debt/Total assets |
| *Liquidity* | Cash and equivalents/Total assets |
| *EBITDA/Assets* | Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA)/Total assets |
| *Debt/EBITDA* | Debt/EBITDA |
| *ROA* | Net income/Total assets |
| *Score* | Firm's credit score attributed by the bank |
| *Restriction* | = 1 if the bank registered any restrictions in relation to the firm, 0 otherwise |
| *Loss* | = 1 if the firm reported a negative profit in the year prior to the loan, 0 otherwise |

*Note. Relationship*, *Outside options*, *Score*, and *Restriction* were measured at the contracting date. All other variables, with the obvious exceptions of *Reneg*, *Delinquency*, contract terms, and post-renegotiation variables, were measured at the end of the year prior to loan inception.

Table 2.4 provides summary statistics for the explanatory variables of the different samples used in this study. Panel A contains summary statistics for the explanatory variables considering the entire database, used to test our first two hypotheses (H1 and H2). The sample is divided between renegotiated and non-renegotiated contracts to provide a better perspective on the influence of variables on frequency of renegotiation. One can see that the average firm with renegotiated loans has larger assets, a longer borrower-lender relationship, and a greater number of alternative financing sources than the average firm with non-renegotiated loans. It also incurs delinquency events more frequently. Interest spread, collateral incidence, loan amount, and maturity are higher for firms with renegotiated loans than for firms with non-renegotiated loans. Panel B contains summary statistics for the explanatory variables considering the subsample of renegotiated loans, used to test hypotheses H3, H4, H5, and H6. This subsample is divided between borrower favorable outcomes and borrower not favorable outcomes, according to the criteria used in the construction of the variable *Favorable* (see Table 2.2). One can see that the average firm that obtains more favorable outcomes in a renegotiation has larger assets, a longer banking relationship, and a greater number of alternative financing sources than the average firm that does not obtain more favorable terms than the original loan. It also incurs less frequent delinquency events, which may be indicative that more frequent delinquencies reduce the firm's bargaining power. Borrowers that obtained more favorable terms on renegotiation also have a lower interest spread and a higher loan amount in the original contract than borrowers that did not obtain the same advantageous outcome in a renegotiation.

Table 2.4
*Summary Statistics*

| Panel A | | | | | | |
|---|---|---|---|---|---|---|
| Variable | Renegotiated | | | Non-renegotiated | | |
| | Mean | Std. Dev. | Median | Mean | Std. Dev. | Median |
| *Delinquency* | 0.63 | 0.48 | 1 | 0.33 | 0.47 | 0 |
| *Assets ($ Mil)* | 1.93 | 1.94 | 1.00 | 1.08 | 1.29 | 0.50 |
| *Relationship* | 10.91 | 6.46 | 10.00 | 8.93 | 5.78 | 7.87 |
| *Outside options* | 16.92 | 6.50 | 18.00 | 13.10 | 8.19 | 13.00 |
| *Spread (bps)* | 13.02 | 6.16 | 11.67 | 11.23 | 5.84 | 10.14 |
| *Collateral* | 0.29 | 0.46 | 0 | 0.25 | 0.43 | 0 |
| *Maturity (months)* | 26.78 | 10.12 | 24.30 | 20.22 | 8.06 | 24.13 |
| *Log Amount ($ Thousand)* | 115.50 | 360.13 | 25.00 | 56.07 | 195.31 | 15.00 |
| *Log Sales ($ Mil)* | 1.77 | 1.37 | 1.26 | 1.55 | 1.28 | 1.07 |
| *Book leverage* | 0.55 | 0.30 | 0.54 | 0.50 | 0.28 | 0.49 |
| *Liquidity* | 0.14 | 0.17 | 0.09 | 0.16 | 0.19 | 0.09 |

| Panel A | | | | | | |
|---|---|---|---|---|---|---|
| Variable | Renegotiated | | | Non-renegotiated | | |
| | Mean | Std. Dev. | Median | Mean | Std. Dev. | Median |
| *EBITDA/Assets* | 0.29 | 0.54 | 0.17 | 0.25 | 0.36 | 0.18 |
| *Debt/EBITDA* | 13.76 | 133.13 | 5.19 | 7.01 | 68.19 | 3.61 |
| *ROA* | 0.24 | 0.52 | 0.13 | 0.21 | 0.47 | 0.14 |
| *Score* | 9.33 | 0.83 | 9.56 | 9.20 | 0.72 | 9.23 |
| *Restriction* | 0.83 | 0.37 | 1 | 0.61 | 0.49 | 1 |
| *Loss* | 0.07 | 0.26 | 0 | 0.07 | 0.26 | 0 |
| Panel B | | | | | | |
| Variable | Borrower favorable | | | Borrower not favorable | | |
| | Mean | Std. Dev. | Median | Mean | Std. Dev. | Median |
| *Delinquency* | 0.46 | 0.50 | 0 | 0.71 | 0.45 | 1 |
| *Assets ($ Mil)* | 2.72 | 2.01 | 2.45 | 1.59 | 1.81 | 0.65 |
| *Relationship* | 13.20 | 6.73 | 12.08 | 9.92 | 6.09 | 8.99 |
| *Outside options* | 19.43 | 6.65 | 20.00 | 15.83 | 6.13 | 16.00 |
| *Spread (bps)* | 12.26 | 5.20 | 11.14 | 13.34 | 6.51 | 11.80 |
| *Collateral* | 0.34 | 0.47 | 0 | 0.27 | 0.45 | 0 |
| *Maturity (months)* | 27.06 | 11.69 | 24.30 | 26.66 | 9.37 | 24.30 |
| *Log Amount ($ Thousands)* | 163.17 | 431.69 | 47.50 | 94.96 | 322.53 | 18.47 |
| *Log Sales ($ Mil)* | 2.28 | 1.29 | 2.78 | 1.54 | 1.35 | 0.89 |
| *Book leverage* | 0.59 | 0.27 | 0.57 | 0.54 | 0.30 | 0.53 |
| *Liquidity* | 0.12 | 0.14 | 0.08 | 0.15 | 0.18 | 0.09 |
| *EBITDA/Assets* | 0.21 | 0.25 | 0.15 | 0.32 | 0.62 | 0.19 |
| *Debt/EBITDA* | 20.96 | 198.73 | 6.69 | 10.65 | 91.33 | 4.48 |
| *ROA* | 0.17 | 0.25 | 0.10 | 0.28 | 0.59 | 0.15 |
| *Score* | 9.30 | 0.69 | 9.36 | 9.35 | 0.88 | 9.65 |
| *Restriction* | 0.84 | 0.37 | 1 | 0.83 | 0.37 | 1 |
| *Loss* | 0.07 | 0.26 | 0 | 0.07 | 0.26 | 0 |

*Note*. Summary statistics for the explanatory variables of the different samples used in this study. Panel A contains summary statistics for the explanatory variables considering the entire database, divided into renegotiated and non-renegotiated loans. Panel B contains summary statistics for the explanatory variables considering the subsample of renegotiated loans, divided into borrower favorable and borrower not favorable outcomes. Check Table 3 for description of variables.

### 2.3.3. Econometric model

We use three equations to test our six hypotheses. We start by adopting a binary-choice regression model, formalizing the decision to renegotiate or not a loan agreement, as a function of covariates. Write this model as:

$$Reneg_i = \mathbf{1}(X_i\beta + u_i \geq 0), \quad (1)$$

where *Reneg* represents a binary variable equal to 1 if the loan was renegotiated and 0 otherwise, $X$ denotes the vector of covariates, as described in Table 3, $\beta$ represents an unknown parameter vector, $u$ denotes an unobserved error term, and $\mathbf{1}(\cdot)$ is an indicator function equal to 1(0) if the inner condition, $X_i\beta + u_i \geq 0$, is true (false). The observational

index $i$ refers to each individual loan contract. The error, $u$, is assumed to follow a normal conditional distribution, which yields a probit model for the conditional probability of renegotiation. Formally,

$$\Pr(Reneg_i = 1|X_i) = \Phi(X_i\beta), \quad (2)$$

where $\Phi(\cdot)$ denotes the standard normal distribution. Eq. (2) is used to test the first two hypotheses. To test the third hypothesis, we only change the dependent variable in Eq. (2):

$$\Pr(Favorable_i = 1|X_i) = \Phi(X_i\beta). \quad (3)$$

To test of the fourth hypothesis, we use a discrete dependent variable. In this case, the simple bivariate probit turns into a multivariate probit. Formally,

$$\Pr(Nr\ Favorable_i = y_i|X_i) = \Phi(X_i\beta), \quad (4)$$

where $y_i$ varies from 0 to 4.

## 2.4. Results and discussion

We begin by examining the factors that influence the frequency of renegotiation in the database provided by the bank. We computed a correlation matrix (Table 2.5) to alleviate concerns related to multicollinearity issues. The variables *Log Sales* and *EBITDA/Assets* were excluded from the specifications tested due to their high correlation with *Log Assets* (0.83) and *ROA* (0.79), respectively. The correlation matrix also suggests caution in using *Log Assets* and *Log Amount* in the same specification of the model to be estimated, as these two variables have a correlation coefficient of 0.75. Considering that *Log Assets* is one of our variables of interest, as well as the importance of *Log Amount* as one of the main contractual terms, we choose to present alternative estimation results in which both variables are tested, but not in the same model specification.

Table 2.5
*Correlation matrix*

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Delinquency (1) | 1.00 | | | | | | | | |
| Log Assets (2) | 0.01 | 1.00 | | | | | | | |
| Relationship (3) | 0.01 | 0.69 | 1.00 | | | | | | |
| Outside options (4) | 0.03 | 0.28 | 0.21 | 1.00 | | | | | |
| Spread (5) | 0.04 | -0.25 | -0.17 | -0.06 | 1.00 | | | | |
| Collateral (6) | 0.01 | 0.32 | 0.22 | 0.08 | -0.08 | 1.00 | | | |
| Maturity (7) | 0.06 | -0.03 | -0.01 | 0.03 | 0.10 | -0.01 | 1.00 | | |
| Log Amount (8) | 0.01 | 0.75 | 0.55 | 0.21 | -0.40 | 0.37 | 0.10 | 1.00 | |
| Log Sales (9) | -0.01 | 0.83 | 0.55 | 0.24 | -0.25 | 0.32 | -0.06 | 0.70 | 1.00 |

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Book leverage (10) | 0.01 | 0.29 | 0.21 | 0.10 | -0.09 | 0.16 | -0.00 | 0.29 | 0.31 |
| Liquidity (11) | -0.02 | -0.20 | -0.14 | -0.04 | 0.04 | -0.11 | -0.02 | -0.14 | -0.14 |
| EBITDA/Assets (12) | 0.01 | -0.29 | -0.20 | -0.08 | 0.06 | -0.09 | 0.05 | -0.21 | -0.19 |
| Debt/EBITDA (13) | -0.01 | 0.05 | 0.03 | 0.03 | -0.01 | 0.03 | 0.03 | 0.06 | 0.03 |
| ROA (14) | 0.01 | -0.21 | -0.16 | -0.06 | 0.05 | -0.07 | 0.03 | -0.16 | -0.15 |
| Score (15) | 0.02 | -0.06 | -0.07 | 0.00 | -0.12 | -0.09 | 0.10 | -0.07 | -0.01 |
| Restriction (16) | 0.04 | 0.12 | 0.09 | 0.04 | 0.01 | -0.02 | 0.09 | 0.03 | 0.09 |
| Loss (17) | -0.00 | 0.04 | 0.04 | 0.01 | -0.00 | -0.00 | 0.02 | 0.07 | -0.02 |
| Variable | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | |
| Book leverage (10) | 1.00 | | | | | | | | |
| Liquidity (11) | -0.11 | 1.00 | | | | | | | |
| EBITDA/Assets (12) | -0.27 | 0.09 | 1.00 | | | | | | |
| Debt/EBITDA (13) | 0.05 | -0.02 | -0.04 | 1.00 | | | | | |
| ROA (14) | -0.24 | 0.06 | 0.79 | -0.02 | 1.00 | | | | |
| Score (15) | -0.07 | 0.07 | 0.05 | -0.01 | 0.04 | 1.00 | | | |
| Restriction (16) | 0.02 | -0.04 | -0.01 | 0.01 | -0.01 | 0.22 | 1.00 | | |
| Loss (17) | 0.25 | -0.02 | -0.23 | -0.02 | -0.20 | -0.06 | -0.00 | 1.00 | |

*Note.* Correlation matrix of the explanatory variables considering the entire database (11,491 observations).

Table 2.6 presents the results of the probit model that tests the influence of some attributes on the probability of renegotiation of small loans for SMEs. We tested five model specifications, starting with the most parsimonious one, in which only our four variables of interest are used as explanatory variables. Next, we added the control variables: firstly, the four main contractual terms; secondly, the remaining controls, which include variables that capture the perspective of the financed firm' financial health prior to the granting of the loan, as well as controls for industry and year fixed effects.

Table 2.6

*Determinants of renegotiation*

| Variable | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Delinquency | 13.682*** | 12.147*** | 12.131*** | 10.974*** | 10.990*** |
| | (0.709)*** | (0.694)*** | (0.698)*** | (0.694)*** | (0.698)*** |
| Log Assets | 1.510*** | | 2.309*** | | 2.124*** |
| | (0.078)*** | | (0.133)*** | | (0.135)*** |
| Relationship | 0.170*** | 0.377*** | 0.132** | 0.294*** | 0.138** |
| | (0.009)*** | (0.022)*** | (0.008)** | (0.019)*** | (0.009)** |
| Outside options | 0.579*** | 0.587*** | 0.525*** | 0.518*** | 0.476*** |
| | (0.030)*** | (0.034)*** | (0.030)*** | (0.033)*** | (0.030)*** |
| Spread | | 0.562*** | 0.570*** | 0.676*** | 0.654*** |
| | | (0.032)*** | (0.033)*** | (0.043)*** | (0.042)*** |
| Collateral | | -0.048 | -0.601 | -0.347 | -0.399 |
| | | (-0.003) | (-0.035) | (-0.022) | (-0.025) |
| Maturity | | 0.782*** | 0.803*** | 0.693*** | 0.722*** |
| | | (0.045)*** | (0.046)*** | (0.044)*** | (0.046)*** |
| Log Amount | | 0.682*** | | 0.962*** | |
| | | (0.039)*** | | (0.061)*** | |
| Book leverage | | | | 4.751*** | 4.191*** |
| | | | | (0.300)*** | (0.266)*** |
| Liquidity | | | | -3.323** | -2.747* |
| | | | | (-0.210)*** | (-0.174)*** |
| Debt/EBITDA | | | | 0.000 | 0.004 |
| | | | | (0.000) | (0.000) |

| Variable | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| ROA | | | | 4.340*** | 5.142*** |
| | | | | (0.274)*** | (0.327)*** |
| Score | | | | -1.098*** | -1.223*** |
| | | | | (-0.069)*** | (-0.078)*** |
| Restriction | | | | 5.884*** | 5.389*** |
| | | | | (0.372)*** | (0.342)*** |
| Loss | | | | -1.451 | -1.073 |
| | | | | (-0.092) | (-0.068) |
| Industry fixed effects | | | | Yes | Yes |
| Year fixed effects | | | | Yes | Yes |

*Note*. The sample consists of 11,491 private credit agreements between a bank and distinct SMEs during the period 2007-2016. The table presents marginal effects and estimated coefficients (in parenthesis) from a bivariate regression of whether or not renegotiation occurs. Average marginal effects are expressed as a percentage. Industry fixed effects correspond to four possible classifications: Manufacture, construction, commerce, and services. Robust estimator of variance used. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively. Diagnostic tests for specification (5): Wald $chi^2$: 1,671.68; p-value: .000; Pseudo R2: .272. Check Table 3 for variable definitions.

The results support our first two hypotheses, H1 and H2. The positive and statistically significant coefficient of *Delinquency* show that the likelihood of renegotiating a small debt contract increases if the borrower delays or misses any debt payment. The variable remains significant in all five model specifications. The average marginal effect of *Delinquency* suggests that, on average, the probability of renegotiation increases by 11% if the borrower incurs a delinquent event, when considering all controls. This makes *Delinquency* the most important attribute of the estimated model to explain renegotiation of small debt contracts. This result is in line with theoretical predictions that point to the non-payment of debt as a major trigger of the shift of contractual control to the lender (Hart and Moore 1998). It also corroborates the prediction that, in the face of default, the creditor prefers to renegotiate the loan instead of seizing assets (Huberman and Kahn 1988a). The positive and statistically significant coefficients of *Log Assets*, *Relationship*, and *Outside options*, in turn, support our second hypothesis that the borrower's bargaining power relate positively to the frequency of renegotiation of small debt contracts. In this sense, they confirm theoretical predictions that claim the bargaining power of the parties as a major driver of financial contracts renegotiation (Berger and Udell 1990; Moraux and Silaghi 2014). This evidence does not change across the five model specifications tested. Taken together, these three variables indicate that larger firms, firms with longer banking relationships, and firms with a larger number of financing alternatives – that is, firms with greater bargaining power – renegotiate small loan contracts more frequently than their peers with less bargaining power. The average marginal effect of *Log Assets* indicates that every additional logarithmic unit of a firm's assets increases the probability of renegotiation by 2.1%, when all other attributes are controlled for. On average, every additional year of bank-

borrower relationship increases the renegotiation probability by 0.4%, and every external financing option augments the same probability by 0.7%. To the best of our knowledge, only *Log Assets* among those three variables had been previously tested by the empirical literature on renegotiation. Dou (2020) finds a negative relationship between the natural logarithm of the firm's assets and the frequency of covenants renegotiation. Nikolaev (2018) finds that the natural logarithm of the firm's assets relate positively to the number of debt renegotiations in any given firm-year. Roberts and Sufi (2009a) do not find any explanatory power of this variable on the probability of renegotiation, but they find that changes in a firm's assets have a slightly significant power to explain the occurrence of renegotiation.

In addition to delinquency events and a firm's bargaining power, the control variables used also contribute to explain the frequency of renegotiation of small debt contracts. Except for collateral, all the other three main contractual terms show positive and statistically significant coefficients. In general, the covariates that aim to capture the firm's financial health before signing the contract signature also impact the likelihood of renegotiation in the sense that firms with better financial perspectives (lower book leverage, larger liquidity, fewer restrictions, and greater credit score assigned by the bank, for example) show lower probability of renegotiating their loans. The importance of the initial debt contract design and *ex-ante* financial figures of the firm to explain the frequency of *ex-post* renegotiation of debt contracts had already been found by previous studies (e.g., Dou 2020; Godlewski 2019; Nikolaev 2018; Roberts 2015).

To triangulate the evidence on the link between renegotiation of small debt contracts and the contracting parties' bargaining power, we proceeded to further analysis of the outcomes of the renegotiation process. In this analysis, we only deal with the subsample of the 1,531 renegotiated loans. Based on the classification outlined in Table 2.2, we labeled 461 of the renegotiation outcomes as borrower favorable. In addition, we counted the number of changes in the four main contractual terms of the loan – that is, the interest spread, the collateral requirements, the stated maturity and the loan amount – that were made in a manner favorable to the borrower. By favorable to the borrower, we mean any of the following possibilities: i. an interest spread decrease, ii. a collateral requirement decrease, iii. an increase in stated maturity, and iv. an increase in loan amount. This means that a renegotiated loan with increased spread, reduced collateral requirements, increased maturity, and no change to the original amount would result in two favorable outcomes for the borrower. The same variables that could cause multicollinearity concerns in the entire dataset

also presented the same correlation issues in the subsample (see Table 2.7) and were kept aside.

Table 2.7

*Correlation matrix – renegotiated contracts sample*

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Delinquency (1) | 1.00 | | | | | | | | |
| Log Assets (2) | -0.13 | 1.00 | | | | | | | |
| Relationship (3) | -0.10 | 0.69 | 1.00 | | | | | | |
| Outside options (4) | -0.21 | 0.52 | 0.39 | 1.00 | | | | | |
| Spread (5) | 0.05 | -0.28 | -0.18 | -0.15 | 1.00 | | | | |
| Collateral (6) | -0.02 | 0.29 | 0.21 | 0.13 | -0.13 | 1.00 | | | |
| Maturity (7) | 0.03 | 0.05 | 0.08 | 0.01 | -0.02 | 0.06 | 1.00 | | |
| Log Amount (8) | -0.08 | 0.74 | 0.55 | 0.37 | -0.40 | 0.41 | 0.30 | 1.00 | |
| Log Sales (9) | -0.12 | 0.91 | 0.63 | 0.48 | -0.28 | 0.30 | 0.05 | 0.74 | 1.00 |
| Book leverage (10) | -0.03 | 0.34 | 0.25 | 0.19 | -0.10 | 0.11 | 0.04 | 0.28 | 0.38 |
| Liquidity (11) | 0.02 | -0.22 | -0.12 | -0.10 | 0.15 | -0.12 | 0.00 | -0.22 | -0.21 |
| EBITDA/Assets (12) | 0.03 | -0.39 | -0.25 | -0.20 | 0.08 | -0.10 | -0.00 | -0.22 | -0.29 |
| Debt/EBITDA (13) | -0.03 | 0.09 | 0.05 | 0.05 | 0.02 | 0.06 | 0.05 | 0.13 | 0.08 |
| ROA (14) | 0.04 | -0.39 | -0.25 | -0.21 | 0.08 | -0.10 | 0.01 | -0.22 | -0.30 |
| Score (15) | -0.00 | -0.12 | -0.11 | -0.06 | -0.11 | -0.07 | 0.07 | -0.16 | -0.08 |
| Restriction (16) | 0.00 | 0.02 | -0.00 | -0.00 | 0.02 | -0.03 | -0.12 | -0.11 | -0.03 |
| Loss (17) | -0.04 | 0.07 | 0.06 | 0.05 | 0.06 | 0.01 | 0.07 | 0.08 | 0.07 |
| Variable | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | |
| Book leverage (10) | 1.00 | | | | | | | | |
| Liquidity (11) | -0.08 | 1.00 | | | | | | | |
| EBITDA/Assets (12) | -0.26 | 0.09 | 1.00 | | | | | | |
| Debt/EBITDA (13) | 0.06 | -0.03 | -0.04 | 1.00 | | | | | |
| ROA (14) | -0.28 | 0.11 | 0.97 | -0.03 | 1.00 | | | | |
| Score (15) | -0.07 | 0.08 | 0.08 | -0.06 | 0.09 | 1.00 | | | |
| Restriction (16) | 0.02 | 0.04 | -0.01 | -0.01 | -0.01 | 0.10 | 1.00 | | |
| Loss (17) | 0.30 | 0.03 | -0.16 | 0.01 | -0.17 | -0.07 | 0.05 | 1.00 | |

*Note*. Correlation matrix of the explanatory variables considering the subsample of renegotiated loans only (1,531 observations)

The test of the next four hypotheses of this study revolves around the idea that the result of the renegotiation game in small debt contracts is the result of the clash between the bargaining powers of the contracting parties. Theoretically, this applies not only to small loans, but to all types of contracts. However, in this study we claim that, in the absence of *ex-ante* contingencies like covenants and the like, delinquency events are a major determinant of the shift control towards the lender, and, ultimately, what determines the bank's bargaining power when renegotiating a small loan. Table 2.8 presents the results of two approaches trying to link bargaining powers to renegotiation of small debt contracts. Before performing the estimations, we checked the correlation matrix of the explanatory variables in the subsample. Panel A presents the results of a probit estimation, in which the bivariate dependent variable, *Favorable*, informs whether the outcome of the renegotiation was borrower-friendly or not, following the concept outlined in the previous Section. Panel B presents the results of an ordered probit estimation, in which the multivariate dependent

variable, *Nr Favorable*, informs the number of main contractual terms renegotiated in a borrower-friendly way, ranging from 0 to 4.

Table 2.8
*Determinants of renegotiation outcomes*

| PANEL A: Renegotiation outcome favorable or not favorable to the borrower | | | | | |
|---|---|---|---|---|---|
| Variable | (1) | (2) | (3) | (4) | (5) |
| Delinquency | -16.072*** | -16.428*** | -16.096*** | -16.501*** | -16.216*** |
| | (-0.520)*** | (-0.527)*** | (-0.521)*** | (-0.533)*** | (-0.527)*** |
| Log Assets | 4.807*** | | 4.868*** | | 4.837*** |
| | (0.156)*** | | (0.158)*** | | (0.157)*** |
| Relationship | 0.409* | 0.803*** | 0.403* | 0.768*** | 0.425* |
| | (0.013)* | (0.026)*** | (0.013)* | (0.025)*** | (0.014)* |
| Outside options | 0.706*** | 0.957*** | 0.709*** | 0.922*** | 0.724*** |
| | (0.023)*** | (0.031)*** | (0.023)*** | (0.030)*** | (0.024)*** |
| Spread | | -0.030 | -0.004 | 0.029 | 0.049 |
| | | (-0.001) | (-0.000) | (0.001) | (0.002) |
| Collateral | | -0.763 | -0.894 | -0.872 | -0.997 |
| | | (-0.024) | (-0.029) | (-0.028) | (-0.032) |
| Maturity | | -0.020 | 0.054 | 0.013 | 0.037 |
| | | (-0.001) | (0.002) | (0.000) | (0.001) |
| Log Amount | | 1.764* | | 1.431 | |
| | | (0.057)* | | (0.046) | |
| Book leverage | | | | -0.311 | -2.463 |
| | | | | (-0.010) | (-0.080) |
| Liquidity | | | | -7.041 | -5.659 |
| | | | | (-0.227) | (-0.184) |
| Debt/EBITDA | | | | 0.002 | 0.002 |
| | | | | (0.000) | (0.000) |
| ROA | | | | -3.336 | -0.698 |
| | | | | (-0.108) | (-0.023) |
| Score | | | | 0.432 | 0.128 |
| | | | | (0.014) | (0.004) |
| Restriction | | | | 2.828 | 1.228 |
| | | | | (0.091) | (0.040) |
| Loss | | | | -4.963 | -4.213 |
| | | | | (-0.160) | (-0.137) |
| Industry fixed effects | | | | Yes | Yes |
| Year fixed effects | | | | Yes | Yes |
| PANEL B: Number of items favorable to the borrower | | | | | |
| Variable | (1) | (2) | (3) | (4) | (5) |
| Delinquency | -15.204*** | -16.014*** | -15.385*** | -16.008*** | -15.456*** |
| | (-1.883)*** | (-1.894)*** | (-1.901)*** | (-1.913)*** | (-1.921)*** |
| Log Assets | 1.916*** | | 1.690*** | | 1.611*** |
| | (0.237)*** | | (0.210)*** | | (0.200)*** |
| Relationship | 0.770*** | 0.929*** | 0.773*** | 0.933*** | 0.793*** |
| | (0.095)*** | (0.110)*** | (0.095)*** | (0.112)*** | (0.099)*** |
| Outside options | 0.821*** | 0.935*** | 0.831*** | 0.928*** | 0.842*** |
| | (0.102)*** | (0.111)*** | (0.103)*** | (0.111)*** | (0.105)*** |
| Spread | | -0.042 | -0.058 | -0.052 | -0.064 |
| | | (-0.005) | (-0.007) | (-0.621) | (-0.008) |
| Collateral | | 1.763*** | 1.897*** | 1.668*** | 1.690*** |
| | | (0.209)*** | (0.234)*** | (0.199)*** | (0.210)*** |
| Maturity | | -0.012 | 0.028 | -0.009 | 0.012 |
| | | (-0.001) | (0.003) | (-0.001) | (0.001) |
| Log Amount | | 0.922*** | | 0.699*** | |
| | | (0.109)*** | | (0.083)*** | |

| | | |
|---|---|---|
| Book leverage | -0.005 | -0.558 |
| | (-0.001) | (-0.069) |
| Liquidity | -5.401*** | -4.864*** |
| | (-0.645)*** | (-0.605)*** |
| Debt/EBITDA | 0.006*** | 0.005*** |
| | (0.001)*** | (0.001)*** |
| ROA | -0.638 | 0.106 |
| | (-0.076) | (0.013) |
| Score | -0.370 | -0.534 |
| | (-0.044) | (-0.066) |
| Restriction | 0.446 | -0.143 |
| | (0.053) | (-0.018) |
| Loss | 0.145 | 0.385 |
| | (0.017) | (0.048) |
| Industry fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |

*Note*. The subsample consists of 1,531 renegotiated private credit agreements between a bank and distinct SMEs during the period 2007-2016. Panel A presents marginal effects and estimated coefficients (in parenthesis) from a bivariate regression of whether or not the renegotiation outcome favors the borrower. Panel B presents estimated coefficients (in parenthesis) from an ordered probit in which the dependent variable is the number of original contract items renegotiated favorably to the borrower, which ranges from 0 to 4. Panel B also presents average marginal effects referring to the probability that 2 original contract items will be renegotiated in a borrower-friendly way. Average marginal effects are expressed as a percentage in both Panels. Industry fixed effects correspond to four possible classifications: Manufacture, construction, commerce, and services. Robust estimator of variance used. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively. Diagnostic tests for specification (5) in Panel A: Wald chi2: 188.90; p-value: .000; Pseudo R2: .113. Diagnostic tests for specification (5) in Panel B: Wald chi2: 866.63; p-value: .000; Pseudo R2: .432. Check Table 3 for variable definitions.

In both panels, the coefficients of our variables of interest offer support to our next four hypotheses. One can see that *Delinquency*, *Log Assets*, *Relationship*, and *Outside options* remain statistically significant across all model specifications. In Panel A, all control variables are not statistically significant, except for model (2), in which *Log Amount* takes the place of *Log Assets* and shows some significance. However, this may be explained by the absence of *Log Assets* in the model, and by the capture of the effect of *Log Assets* by *Log Amount* through the correlation between the two variables. Unlike the first estimation, in which both the initial contractual design and the firm's financial health perspective seemed to explain the likelihood of renegotiation, when it comes to define whether the outcome will be borrower-friendly or not, the parties' bargaining powers are apparently all that matters. *Delinquency*, which had a positive sign in the previous estimate, relating positively to the renegotiation likelihood, changes its sign in the new estimations, suggesting that any delay or missed debt payment strengthens the bank's bargaining power in the renegotiation game. A negative relationship between this variable and *Favorable* indicates that the bank takes advantage of delinquent events to reduce the frequency of borrower-friendly outcomes in the renegotiation process. A negative relationship between *Delinquency* and *Nr Favorable* suggests that, in the event of delinquency, not only is the frequency of borrower-friendly outcomes reduced, but also the bank tends to make fewer concessions to the borrower. Table

2.9 provides an additional illustration of this argument. One can see that even in the outcomes labeled as borrower-friendly the bank asserts its bargaining power in loan renegotiations in which borrower delinquency events were observed, reducing the number of key contractual terms changed in favor of the borrower. The average number of key contractual terms renegotiated in a borrower-friendly way is higher in the absence of delinquency events, when then the bank's bargaining power is possibly lower.

Table 2.9
*Distribution of renegotiation outcomes*

| Average number of key contractual terms renegotiated in favor of the borrower | Borrower favorable | | Borrower not favorable | |
|---|---|---|---|---|
| | Delinquent loans | Non delinquent loans | Delinquent loans | Non delinquent loans |
| | 1.35 | 2.50 | 0.87 | 1.82 |

The table shows the average number of key contractual terms renegotiated in favor of the borrower in other subsamples of the 461 renegotiation outcomes labeled as borrower-friendly.

The positive and statistically significant sign of *Log Assets*, *Relationship*, and *Outside options* in both panels, in turn, suggests that the borrower's bargaining power is opposed to that of the bank, forcing a greater number of concessions from the latter (Panel A), and more frequently (Panel A). Those with larger assets, longer banking relationships, and more external financing alternatives not only more often obtain a favorable outcome, but they also obtain a greater number of terms renegotiated in their favor. However, it can be noted that, from an economic perspective, the average partial effect of *Delinquency* on the renegotiation outcomes seems to outweigh the average partial effects of borrower's bargaining powers, even if considering the sum of the effects of the three proxies used to capture the borrower's bargaining power. This may be indicative of the fact that, regardless of the borrower's bargaining power, the bank's prevails, at least in cases of delinquency events.[16]

The statistically significant sign of the coefficients of the variables *Delinquency*, *Log Assets*, *Relationship*, and *Outside options* support our hypotheses H3, H4, H5, and H6. It also confirm theoretical predictions that point out the bargaining power of the contracting parties as one of the main attributes that determine the renegotiation outcomes (e.g., Aghion et al. 1994; Hart and Moore 1988, 1998; Huberman and Kahn 1988a; Rajan 1992; Rajan and Winton 1995). They are also in line with previous studies that address the parties' bargaining

[16] It should be borne in mind that it may be in the bank's interest to make concessions to the borrower even in a situation where the bank's bargaining power is absolute, in order to increase the prospect of recovering the funds granted.

power only tangentially. For example, Godlewski (2019) argue that the greater the bargaining power of the bank in relation to the borrower, the fewer the number of amendments made in a loan renegotiation. The author finds a positive sign for maturity, claiming that the longer the maturity, the smaller the information asymmetries and, therefore, the greater the borrower's bargaining power. Conversely, the negative sign for secured loans is explained by the greater bargaining power of the bank in the presence of collateral, which would reduce the number of amendments in a renegotiation. Although we did not find explanatory power of maturity for renegotiation outcomes – and despite the sign of *Collateral* have been positive in Panel B –, our results provide additional evidence to the importance attributed by the Author to the bargaining power of the contracting parties.

## 2.5. Concluding remarks

The literature on financial contracting that deals with renegotiation of debt contracts has grown substantially in recent years. This study contributes to enrich this literature by examining the role of contracting parties' bargaining power in explaining the renegotiation process of small debt contracts. Previous studies have analyzed the renegotiation of large loans to publicly listed companies, in which *ex-ante* contingencies like covenants allocate control rights in a state-contingent way, making renegotiation of these kind of loans much more common in contexts outside of financial distress. A distinctive feature of this study is that we use a novel sample of debt contracts, composed of small loans that do not include *ex-ante* contingencies in their design. We hypothesize and provide evidence that, in the absence of such contingencies, a major – and possibly single – driver of shift of control towards the creditor is a delinquency event, that is, a delayed or missed debt payment by the borrower. In such case, the bank's bargaining power is increased, and the outcome of the renegotiation tends to be less favorable to the borrower than in the absence of delinquency events. We also argue and provide evidence that the borrower's bargaining power plays a significant role in explaining the frequency and the outcome of renegotiation of small debt contracts.

We find that, in fact, the frequency of renegotiation of small loans is much lower than that observed in the context of large debt agreements. We claim that this is explained by: i. the lack of *ex-ante* contingencies, which reduces the bank's control and bargaining power outside of financial distress, and ii. the lower bargaining power of SMEs compared to large public companies. We use three proxies for capturing the borrower's bargaining

power: Their total assets, the length of bank-borrower relationship, and the number of financing alternatives available to the borrower. We confirm the relevance of these proxies and borrower delinquency to explain the process of renegotiating these small debt contracts through three regressions. In the first one, we deal with the frequency of renegotiation. We find that delinquent firms and firms with larger assets, lengthier bank-borrower relationships, and more financing alternatives are more likely to renegotiate their small loans. To confirm the hypothesis that the contracting parties' bargaining power governs the entire process of renegotiating small debt contracts, we also investigate the outcomes of renegotiation. We find that borrower delinquency events reduce the probability that the renegotiation will end up in a borrower-friendly way, while firms with higher bargaining power increase this likelihood. Delinquency events also reduce the number of key contract terms (interest spread, collateral requirements, maturity, and loan amount) renegotiated in a favorable way for the borrower, while the greater the firm's bargaining power, the greater the number of key terms renegotiated in a borrower-friendly way.

These findings are consistent with theoretical predictions that the contracting parties' bargaining power governs the renegotiation process. This is a distinctive contribution of this study to the financial contracting literature. To the best of our knowledge, the related empirical literature has not yet properly tested parties' bargaining power proxies when investigating the determinants of the renegotiation of debt contracts.

# Chapter 3: Monitoring microcredit loans and repayment performance: Evidence from Brazil

**Abstract**

Microcredit has grown tremendously, since many policymakers regard them as effective tools for reducing poverty. In this context, repayment performance is crucial to ensure the sustainability of microfinance institutions and the continuity of microcredit policies. This study assesses the impact of the monitoring role of loan officers on the repayment performance of microcredit loans. To this end, the study uses a dataset of 9,365 visits scheduled by loan officers to meet borrowers in Brazil. We divide borrowers into treatment and control groups according to the visit confirmation and analyse the treatment effects on the treated in terms of late payments using propensity score matching. The results indicate that the lack of face-to-face meetings with borrowers significantly affects the punctuality of loan payments, thus increasing potential delay. In conclusion, microfinance institutions should be cautious when considering cost reduction by minimising or eliminating the face-to-face monitoring carried out by loan officers.

**Keywords**: microcredit loans; repayment performance; monitoring; loan officer; microfinance institutions; propensity score.

## 3.1. Introduction

From 2009 to 2018, the number of active microcredit clients increased by 43% globally, that is, from 98 million to 140 million (Convergences, 2019). This growth is partly explained by the enthusiasm with which policymakers have received evidence of the role of microcredit in effectively reducing poverty (Imai *et al*., 2010; Khandker, 2005). To maintain this growth and the enthusiasm of policymakers, microfinance institutions (MFIs) should establish social goals without losing sight of their financial sustainability, since the development of microcredit programmes is possible only if there is a supply chain. In this sense, scholars have paid special attention to both the social performance (e.g., Bibi *et al*., 2018; D'Espallier, Guérin, & Mersland, 2013; Dorfleitner, Priberny, & Röhe, 2017; Rahman, Luo, & Minjuan, 2015) and financial performance (e.g., Adusei, Akomea, & Poku,

2017; García-Rodríguez *et al*., 2019; Saint-Fernandez, Torre-Olmo, & Lopez-Gutierrez, 2015; Zamore, 2018) of MFIs.[17] Although research on these two dimensions is growing, it is hitherto unclear how loan officers contribute to maintaining a high repayment rate and help MFIs achieve financial sustainability.[18]

Granting credit to low-income borrowers is more expensive than granting credit to high-income ones because the former have no assets to pledge as collateral, nor do they have accurate data on their incomes. Thus, they are riskier borrowers, and have more opaque information about their ability to repay loans. This is why screening and monitoring borrowers requires more resources from an MFI than from traditional banks, which deliver credit to clients with greater purchasing power and collateral assets. One of the main tools used by MFIs to address the informational asymmetry problems is the group lending model (Ghatak, 1999, 2000; Morduch, 1999). Under this model, MFIs transfer the cost of identifying and screening clients to a group whose members are encouraged to evaluate and monitor each other through a joint responsibility scheme for repaying loans. If the group defaults payments, they are denied future loans until outstanding loans are settled.

The role of the joint responsibility lending scheme in reducing screening and monitoring costs and explaining the high repayment rates of microcredit has been extensively investigated.[19] However, the role of loan officers in reducing the likelihood of default has been much less studied. This results from the prominence in the literature of the group lending model in mitigating *ex-ante* (e.g., Ghatak, 1999, 2000; Stiglitz, 1990) and *ex-post* moral hazard problems (e.g., Besley & Coate, 1995). This prominence suggests that the monitoring role of loan officers is less important than peer monitoring. It follows that loan officers are an operational resource that can be saved (Sharma *et al*., 2017) to boost the financial sustainability of MFIs. This reasoning can explain initiatives, such as that of the Brazilian government, which has been altering the country's legislation to eliminate the hitherto mandatory face-to-face contact performed by loan officers, replacing it with digital solutions.[20]

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[17] For a literature review of MFI's social and financial performance, see, for example, Hermes and Hudon (2018).

[18] Loan officers are frontline employees of the MFIs; specifically, they are the link between the borrower and the institution, mediating transactions, and interacting with clients. Other terms include credit officers, field staff, and fieldworkers. This study adopts the term 'loan officer'.

[19] For a literature review on the group lending model and the joint responsibility scheme see, for example, Rathore (2017).

[20] Law 11,110 instituted the National Microcredit Programme in Brazil in 2005, requiring MFIs to maintain face-to-face contact with the borrowers. Law 13,636 limited this obligation to the first meeting between the loan officer and the borrower in 2018. In 2020, Law 13,999 completely abolished the need for face-to-face meetings between the loan officer and borrowers, making it possible for MFIs to use digital assistance.

However, the characteristics of the tasks performed by loan officers suggest their relevance in guaranteeing the quality of credit portfolios. Specifically, loan officers mediate the relationship between MFIs and borrowers, develop special relationships with the latter, and often play other roles, such as those of councillors and conflict mediators (Ito, 2003). This intense proximity between the lenders and borrowers directly interferes with the default level (Drexler & Schoar, 2014; Schoar, 2012). Additionally, the collection of overdue payments is often a main responsibility of loan officers (Dixon, Ritchie, & Siwale, 2007; Siwale & Ritchie, 2012).

This study contributes to the limited literature on microcredit loan officers by investigating whether they are expendable or indispensable in monitoring borrowers and, consequently, in maintaining high repayment performance for microcredit loans and the MFIs financial sustainability. To this end, we use data from a large MFI in Brazil, so as to verify empirically whether the lack of face-to-face meetings with borrowers has a significant impact on the number of days of overdue payment. Previous studies on the benefits of group lending schemes have generally neglected the role of loan officers. Some exceptions are Van den Berg, Lensink, & Servin (2015), Inekwe (2019), and Tchakoute-Tchuigoua and Soumaré (2019). For instance, Van den Berg, Lensink, & Servin (2015) argued that loan officers play a crucial role in increasing the loan repayment rates, but also admitted that they could not analyse the effects of the direct monitoring of loan officers based on their dataset. Inekwe (2019) confirmed that the total number of loan officers in the institution and the number of borrowers per loan officer are robust variables that explain the credit risk of MFIs. Tchakoute-Tchuigoua and Soumaré (2019) concluded that delegating the credit decisions to loan officers increases the reach of MFIs without deteriorating the quality of their loan portfolios. While these studies highlight the importance of loan officers in maintaining portfolio quality, none observe the monitoring process directly. This study fills this gap and adds to the literature on microcredit and on bank monitoring.

This study also provides policymakers with useful insights on the impact of loan officers' work, which can help improve the design of regulatory frameworks to promote microcredit expansion. MFIs will also profit from unprecedented information on the importance of loan officers in guaranteeing the quality of their loan portfolios.

The remainder of this paper is organized as follows. Section two presents the theoretical background, emphasizing peer and loan officer monitoring contributions to increase repayment performance. Section three describes the research design (data, methods, and variables), and Section four presents the empirical results. Section five discusses the

results considering previous literature. Section six summarizes the main conclusions, mentions the limitations of the study, and suggests future research.

## 3.2. Theoretical background

The success of microcredit programmes, such as that of Grameen Bank, has inspired the study of group lending schemes.[21] Some studies argue that joint responsibility for a loan motivates group members to pre-select those individuals who will join the scheme. Once the group is formed and a loan is granted, the group members monitor each other (e.g., Besley & Coate, 1995; Ghatak, 1999, 2000). Stiglitz (1990) was a pioneer in arguing that penalising group members who are in a good position to monitor a borrower in case he/she goes bankrupt, encourages mutual monitoring. Joint responsibility also motivates the formation of groups with similar risk characteristics. According to Ghatak (1999, 2000), the joint responsibility schemes used by MFIs lead to positive assortative matching in the formation of the group. This results in the mitigation of *ex-ante* moral hazard problems and, consequently, in increased repayment rates. Thus, group lending appears to be a simple solution that exploits local information to mitigate the credit market failures caused by the asymmetric information between borrowers and lenders, regarding the viability of financed projects (Ghatak, 2000).

One second benefit lies in the mitigation of *ex-post* moral hazard problems. For a classic individual loan agreement, in case of default, the sanctions are reduced to the penalties applied by the bank. For group lending, there is also the social sanction of group members, which, in the case of communities with a high degree of social cohesion, can constitute a powerful incentive mechanism for repayment (Besley & Coate, 1995). Faced with the possibility of losing access to future credit in the event of default, members are encouraged to monitor their peers and oblige them to repay. This joint responsibility results in saving resources that would otherwise be used by the lenders in monitoring and generates a cost-efficient monitoring system (Varian, 1990).

Based on these theoretical arguments, several studies have investigated the impact of peer monitoring on microcredit repayment rates. For example, Wydick (1999) conducted empirical tests based on data from 137 group loans in Guatemala and showed that the members of groups that work further away from other members show lower default rates,

[21] Grameen Bank is a microfinance organisation and community development bank founded in Bangladesh in 1976. It grants small loans to the impoverished without requiring collateral by means of joint responsibility schemes.

while groups that demonstrate knowledge of the sales of other members exhibit higher repayment rates. These results suggest that peer monitoring significantly improves reimbursement rates through stimulating intra-group insurance. Kritikos and Vigenina (2005) examine what factors improve and what factors have no measurable or even a counterproductive effect on loan repayment. Using the frequency of meetings between group members as a proxy for peer monitoring, these Authors provided evidence that repayment rates improve significantly if members monitor each other more intensively. Karlan (2007) exploits a quasi-random group formation process to find evidence of peers successfully monitoring and enforcing joint-liability loans. The Author showed that the geographical distance between group members affects reimbursement: the greater the fraction of members of the group that lives within a 10-minute walk from each other, the lower the default rates. Carpenter and Williams (2014) conducted a field experiment in Paraguay: treatment group members received a sum of money that could be spent on obtaining information about the other members of the group, and the remainder could be kept for themselves. The decision to 'buy' this information is the proxy used for costly peer monitoring. The authors showed that repayment rates are higher in groups where members decided to invest in monitoring their peers.

These empirical studies indicate that repayment is optimised where peer monitoring is in effect. Nonetheless, several studies question the effectiveness of group loan schemes in encouraging peer monitoring. The basic peer monitoring model developed by Stiglitz (1990) assumes that the information each member of the group has about the other is essentially costless. However, if monitoring is costly, group members should receive some incentive to monitor each other; otherwise, monitoring will not be carried out in practice (Ghatak & Guinnane, 1999). Further, Chowdhury (2005) developed a simple theoretical model based on peer monitoring and moral hazard. The Author demonstrates that group loan schemes involve a serious under-monitoring problem – with the borrowers investing in undesirable projects – in the absence of sequential financing or monitoring by MFIs. Armendáriz De Aghion and Morduch (2000) drew attention to the fact that many studies have focused on joint responsibility and ignored other characteristics of microcredit programmes that also result in high repayment rates, such as direct monitoring by MFIs. According to these Authors, direct monitoring by MFIs is an example of a mechanism that allows microcredit programmes to generate high repayment rates from borrowers without the necessity of collateral and without resorting to group lending arrangements or joint liability schemes.

The empirical literature offers evidence that peer monitoring is not necessarily present for joint responsibility arrangements. For instance, Hermes, Lensink, & Mehrteab (2006) analysed data from an extensive questionnaire held in Eritrea among participants of 102 groups and suggested that borrowers choose to delegate monitoring activities to only one of the group members, typically the leader. Such delegated monitoring may be more cost-effective from the borrower's viewpoint than peer monitoring. If peer monitoring is costly, it can be argued that group members have an incentive to delegate the monitoring to third parties, such as MFIs' staff. Similarly, Kritikos and Vigenina (2005) collected testimonials from practitioners who claimed that high reimbursement rates only occur because of the complementary role that loan officers play in monitoring members. Jain (1996) claims that factors that are not considered in theoretical models, like the collection effort performed by loan officers, might be the true explanation for the MFIs high reimbursement rates.

Loan officers are at the frontline of MFIs' operations, thus maintaining direct contact with borrowers through regular visits to their businesses (Chakravarty & Pylypiv, 2017). In fieldwork conducted at Grameen Bank, Ito (2003) reported that loan officers often play other roles such as village councillors, money managers, and conflict mediators. The Author calls "social capital" the aspects regarding social relationships that emerge between loan officers and borrowers. Given that loan officers provide a link between borrowers and MFIs, it is natural to expect that their work will affect the group's operating dynamics, including its repayment performance. In another fieldwork conducted in India, Kar (2013) described the role of collecting money performed by loan officers in group meetings. According to Fisher and Sriram (2002), loan officers have three main roles in microcredit: (i) they are fundamental to overcoming clients' reluctance to participate in lending groups; (ii) they reduce the probability of default, and (iii) they guarantee high-quality services. This default reduction has been highlighted in several empirical studies. In a qualitative study conducted in Zambia, Siwale and Ritchie (2012) found that loan officers act more as 'repayment agents' and 'debt collectors' than as development facilitators for the poor. Siwale (2016) reports that loan officers manage every step of a loan's process, including the recruitment, screening, and training of borrowers. Loan officers also follow up repayments, and their constant interaction with borrowers is crucial to ensure loan repayment and maintain the MFI portfolio quality (Siwale, 2016).

A few quantitative studies corroborate the hypothesis that these professionals actively monitor borrowers and reduce delinquency rates. For instance, Inekwe (2019) used

data on 1,234 firms in 106 countries to investigate the determinants of default for MFIs. Specifically, the author examined the importance of 42 variables in explaining default risk. The Author's results from the modeling of model uncertainty reveal that the average number of borrowers per loan officer and the total number of loan officers for an MFI are robust variables that explain repayment rates. Tchakoute-Tchuigoua and Soumaré (2019) investigated the effects of loan approval by loan officers on MFI portfolio quality in 70 countries. Their results showed that allocating decision-making authority to the loan officer increases the outreach of the MFI without altering its loan portfolio quality.

The literature on relationship lending also suggests that loan officers contribute to the high microcredit repayment rates. For example, in a randomised experiment conducted at a large Indian commercial bank, Schoar (2012) argues that personal interactions between borrowers and loan officers of banks reduce the borrower's willingness to defaut. The Author found that borrowers who are regularly called by a relationship manager show better repayment behaviour than those who either receive no follow-up or only receive follow-up calls from the bank when they are delinquent. Similarly, Drexler and Schoar (2014) argued that the employee turnover has a cost that is dependent on the firm's planning horizons and the departing employee's incentives to transfer information. The Authors showed that the borrowers of a Chilean bank whose loan officers are on leave are more likely to miss payments or default. In their study on the value of the relationship between microcredit loan officers and borrowers in Mexico, Canales and Greenberg (2016) argued that loan officers who employ consistent relational styles improve loan outcomes. In addition, they show that negative effects of loan officer turnover can be mitigated by replacing professionals who are fired with other loan officers who employ reoccurring patterns of interaction with borrowers. This literature stream suggests that the repayment performance cannot be fully attributed to peer monitoring alone, without MFI interference. If this is the case, the recent changes in Brazilian legislation, which removed the legal obligation of loan officers to have face-to-face contact with the borrowers, introduce a negative incentive for MFIs, as they signal that the monitoring task performed by loan officers is expendable. Ultimately, this incentive can compromise the high microcredit repayment rates in Brazil and threaten the financial sustainability of the country's MFIs. We contribute to the discussion of this issue by investigating whether the lack of on-site monitoring carried out by loan officers influences the timeliness of repayment of microcredit loans.

## 3.3. Materials and methods

### 3.3.1. Data

Data were obtained from a large microfinance institution in the north-eastern region of Brazil, one of the least developed regions in the country. The institution grants loans in the average amount of US$ 480 that are intended for financing working capital or capital expenditures; it does not offer consumer loans. The average interest rate charged is 33% per annum. Around 80% of the loans are in the form of group lending with joint responsibility. Lending groups are gateways for borrowers to access the institution. The groups are composed of three to ten micro-entrepreneurs who know each other and work closely, mostly in urban areas, usually performing commercial activities and services.

Loan officers promote the institution and inform borrowers about the format of group loans through face-to-face meetings. Borrowers are free to choose group members. The loan officer collects data on the borrowers' micro-businesses, their working capital or capital expenditure needs, and their ability to repay the loan. After data collection, the loan officer meets with the group and emphasises the need for mutual trust and joint responsibility to repay the loan. Once the loan is granted, the loan officer is responsible for monitoring and renewing it. Given the high average number of borrowers per loan officer (around 700), in practice, the group is only visited again if it incurs a late payment or when the loan is renewed, which happens six months after granting, on average. In this visit, the loan officer analyses the investment made with the borrowed funds and highlights the penalties in case of default. These professionals receive an average monthly salary of USD 500.

As of June 2019, loan officers had to schedule their face-to-face meetings with overdue loan borrowers. The purpose of these meetings was to monitor whether the borrowed funds had in fact been invested in the microbusiness, as well as to ensure that the payment is made on time. We accessed data on the visits scheduled between June 2019 and January 2020, as the visits scheduled after January 2020 were compromised by the COVID-19 outbreak. We also had access to data informing whether the visit was carried out as scheduled. The final dataset comprised 9,365 meetings scheduled with different clients participating in different lending groups, of which 1,256 (13.4%) were actually held.

### 3.3.2. Methods

To assess the causal effect of the absence of face-to-face meetings in microcredit repayment performance, we follow the Roy-Rubin model (Roy, 1951; Rubin, 1973). Under

this approach, two groups are compared: the treatment group, composed of individuals who participated in the treatment, and the control group, composed of individuals who did not participate. In this study, the treatment group comprises borrowers who were not visited (8,109 borrowers) by the loan officer as scheduled, while the control group comprises borrowers who were indeed visited (1,256 borrowers). Two reasons justify this distribution. Firstly, we are interested in assessing the impact of *not receiving* a visit by the loan officer on repayment punctuality. Secondly, the dataset shows that most scheduled visits (86.6%) are indeed performed, making it a lot easier to find good matches in the control group if it is represented by borrowers who were visited. The treatment effect ($\tau_i$) for an individual *i* can be computed as:

$$\tau_i = Y_i(1) - Y_i(0) \quad (1)$$

We are interested in determining the average treatment effect on the treated (ATT). In this study, the ATT is defined as the expected value of the difference in the outcome variable with $[Y_i(1)]$ and without $[Y_i(0)]$ visit for those not visited as scheduled by the loan officer. It can be written as:

$$\tau_{ATT} = E[Y_i(1)|D_i = 1] - E[Y_i(0)|D_i = 1] \quad (2)$$

The outcome variable is computed as follows: the number of days in arrears incurred by the borrower on the date scheduled for the loan officer's visit is subtracted from the number of days in arrears 30 days after the scheduled date. The result – the difference in the number of days the loan is late – then becomes the outcome variable in the model that will evaluate the impact of the lack of loan officer's monitoring on the timeliness of repayment.

The estimated impact is composed of the treatment effect and selection bias. Technically, the selection bias arises exclusively from differences in observable characteristics. To make this selection bias equal to zero (conditional independence assumption) and ensure that systematic differences in outcomes between individuals in the treatment and control groups are attributed to the treatment, we must find a borrower who was visited as scheduled (control group member) with the same observable characteristics

of a borrower who was not visited as scheduled (treatment group member).[22]

A visited individual is an adequate control of an unvisited individual if both are similarly likely to be monitored by the loan officer. To overcome the selection bias in the composition of treatment and control groups, we use a propensity score to match individuals. This guarantees the matching quality, so that only observations with similar characteristics (i.e., similar propensity scores) are compared. A *probit* model is used to estimate the propensity score, that is, the probability that the borrowers in the sample will not receive visits from the loan officers. The propensity score matching (PSM) estimator is the mean difference in outcomes of both treatment and control groups over the common support region (there is overlap between the probabilities of participation in the treatment for individuals from both groups). In this study, we use the PSM estimator suggested by Dehejia and Wahba (2002) called radius matching, without replacement. This estimator uses only the comparison units that are closest in terms of propensity score, allowing for usage of extra (fewer) units when good matches are (not) available. As a robustness check, we also present the results of the kernel estimator, a nonparametric matching estimator that achieves a lower variance because it uses weighted averages of nearly all individuals in the control group to construct the counterfactual outcome. To assess the matching quality, the standardized bias suggested by Rosenbaum and Rubin (1985) is used. Stata's *psmatch2* command is used for the estimation. We also perform a sensitivity analysis to account for the presence of a 'hidden bias' in the results that may be caused by the absence of key variables in the development of propensity score proposed by Rosenbaum (2002). In this test, the parameter of interest is gamma (Γ). It measures the probability ratio of a match between the two groups of covariates. For the two groups to have the same probability of participation in the treatment, Γ must be equal to 1. The test statistic $Q_{MH}$ can be bounded by two known distributions. By increasing the value of Γ, the bounds move apart, and the degree of influence that an unmeasured variable has on the treatment participation and on the validity of the results can be observed. Stata's command *mhbounds* is used for the sensitivity analysis.

### 3.3.3. Variables

To guarantee the conditional independence assumption, we only include in the *probit* model those variables that simultaneously influence the loan officer's decision not to visit the borrower (the treatment) and the late payments (the outcome variable) in the model.

[22] The CIA implies that the systematic differences in outcomes between individuals in the treatment and control groups with the same values for covariates are attributed to the treatment (Imbens, 2004).

Since our sample is composed of overdue loans, the loan officer's visit depends on the same factors that influence default. Therefore, the repayment determinants of microcredit operations are also potential explanatory variables of the probability of carrying out the visit scheduled by the loan officer. The set of potential covariates to be used in the *probit* model – with the respective reference in the literature on the determinants of microcredit repayment – is as follows:

(1) Characteristics of the loan officer, such as gender (e.g., Van den Berg , Lensink, & Servin, 2015) and experience (e.g., Agier, 2012);
(2) Borrower characteristics, such as age (e.g., Baklouti, 2013; Reinke, 1998), gender (e.g., Bilau & St-Pierre, 2018; D'Espallier, Guérin, & Mersland, 2011), education level (e.g., Oke, Adeyemo, & Agbonlahor, 2007; Bilau & St-Pierre, 2018), marital status (e.g., Vogelgesang, 2003), role as group leader (e.g., Herme, Lensink, & Mehrteab, 2006), and record at the MFI (e.g., Hering & Musshoff, 2017; Van Gool *et al*., 2012);
(3) Characteristics of the operation, such as the loan amount (e.g., Godquin, 2004), loan term (e.g. Godquin 2004; Ledgerwood, 1999), and group size (e.g., Ahlin 2015);
(4) Business characteristics, such as assets and the economic sector, whether industrial, commercial, services, or agriculture (e.g., Van Gool *et al*., 2012).

An additional dummy variable is included to provide further information on the economic sector in which the client operates. We use the differentiation between modern and non-modern sectors proposed by Lavopa and Szirmai (2018). Given that the borrower's working capital needs and his/her repayment ability are part of the additional information considered by the loan officer in assessing credit risk, these two variables are included as additional controls. Another control related to credit risk informs whether the loan is the result of renegotiation or not. Table 3.1 describes how the variables are computed, including the treatment variable and the outcome variable. All variables are measured before the date scheduled for the loan officer's visit; therefore, they are not affected by whether the visit was indeed carried out.

Table 3.1

*Variables definitions*

| Variable | Description | Source |
|---|---|---|
| *Loan officer traits* | | |
| Gender O | Dummy variable for the loan officer's gender equal to 1 if woman, and 0 otherwise | Van den Berg *et al*. (2015) |
| Experience | Experience of loan officer at the MFI expressed in months | Agier (2012) |
| *Borrower traits* | | |
| Age | Age of the client measured in years | Baklouti (2013), Reinke (1998) |
| Gender B | Dummy variable for the borrower's gender equal to 1 if woman, and 0 otherwise | Baklouti (2013), D'Espallier *et al*. (2011) |
| Education | Educational level measured as the number of years of formal education | Oke *et al*. (2007), Reinke (1998) |
| Single | Dummy variable for marital status equal to 1 if single or divorced, and 0 otherwise | Vogelgesang (2003) |
| Leader | Dummy variable for leadership equal to 1 if the borrower is a group leader, and 0 otherwise | Hermes et al. (2006) |
| Cycle Group | History of borrower at the MFI measured as the number of group loans disbursed | Hering and Musshoff (2017), Van Gool *et al*. (2012) |
| Cycle Individual | History of borrower at the MFI measured as the number of individual loans disbursed | Hering and Musshoff (2017), Van Gool *et al*. (2012) |
| Arrears | Total number of days overdue for the loan at the date of the scheduled visit | Hering and Musshoff (2017), Van Gool *et al*. (2012) |
| *Loan traits* | | |
| Size | Loan amount measured in USD | Godquin (2004) |
| Share | Borrower's loan size divided by the lending group's total loan amount | Authors' suggestion |
| Term | Loan term measured in months | Godquin (2004), Ledgerwood (1999) |
| Members | Number of members in the lending group | Ahlin (2015) |
| *Business traits* | | |
| Assets | Total asset value of the microbusiness | Van Gool *et al*. (2012) |
| Modern | Dummy variable for economic sector equal to 1 for modern sector, and 0 otherwise[a] | Lavopa and Szirmai (2018) |

| Variable | Description | Source |
|---|---|---|
| Manufacture | Dummy variable for economic sector equal to 1 for manufacture, and 0 otherwise | Van Gool *et al*. (2012) |
| Trade | Dummy variable for economic sector equal to 1 for trade, and 0 otherwise | Van Gool *et al*. (2012) |
| Services | Dummy variable for economic sector equal to 1 for services, and 0 otherwise | Van Gool *et al*. (2012) |
| Agriculture | Dummy variable for economic sector equal to 1 for agriculture, and 0 otherwise | Van Gool *et al*. (2012) |
| *Additional controls* | | |
| Renegotiation | Dummy variable for renegotiated loans equal to 1 if the loan is a renegotiated operation, and 0 otherwise | Authors' suggestion |
| Working capital (WC) needs | Working capital needs of the microbusiness computed by the loan officer as receivable accounts plus inventory minus payable accounts | Authors' suggestion |
| Repay Ability | Borrower's repayment ability computed by the loan officer as the monthly revenue minus current monthly payment obligations | Authors' suggestion |
| Visit | Treatment variable equal to 1 if the borrower was not visited by the loan officer, and 0 otherwise | |
| Difference in arrears | Outcome variable equal to the number of days of delay incurred by the borrower 30 days after the scheduled date for a visit minus the number of days overdue on the date scheduled for a visit | |

[a] The economic activities considered as pertaining to the modern sector are mining and quarrying; manufacturing; electricity, gas, and water; construction; transport, storage, and communication; and finance, insurance, and business services (excluding real estate). All the other economic activities are considered to be part of the non-modern sector (Lavopa & Szirmai, 2018).

In the *probit* model specification, we use the approach suggested by Heckman, *et al*., (1998), which is common in textbook econometrics and relies on statistical significance. Under this approach, one starts by including all variables suggested by the literature and excluding those that do not present statistical significance at the 10% level in an iterative process. The initial specification is defined as (check Table 1 for description of variables):

$$\Pr(Visit_i = 1|X_i) = \Phi(\beta_0 + \beta_1 Gender\ O_i + \beta_2 Experience_i + \beta_3 Age_i + \beta_4 Gender\ B_i + \beta_5 Education_i + \beta_6 Single_i + \beta_7 Leader_i + \beta_8 Cicle\ Group_i + \beta_9 Cicle\ Individual_i + \beta_{10} Arrears_i + \beta_{11} Size_i + \beta_{12} Share_i + \beta_{13} Term_i + \beta_{14} Members_i + \beta_{15} Assets_i + \beta_{16} Modern_i +$$

$$\beta_{17}Manufacture_i + \beta_{18}Trade_i + \beta_{19}Services_i + \beta_{20}Renegotiation_i + \beta_{21}WC\ Needs_i + \beta_{22}Repay\ Ability_i), \quad (3)$$

where $\Phi(\cdot)$ denotes the standard normal distribution.

Table 3.2 presents the characteristics of the borrowers included in the sample, of which 1,256 (13.4%) were not visited as scheduled (treatment group) and 8,109 (86.6%) were visited as scheduled (control group). Most borrowers (67%) are women, whereas most loan officers (68%) responsible for monitoring these borrowers are men. On average, these loan officers had 3 years of work experience at the time of the scheduled visit. Borrowers are mostly middle-aged (39 years old, on average), single (71%), leaders of lending groups (69%), engaged in economic trade (81%), and engaged in non-modern economic activities (93%). On average, they are on their 8$^{th}$ group loan, and have had only 0.3 individual loans. The mean loan size is US$ 373, representing around 29% of the total group loan size, to be repaid in 5.8 average monthly installments. The average loan size is below the average working capital needs of US$ 666. The average number of lending group members is 4.2. Their average assets above US$ 14,000 seem rather overestimated through informal measurements by loan officers, not being based on formal financial statements. A substantial proportion (29%) of the loans are renegotiated loans. Although the average repayment ability of US$ 425 exceeds the average loan size, the average number of days overdue on the scheduled visit date is 71 days.

Table 3.2
*Descriptive statistics.*

| Variable | Mean | Std. Dev. | Minimum | Maximum |
|---|---|---|---|---|
| Treatment | .13 | .34 | 0 | 1 |
| *Loan officer traits* | | | | |
| Gender O | .32 | .47 | 0 | 1 |
| Experience | 36.15 | 36.95 | 0 | 247 |
| *Borrower traits* | | | | |
| Age | 39.29 | 12.68 | 18 | 89 |
| Gender B | .67 | .47 | 0 | 1 |
| Education | 7.21 | 3.34 | 0 | 18 |
| Single | .71 | .45 | 0 | 1 |
| Leader | .69 | .46 | 0 | 1 |
| Cycle group | 8.09 | 7.27 | 0 | 56 |
| Cycle individual | .32 | 1.21 | 0 | 29 |

| Variable | Mean | Std. Dev. | Minimum | Maximum |
|---|---|---|---|---|
| Arrears | 71.06 | 121.60 | 0 | 2,008 |
| *Loan traits* | | | | |
| Size | 373.01 | 398.48 | 1.52 | 3,965.00 |
| Share | .29 | .11 | .00 | .99 |
| Term | 5.82 | 1.39 | 2 | 24 |
| Members | 4.16 | 1.26 | 2 | 10 |
| *Business traits* | | | | |
| Assets | 14,336.33 | 14,311.23 | .00 | 223,760.00 |
| Modern | .07 | .26 | 0 | 1 |
| Manufacture | .06 | .24 | 0 | 1 |
| Trade | .81 | .39 | 0 | 1 |
| Services | .12 | .33 | 0 | 1 |
| Agriculture | .01 | .07 | 0 | 1 |
| *Additional controls* | | | | |
| Renegotiation | .29 | .45 | 0 | 1 |
| WC needs | 666.57 | 1,803.35 | 0 | 51,998.00 |
| Repay ability | 425,12 | 547.74 | 0 | 30,229.84 |
| Difference in arrears | 26.84 | 58.53 | 0 | 3,601 |

*Note*. WC, working capital; Std. Dev., standard deviation. Check table 3.1 for description of variables.

## 3.4. Results

The first step was to define the appropriate specification for the *probit* model used to estimate the propensity scores. To alleviate concerns related to correlation of covariates, we excluded variables *Manufacture* and *Services*, which showed correlations above 0.7 with *Modern* and *Trade*, respectively.[23] Table 3.3 presents the results of the nine variables that remained statistically significant at the 10% significance level in Eq. (3) in the general-to-specific modelling strategy. The positive coefficients on *age*, *leader*, *arrears*, *members*, and *renegotiation* indicate that the likelihood that the loan officer's collection visit will not be confirmed increases with the age of the borrower, number of group members, and number of days overdue on the scheduled date of the visit, as well as whether the borrower is the leader of the group and whether the loan has been renegotiated. The negative sign on *gender o* means that female loan officers are more prone to confirm a collection visit than their male counterparts, whereas the negative signs of *modern*, *trade*, and *agriculture* indicate that the likelihood that the loan officer's collection visit will not be confirmed decreases if the

[23] The correlation matrix is omitted for space saving purposes. It is available upon request.

borrower is in a modern economic sector, in trade or in agriculture activities. Since the objective of the propensity score model is not to predict participation in the treatment as well as possible, but to balance all variables (Augurzky & Schmidt, 2001), we do not discuss the results of the *probit* model in view of previous empirical literature.

Table 3.3

*Propensity score model (probit regression).*

| Explanatory variable | Coefficient | Standard Error | $p > \| z \|$ |
|---|---|---|---|
| Gender O | -0.078 | 0.036 | 0.029 |
| Age | 0.002 | 0.001 | 0.073 |
| Leader | 0.129 | 0.036 | 0.000 |
| Arrears | 0.000 | 0.000 | 0.000 |
| Members | 0.030 | 0.013 | 0.018 |
| Modern | -0.190 | 0.079 | 0.016 |
| Trade | -0.090 | 0.050 | 0.073 |
| Agriculture | -0.553 | 0.284 | 0.052 |
| Renegotiation | 0.132 | 0.037 | 0.000 |
| Constant | -1.381 | 0.092 | 0.000 |

*Note*. Number of observations: 9,365. LR chi2(9): 67.44. Prob > chi2: 0.000. Pseudo $R^2$: 0.009. Log likelihood: -3,657.378. Check table 1 for description of variables.

Table 3.4 presents the covariate balancing between treatment and control groups in matched and unmatched samples. All variables present biases inferior to 10% after matching, which can be considered adequate for matching purposes (Austin, 2009; Stuart, Lee, & Leacy, 2013). Overall, the model bias decreased from 7.2 to 1.9 after matching. The t-tests that compare the variables across treatment (unconfirmed scheduled visit = 1) and control sample (confirmed scheduled visit = 0) indicate that there is no significant difference in any variable across the two samples after matching, confirming that the balancing property is satisfied and that the two groups are comparable. The assumption of common support may be graphically assessed by means of Figure 3.1.

Table 3.4

*Covariate balancing before and after matching*

| Variable | Unmatched / Matched | Mean | | % bias | % reduction \| bias \| | t-test | |
|---|---|---|---|---|---|---|---|
| | | Treated | Control | | | t | p > \| t \| |
| *Gender O* | U | 0.295 | 0.324 | -6.1 | | -2.00 | 0.045 |
| | M | 0.296 | 0.296 | -0.1 | 98.1 | -0.03 | 0.977 |
| *Age* | U | 39.772 | 39.218 | 4.4 | | 1.44 | 0.150 |
| | M | 39.750 | 39.664 | 0.7 | 84.6 | 0.17 | 0.865 |
| *Leader* | U | 0.732 | 0.685 | 10.2 | | 3.31 | 0.001 |
| | M | 0.731 | 0.731 | 0.1 | 99.3 | 0.02 | 0.985 |
| *Arrears* | U | 87.221 | 68.559 | 13.9 | | 5.07 | 0.000 |
| | M | 85.691 | 77.086 | 6.4 | 53.9 | 1.58 | 0.114 |

| Variable | Unmatched / Matched | Mean: Treated | Mean: Control | % bias | % reduction \| bias \| | t-test: t | t-test: p > \| t \| |
|---|---|---|---|---|---|---|---|
| *Members* | U | 4.220 | 4.155 | 5.1 | | 1.71 | 0.087 |
| | M | 4.218 | 4.210 | 1.2 | 76.4 | 0.30 | 0.766 |
| *Modern* | U | 0.060 | 0.073 | -5.2 | | -1.65 | 0.100 |
| | M | 0.060 | 0.060 | 0.1 | 98.3 | 0.02 | 0.981 |
| *Trade* | U | 0.813 | 0.815 | -0.5 | | -0.15 | 0.882 |
| | M | 0.813 | 0.819 | -1.6 | -256.0 | -0.40 | 0.687 |
| *Agriculture* | U | 0.002 | 0.006 | -5.3 | | -1.54 | 0.123 |
| | M | 0.002 | 0.002 | 0.05 | 90.6 | 0.17 | 0.864 |
| *Renegotiation* | U | 0.347 | 0.282 | 14.1 | | 4.75 | 0.000 |
| | M | 0.347 | 0.319 | 6.0 | 57.4 | 1.48 | 0.139 |

| Sample | Pseudo-$R^2$ | LR chi2 | p > chi2 | Mean Bias | Median Bias | B* | R* | % Var |
|---|---|---|---|---|---|---|---|---|
| Unmatched | 0.009 | 67.44 | 0.000 | 7.2 | 5.3 | 24.5 | 1.18 | 67 |
| Matched | 0.001 | 4.09 | 0.906 | 1.9 | 0.7 | 8.1 | 1.10 | 0 |

*Note*. *If *B*>25, *R* outside [0.5;2]. Check table 3.1 for description of variables.

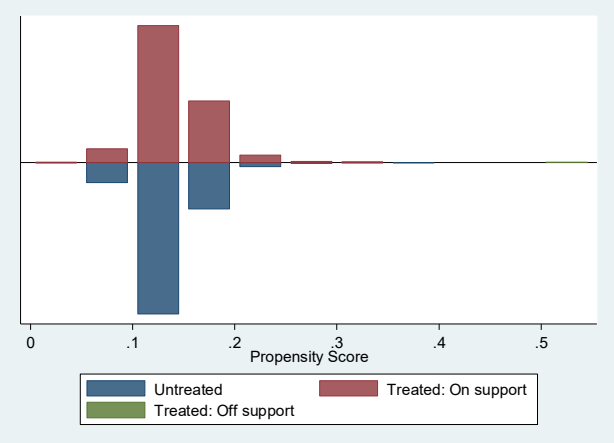


*Figure 3.1.* Propensity score histogram

The estimation of the impact of the lack of face-to-face meetings between loan officers and borrowers on the repayment timeliness is presented in Table 3.5. Two PSM estimators are used to compare the results, radius and kernel. A caliper (propensity range) of 0.03 was used in the estimated PSM radius and a bandwidth of 0.04 in the estimated PSM kernel, in order to reduce the biases of the covariates and produce better matches. The estimated PSM radius (no replacement) indicates that, on average, borrowers who did not receive the scheduled visit from the loan officer showed, 30 days later, 4.8 more days in arrears than if they had had the scheduled visit confirmed. The estimated PSM kernel showed

similar results: the estimated ATT was 4.7 days. Both results are statistically significant at the standard 5% significance level. Figure 3.2 shows the standardized bias in the variables used in the PSM estimation before and after matching.

Table 3.5

*Treatment effects – impact of lack of face-to-face meetings with borrowers, conducted by loan officers, on repayment timeliness of 1,255 microcredit borrowers.*

| PSM estimator | Treated | Controls | ATT | S.E. | t-stat | p value |
|---|---|---|---|---|---|---|
| Radius | 32.079 | 27.311 | 4.768 | 1.884 | 2.53 | 0.016 |
| Kernel | 32.079 | 27.363 | 4.716 | 1.883 | 2.50 | 0.018 |

*Note*. ATT, average treatment effect on the treated; S.E., standard error; radius estimator using caliper of 0.03; kernel estimator using bandwidth of 0.04.

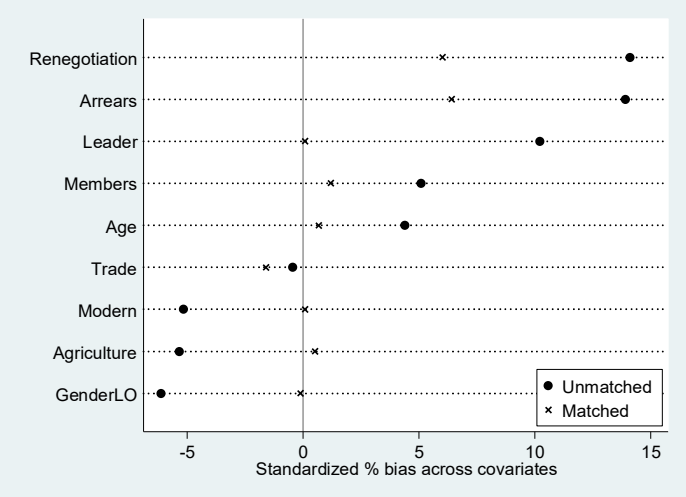


*Figure 3.2*. Standardized % bias across covariates before and after matching

Table 3.6 presents the *p-values* of the test statistic $Q_{MH}$ in the sensitivity analysis proposed by Rosenbaum (2002). The $Q_{MH+}$ statistic relates to a situation in which we have overestimated the treatment impact, whereas the $Q_{MH-}$ statistic relates to a situation in which we have underestimated the treatment impact. If there is no hidden bias due to unobservable covariates that may alter the probability of not having a face-to-face meeting with the loan officer, the $Q_{MH}$ statistic remain significant as we increase the values of Γ. The sensitivity analysis was performed increasing the Γ values from 1, in increments of 0.05. As one can see, the $Q_{MH+}$ statistic remains significant at the standard 5% significance level for all Γ values, indicating that it is unlikely that we have overestimated the impact of the lack of loan officers' on-site monitoring. The $Q_{MH-}$ statistic, in turn, presents statistical significance at 5% significance level for Γ values up to 1.05, and at 10% significance level for Γ values up

to 1.10. This means that an unobserved variable would have to impact the odds ratio of confirming a loan officer's visit to differ by a factor bigger than 1.10 between treatment and control groups for the results to be downwardly biased.

Table 3.6

*Sensitivity analysis for estimating the impact of the lack of face-to-face meetings with borrowers, conducted by loan officers, on repayment timeliness of 1,255 microcredit borrowers.*

| Gamma (Γ) | p_mh+ | p_mh- |
|---|---|---|
| 1.000 | 0.021 | 0.021 |
| 1.050 | 0.009 | 0.044 |
| 1.010 | 0.004 | 0.081 |
| 1.150 | 0.001 | 0.134 |
| 1.200 | 0.001 | 0.204 |
| 1.250 | 0.000 | 0.289 |
| 1.300 | 0.000 | 0.383 |
| 1.350 | 0.000 | 0.480 |
| 1.400 | 0.000 | 0.485 |
| 1.450 | 0.000 | 0.395 |
| 1.500 | 0.000 | 0.313 |
| 1.550 | 0.000 | 0.241 |
| 1.600 | 0.000 | 0.182 |
| 1.650 | 0.000 | 0.133 |
| 1.700 | 0.000 | 0.096 |
| 1.750 | 0.000 | 0.067 |
| 1.800 | 0.000 | 0.046 |
| 1.850 | 0.000 | 0.031 |
| 1.900 | 0.000 | 0.021 |
| 1.950 | 0.000 | 0.014 |
| 2.000 | 0.000 | 0.009 |

*Note*. Gamma (Γ): odds of differential assignment due to unobserved factors. p_mh+: significance level (assumption: overestimation of treatment effect). p_mh-: significance level (assumption: underestimation of treatment effect).

## 3.5. Discussion

By applying a treatment effects approach to estimate the impact of the lack of face-to-face meetings between loan officers and borrowers on the number of days overdue on microcredit loans, the present study shows that the loan officer plays a crucial role in reducing late payments. After using PSM estimates to match groups of borrowers not visited (treatment group) and visited (control group) by the loan officer, borrowers not visited as

scheduled were found to show a total of days late substantially higher than the sum of days late in the visited borrowers' installments. The estimated ATT of 4.7 means that those borrowers who were not monitored on-site by the loan officer on the scheduled visit date exhibited arrears 17.5% higher than the arrears they would have exhibited had they been visited by the loan officer as expected. Considering the interest rate of 33% and the average loan amount of US$ 480, the 4.7 extra days late represent USD 1,250 of additional debt in one month for an average portfolio of 700 clients per loan officer, should all the clients of the portfolio default. That is more than double the average salary of a loan officer. It also increases the burden of borrowers who have non-performing loans and hence adds more credit risk to the loan officer's portfolio.

As the sensitivity analysis shows, the results are robust to potential hidden bias that may have overestimated the impact of the absence of visits on delinquency due to unobserved covariates in the development of the model that explains face-to-face meetings between loan officers and borrowers. Conversely, the analysis shows a possibility of underestimation in the results should an unobserved covariate impact the odds treatment ratio to differ between treatment and control groups by a factor of more than 1.10. This means that the impact of the loan officer's lack of monitoring on the timely repayment of microcredit loans could be even greater if there are any factors not considered in the present study that influence the confirmation of visits.

The results are in line with qualitative studies that suggest that the loan officer plays a significant role in ensuring a high repayment performance for microcredit loans (Dixon, Ritchie, & Siwale, 2007; Kritikos & Vigenina, 2005; Siwale, 2016; Siwale & Ritchie, 2012). Our results also corroborate the findings of previous quantitative studies, such as Van den Berg, Lensink, and Servin (2015), who suggested that loan officers improve repayment rates for microfinancing; Canales and Greenberg (2016), who reported that clients are approximately 24% more likely to miss a payment when loan officers leave the MFI; and Inekwe (2019), who found that the number of borrowers per loan officer and the total number of loan officers at the MFI are robust factors explaining the default in microcredit across countries. By accessing a database with information on the meetings between the loan officer and borrower in the business location, our study is the first to use active monitoring data – which is a type of monitoring associated with substantial costs – to assess the impact of the MFIs monitoring on the timely payment of loans. In this sense, it adds to the literature on loan officers and their monitoring role in microcredit repayment performance.

A cautionary note must be made regarding the role of loan officers despite their apparent importance in ensuring high repayment performance of microcredit loans and in contributing to the financial sustainability of MFIs: in some circumstances, this role may come at a social cost. For example, Labie *et al*. (2015) provide evidence of discrimination practiced by loan officers in the provision of microcredit in Uganda. Kar (2013) reports that in India loan officers were often characterized as no better than a moneylender. Siwale and Ritchie (2012) highlight that loan officers have been found to perform ambiguous roles, different from the expected task of empowering and supporting the poor. There is also some concern about these professionals' practices in collecting payments and the pressure that microcredit loans put on borrowers, which could explain suicide rates in places like India (Ashta, Khan, & Otto, 2015).

## 3.6. Conclusions

Using a sample of 9,365 scheduled meetings between loan officers and borrowers from a large microfinance institution in Brazil, we show that these meetings significantly influence the number of overdue days for microcredit loans. This study is of special interest for Brazil, following the change in legislation that seeks to relax the obligation of the face-to-face meeting between loan officers and the borrowers of microcredit loans. It also offers some insights into different markets in which MFIs aim to save money on human resources for financial sustainability. The results showed that the absence of loan officer monitoring increases borrowers' late payments. Any additional days in arrears can mean a significant increase in the overall risk of the portfolio and augment the volume of provisions for risky accounts, thus reducing the profitability of the microfinance institution and putting the MFI at risk.

While it strongly suggests that the monitoring task performed by loan officers is crucial in preventing late payments, the study has some limitations. For instance, proxies for peer monitoring were not included. The difficulty in obtaining this type of data precludes the estimation of ATT in controlling for peer monitoring. Therefore, future research should consider data on peer monitoring to test the reliability of our main findings.

# Concluding Remarks

The agency theory of Jensen and Meckling (1976) has spurred a literature that has increasingly recognized the importance of contracts for the resolution of incentive conflicts between entrepreneurs and investors. Financial contracts have attracted attention of a growing number of researchers concerned with empirical testing of theoretical studies in corporate finance. However, there are still a number of gaps to be filled with regard to the design of these contracts, their renegotiation process, and the incentives for contracting parties.

This Thesis contributes to filling these gaps, through the response of three research questions explained in the general introduction. Accordingly, it begins by investigating whether the determinants of one of the main terms of the bank loan agreement – the interest rate spread charged by the bank – receives a different impact from the factors that influence its behavior depending on the type of loan in question. It follows to analyzing the determinants of the renegotiation process and its outcomes in small loan contracts for SMEs. Finally, it studies the influence of the contractual relationship of a specific type of loan – the microcredit contract, which provides for the monitoring of the borrowers by the loan officer – on the behavior of one of the contracting parties, the microentrepreneur.

This conclusion summarizes the main findings of these investigations, presents the contributions to the managerial and policy practices, lists some limitations, and suggests some perspectives for future research related to financial contracts.

Chapter 1 aimed to answer *RQ1: Does the impact of bank spread determinants differ by loan category?*, using a database composed of spreads charged by 13 different banks in three types of personal loan in Brazil. A dynamic model is estimated by means of the generalized method of moments (GMM) and a static model is estimated by fixed-effects. We found that, as suggested by Allen's (1988) model, the impact is indeed differentiated not only in relation to the attributes involved (for example, some attributes impact the spread of one category, but not the spread of another), but also in terms of the magnitude of that impact. Specifically, we found that the spread of revolving credit loans are influenced by the prior period spread, credit risk, inflation rate, interest risk, market interest rate, economic growth, and bank state-ownership. Among these attributes, only market interest rate, economic growth, and state-ownership of banks also influence payroll-linked loans spreads, and even

so, to a lesser extent. In addition, consumer loans spreads are impacted by implicit interest payments, an attribute that does not influence the spread of the other two loan categories.

Chapter 2 was concerned with answering *RQ2: What are the determinants of the process of renegotiating small loans for SME firms?*, using a database composed of small loans for SMEs granted by a Brazilian bank. Three probit models are used to estimate the impact of some attributes on the probability of renegotiation and on the probability that the renegotiation will have a favorable outcome for the borrower. We found that the frequency of renegotiation of these loans is substantially lower than the frequency of renegotiation of large loans granted to large companies. We argued that the lack of ex-ante contingencies like covenants and the like in this kind of loan explains this difference, since it reduces control rights shifts to the lender in situation in which the borrower is not in financial difficulties. The lower bargaining power of SMEs also explains the lower frequency of renegotiation of these small loans. We found that the contracting parties' bargaining power is a main determinant of the renegotiation frequency and of the renegotiation outcomes, as hypothesized.

Chapter 3 dealt with *RQ3: Does the monitoring work performed by the loan officer influence the borrower's repayment?*, using a proprietary database containing information of face-to-face meetings – and the lack thereof – between loan officers and microcredit borrowers. A treatment effects approach is used, dividing visited and unvisited borrowers into control and treatment groups, respectively. We found that the costly work of face-to-face monitoring carried out by the loan officer has a substantial impact on the timeliness of payments on microcredit loans. Specifically, we found that, in the absence of this face-to-face meeting, borrowers end up making payments later than would have been made if this visit had been confirmed as planned.

The findings of the three central chapters of this Thesis have different implications for policymakers, financial contracting literature, and managerial practice involving loan agreements. Chapter 1 identified a gap in the literature – previous empirical studies had investigated the determinants of banking spread as if the banks had only one loan category, with only one interest rate charged, despite this not happening in the real world and despite theoretical suggestions that a portfolio effect should be considered in those studies. By employing different interest rates charged in different loan categories we were able to provide evidence that impact of the determinants varies according to the type of the loan. In this sense, empirical studies of the determinants of spreads should consider the heterogeneity existing in a bank's loan portfolio. This Chapter also provides insights for regulators on how

to tame interest rate spreads, as it links the impact of some attributes to the characteristics of the loan category. This is especially useful in countries were banking spreads remain at substantially high levels, such as Brazil.

Chapter 2 filled a gap in the financial contract renegotiation literature by studying small loan agreements. Previous empirical studies had focused on large loans granted to large companies. Its main contribution lies in showing that the process of renegotiating small loans has different incentives and attributes involved compared to large loan renegotiation process: bargaining powers are more lopsided, as the creditor has greater bargaining power than in a financial contract with a large company. The creditor also has less incentive to monitor the financed project, and this lower incentive is reflected in the design of the loan agreement, for example, in the absence of ex-ante contingencies. By testing proxies for the bargaining power of parties involved in small loans, this Chapter sheds light on how best to build the contractual relationship in a context where creditor monitoring is more expensive.

In Chapter 3, the identified gap is related to the costly monitoring role performed by loan officers. Previous studies had already signaled the importance of loan officers for maintaining the quality of microcredit portfolio but were unable do directly observe the monitoring process and estimate the impact of this activity on repayment performance. The findings in Chapter 3 have practical implications for both microfinance industry management and microcredit policymakers. Around the globe, the industry struggles to stay financially afloat, and many microfinance institutions (MFI) only remain open due to government subsidies. This context calls for innovations and adaptations that allow MFI to reduce administrative costs, including the replacement of personnel – the largest operational expense – with digital technologies. By verifying that the absence of on-site monitoring carried out by the loan officer increases the delay in payments, this Chapter issues a warning to institutions that consider the work of loan officers less important for repayment rates than the peer monitoring inherent to group lending arrangements. It also provides microcredit policymakers with insights on how best to stimulate the industry's development without compromising its financial sustainability.

Obviously, the three studies that make up this Thesis have some limitations. In Chapter 1, the lack of an international database that provides the interest rates charged by loan category in other countries restricts the analysis to Brazil. The effort to work with a balanced panel and to give robustness to the results prevented us to from including a greater number of banks and loan categories in the study. In addition, multicollinearity concerns prevented the estimation of the impact of some attributes on the spread of some loan

categories. One main limitation is the lack of adequate instruments to report results of estimations considering possible endogeneity issues in the design of debt contracts. Chapter 2 has the limitation of not considering peer monitoring proxies in the estimation, which prevents proper comparisons with the loan officer's contribution to microcredit repayment.

Future research may depart from the limitations mentioned above to provide advances to the literature. For example, proprietary databases can be considered to increase the number of banks and loan categories used in the analysis of spread determinants, including other countries. In the analysis of the renegotiation, adequate instruments can be found to account for the possible endogeneity inherent to the design of financial contracts. In microfinance studies, the literature would benefit from a comparison between the effects of peer monitoring and the effects of other contractual mechanisms on the financial performance of microcredit. Overall, we hope that this Thesis will contribute to inspiring advances in the literature on financial contracts.

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