SUSANA XUE LIU

CORPORATE FINANCE IN BRAZIL:
EVIDENCE ON BANK LINES OF CREDIT
Liu, Susana Xue
Corporate finance in Brazil: evidence on bank lines of credit / Susana Xue Liu. – 2017.
30 f.

Dissertação (mestrado) - Escola Brasileira de Administração Pública e de Empresas, Centro de Formação Acadêmica e Pesquisa.
Orientador: Lars Norden.
Inclui bibliografia.

1. Administração financeira. 2. Créditos. 3. Empresas - Finanças.
I. Norden, Lars. II. Escola Brasileira de Administração Pública e de Empresas. Centro de Formação Acadêmica e Pesquisa. III. Título.

CDD – 658.15
SUSANA XUE LIU

CORPORATE FINANCE IN BRAZIL: EVIDENCE ON BANK LINES OF CREDIT.

Dissertação apresentada ao Curso de Mestrado em Administração da Escola Brasileira de Administração Pública e de Empresas para obtenção do grau de Mestre(a) em Administração.

Data da defesa: 19/12/2016

ASSINATURA DOS MEMBROS DA BANCA EXAMINADORA

Lars Norden
Orientador (a)

José Santiago Fajarde Barbachan

Fabrizio Spargoli
Corporate Finance in Brazil:
Evidence on bank lines of credit

Susana Xue Liu
FGV-EBAPC

Table of Contents

Acknowledgement .................................................................................................................. 2
Abstract ................................................................................................................................. 3
1. Introduction ....................................................................................................................... 4
2. A brief review of the banking system of Brazil ............................................................... 7
3. Literature and Hypotheses .............................................................................................. 9
4. Data .................................................................................................................................. 14
5. Empirical results .............................................................................................................. 20
6. Conclusion ....................................................................................................................... 26
7. References ....................................................................................................................... 28
Acknowledgement

Firstly, I would like to express my sincere gratitude to my advisor Prof. Lars Norden for the continuous support of my Master study and related research, for his patience, motivation, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my Master study. I would also like to thank Professor José Fajardo and Professor Fabrizio Spargoli for providing many valuable comments on my thesis.

My sincere thanks also goes to Mr. Carlos Jourdan, Mr. Vitor Lima, and Mrs. Aline Gomes from Bocom BBM, who provided me an opportunity to join their team as analyst, and who gave access to the database and research facilities. Without their precious support it would not be possible to finish this research.

Last but not the least, I would like to thank my family and my classmates for supporting me spiritually throughout writing this thesis and my life in general.
Abstract

This article represents one of the first empirical examinations of the use of bank lines of credit among Brazilian public and private firms, and finds that lines of credit is a large and important source of corporate finance in Brazilian economy (86.6% of firm-years have a line of credit between 2011 and 2015), but it only represents a tiny portion of total assets. Moreover, the majority of lines of credit are short-term (within 1 year). The principal finding of the articles is that, different from the advanced US and Europe credit market, the EBITDA accounting-based covenant is not prevalent in Brazil. Furthermore, using database of a local Brazilian bank, this is the first paper that proves the cash theory, the relationship-based banking and lending, and the liquidity insurance theory at the same time. I find that younger and larger firms are more likely to use lines of credit. Additionally, older and smaller firms with less tangible assets and less capital expenditure tend to rely more on credit lines than cash in liquidity management.
1. Introduction

Lines of credit, also referred to as revolving credit facilities or loan commitments, is a nominal amount of debt capacity against which the firm draws funds. Besides, there are also various names of lines of credit in the 10 K filing of the listed companies, such as credit lines, credit facility, revolving credit agreement, bank credit line, working capital facility and Line/Lines of credit. The used portion of the line of credit is a debt obligation, whereas the unused portion remains off the balance sheet. In terms of pricing, the firm pays a commitment fee that is a percentage of the unused portion, and a predetermined interest rate on any drawn amounts (Sufi 2007).

Compared with standard debt, credit line allows the firm to access pre-committed debt capacity. This pre-commitment creates value for credit lines as a corporate liquidity management tool, in that they help insulate the corporation from negative shocks that could hinder access to capital markets (Acharya 2014). As a result, bank lines of credit are an instrumental component of corporate liquidity management. Not only the firms’ annual reports but also the research reports by Moody’s and Standard and Poor’s (S&P), and other credit rating agencies, all detail information on revolving credit facilities when evaluating a firm’s default risk (Boot et al. 1987, Holmstrom & Tirole 1998, and Sufi 2007).

In Brazil, lines of credit are fixed for a determined period, which normally varies from six months to a year. In the period of its validity, it operates in a rotational way, the reason why it is called revolving credit facilities (DOUAT, 1995). Sufi (2007) explains why firms may use cash in place of lines of credit in corporate liquidity management using data of public firms from Computast from 1996 through 2003. He shows that firms with high levels of cash flow rely on lines of credit, whereas firms with low levels of cash flow rely on cash. Using the cash-flow sensitivity of cash as a measure of financial constraints, he shows that lack of access to a line of credit is a more statistically powerful measure of financial constraints than traditional measures used in the literature. Overall, he proves that banks provide credit lines that are contingent on maintenance of cash flow.

Different from the US credit market, the lines of credit instrument are less developed and less studied in Brazil. However, there are plenty of research about the financial constraint that Brazilian publicly traded firms facing. Terra, M. C. T. (2003) finds that Brazilian firms are credit-constrained, and only large and multinational firms suffer less constraint, by collecting financial data from 1986
to 1997. Later, by using index Access from Schwab et al. (1999) that measures the ease with which
firms can issue securities, MCLEAN, R. David. (2011) define Argentina, Egypt, Indonesia, Mexico,
and Brazil, these five counties as the ones that offer the least access to equity finance among 44
counties in their sample. And they conclude that, for American firms, the main source of retained
cash is the issuance of shares. By contrast, for the Brazilian firms in their sample, the main source is
the operating cash flow due to the institutional difference between these 2 countries, such as the
financial system, the bank lending environment and the legal environment.

Furthermore, Chalhoub, L., Kirch, G., & Terra, P. R. S. (2015) study the sources of cash retained by
companies in the Brazilian market specifically, by using a panel data formed by accounting and
market information from listed firms in BM&FBOVESPA from 1995 to 2013. Although the shares
issuance, debt and operating cash flow all have positive and significant correlation with the change
in cash, they also find that the main source of cash for Brazilian firms is merely the operating cash
flow. In addition, the firms under financial constraint retain more from operating cash flow.

However, the substitution of cash, or the LOC, and its interaction with cash in firm liquidity
management are less explored. Therefore, it would be interesting to study the popularity, the current
usage of lines of credit in Brazil among industries, and even the firm characteristic of using lines of
credit and the substitution between cash and lines of credit as liquidity management tools.

Therefore, this article attempts to fill this gap. The central question is: What is the form, the usage
of lines of credit in Brazil? What governs the use of cash versus bank lines of credit in corporate
liquidity management? I attempt to answer this question by combining 2 different data sets: 1) data
set of the Brazilian Central Bank, the 3046 document, 2) the data set of BBM Bank of Brazil.

The 3046 document of Brazilian Central Bank is a consolidation of the 3040 documents sent by all
the registered financial institutions in Brazil. It is available on the SCR system for all the financial
institutions that provide financial services for any individuals or legal entities. The SCR records all
the transactions such as loans, trustees, lines of credit and guarantees happened in the Brazilian
credit market. It is established by the national monetary council and administrated by the Brazilian
central bank. The SCR goes back to 2004, while the data on lines of credit is only available since
2012, which becomes one of the limitation of my study.

To study the impact of accounting-based covenant on the usage of lines of credit, I choose EBITDA
which is the most prevalent financial ratios in the US credit liens contract; To examine the impact
of information asymmetry and relationship banking on the use of lines of credit, I choose the
number of year that firm registered on the SCR system; To prove the existence of financial
constraint that motivate firms to use liquidity insurance as buffer for future liquidity shock, I choose the firm size, tangibility, capital expenditure and net-worth.

Based on Sufi (2007), I create two proxies for the measurement of usage of credit lines: has lines of credit or not (dummy variable with value of 0 or 1) and unused bank liquidity to total liquidity ratio. If the firm has unused lines of credit at the end of the year, then variable “has lines of credit” equals to 1. The first explained variable measures the probability of firms having access to bank lines of credit. The second explained variable captures the fraction of liquidity available to the firm in the form of liens of credit, more specifically, I use it to explore why firms rely on cash versus lines of credit for liquidity.

As is shown in Table 1, I find the coexistence of cash theory, credit lines theory and relationship banking and lending theory in the Brazilian credit market. On the one hand, banking relationship negatively correlated with the probability of having lines of credit while firm size positively predicts the probability of having access to lines of credit. On the other hand, firm size, tangibility and capital expenditure negatively correlated with the amount available of credit lines, while banking relationship positively predicts balance between cash and credit lines.

According to the information asymmetry theory, younger firms are new to the banking systems and face more information asymmetry. Therefore, younger firms are motivated to seek for lines of credit as a liquidity buffer. However, older firms with more banking relationship not only enjoy favorable terms and interest rate, but also are easier to raise higher portion of liquidity insurance and thus tend to rely more on lines of credit than cash when they have access to credit lines facility.

The literature related to cash holdings argues that the capital market friction prevents certain firms from raising external financing. Consistent with the theory, I find that small firms have lower probability of having access to lines of credit. Meanwhile, conditional on firms with lines of credit, small firms rely more on lines of credit relative to cash to ensure that funds are available for potential positive NPV projects, which is consistent with the credit lines theory. Similarly, I also find firms with less tangibility rely more on lines of credit as liquidity buffer instead of cash.
Table 1
Summarized Results

<table>
<thead>
<tr>
<th></th>
<th>expected</th>
<th>results</th>
<th>expected</th>
<th>results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>has lines or credit</td>
<td>(0,1)</td>
<td>has lines or credit</td>
<td>(0,1)</td>
</tr>
<tr>
<td></td>
<td>unused limit/ (unused limit+ cash)</td>
<td></td>
<td>unused limit/ (unused limit+ cash)</td>
<td></td>
</tr>
<tr>
<td>[EBITDA/ (assets – cash)]_{t−1}</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln [Firm age (years since registered in SCR)]_{t−1}</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>[Ln (assets – cash)]_{t−1}</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>[Tangible assets/ (assets – cash)]_{t−1}</td>
<td>+</td>
<td>+</td>
<td></td>
<td>−</td>
</tr>
<tr>
<td>[Capital expenditure, cash adjusted]_{t−1}</td>
<td></td>
<td>−</td>
<td></td>
<td>−</td>
</tr>
</tbody>
</table>

Number of observations | 752 | 651 |
Number of firms | 340 | 293 |
R2 | 0.15 | 0.18 |

Additionally, I find that firms with more growth opportunities and thus more capital expenditure tend to use less credit lines relative to cash to overcome the capital market frictions, which is consistent with the result, in Opler et al. (1999), that firms with strong growth opportunities, firms with riskier activities, and small firms hold more cash than other firms.

2. A brief review of the banking system of Brazil

As for the macroeconomic environment and the general financial system, the Brazilian economy was negatively affected by the worsening of the world economic crisis since September 2008, after the failure of Lehman Brothers. Financing conditions for firms and banks deteriorated and only began to improve in the second semester of 2009. The government implemented monetary, fiscal and credit stimuli through 2009 to help accelerate the recovery of the economy. In particular, a quantitative easing was undertaken by the Brazilian central bank due to a cool off of inflation pressures in light of the large contraction of domestic demand. This quantitative easing has helped to normalize credit conditions.
With the disorder triggered by the mortgage market crisis, national financial market indicators presented some kind of resilience. As a result, investors were favorable on bringing their money to Brazil. However, domestic indicators became more volatile, especially in what concerns interest rates and stock markets. The growing dynamics of domestic demand presented significant increases in investment levels and in expanding household consumption. Although credit supply (% GDP) has reached high historical levels in the recent past, it is still relatively low if compared to other countries. The considerable confidence of consumers and of Brazilian businessmen in the market led to an increasing in the average maturity of loans, which can be used as a proxy for measuring risk. Consequently, credit growth in Brazil has not jeopardized financial system solidity.

As for the banking system itself, the Brazilian banking system consists of state-owned, foreign and private domestic banks. However, there are several differences among asset structures of the various banking segments.

There are five State-owned banks, of which two are universal banks (Banco do Brasil-BB and Caixa Econômica Federal-CEF), one is a development bank (Banco Nacional de Desenvolvimento Econômico e Social-BNDES) and the remaining two are regional banks (Banco da Amazônia-BASA and Banco do Nordeste do Brasil-BNB). While BB is an open joint stock company, whose controlling stockholder is the federal government, the other ones are fully state-owned banks. The state-owned banks, or the public banks, are the main managers of the earmarked credit segment. The earmarked segment includes bank loans with lower interest rates that follow some kind of earmarking allocation according to government regulations. The non-earmarked segment includes bank loans that are not subject to these regulations.

With the exception of the National Bank of Economic and Social Development (BNDES), public banks had the lowest proportion of assets invested in loan operations in 2007. Meanwhile, these banks had the largest volume of Stocks and Securities (TVMs), particularly in papers held to maturity. This is due to high interest rates and large profits that stem from these operations with low risk.

Private banks, on the other hand, are characterized by presenting the largest volume of interbank liquidity investments, accompanying the tendency of making greater use of funding through repo operations and permanent assets, due to investments in stockholding positions. Foreign institutions, in the recent period, presented a greater use of other common assets, particularly derivatives. This could be due to hedging purposes as some of these institutions are specialized in intermediating external funding operations for domestic clients in Brazil.
The credit expansion has made the monitoring of default and capitalization levels of financial institutions become more important. Despite the reduction in leverage, state-owned banks continued making intensive use of third-party capital, especially through subordinate debt. Credit assigns have been another important source of financing, particularly to smaller scale banks. In the recent period, private banks hold the largest volume of liabilities for repo operations. Foreign banks have made greater utilization of time deposits and liabilities for loans and on lending operations, as state-owned banks have become known for saving deposits.

In addition, in the corporate sector of Brazilian credit market, despite the banking credit market growth since 2003, it remains featured by a clear and historical “division of duties” between public and private banks. While the state-owned banks are specialized in long-term financing out of earmarked resources, the private banks prioritized short-term credit out of non-earmarked resources for working capital. On the demand side, corporations prefer BNDES loans for financing long-term investments due to their more favorable conditions in terms of cost, term and guarantees.

Hence, the macroeconomic environment improvements since 2003, underlying the longer private credit growth phase in Brazilian history, have not induced private banks to effectively engage themselves in the process of funding aggregate investment. Indeed, even in the finance stage of this process, their engagement still insufficient as the short-term credit out of non-earmarked resources is grant with high lending rates and very short maturities (Prates, D. M., Ferreira, A. N., & Gorayeb, D., 2015).

3. Literature and Hypotheses

A firm that obtains a line of credit receives a nominal amount of debt capacity against which the firm draws funds. The used portion of the line of credit is a debt obligation, whereas the unused portion remains off the balance sheet. In terms of pricing, the firm pays a commitment fee that is a percentage of the unused portion, and a predetermined interest rate on any drawn amounts.

In Sufi (2007), the author collects manually the pricing and maturity data from annual 10-K SEC filings of the public firms. He finds that firms with low cash flow are less likely to obtain a line of credit, and they rely more heavily on cash in their corporate liquidity management since banks restrict firm access to credit facilities in response to the cash flow-based covenant violations.
In Acharya (2013), they collect firm-level credit lines data from the Capital IQ databases for the period 2002–2011. The sample is restricted to US firms covered on both databases and traded on AMEX, NASDAQ, or NYSE. Besides, they not only remove utilities and financial firms, but also remove firm-years with negative revenues, as well as negative or missing assets, obtaining in the end a sample of 32,671 firm-years involving 4,741 unique firms. They find that firms that were more exposed to an increase in liquidity risk moved away from credit lines into cash holdings. In addition, firms with high hedging needs are more likely to use cash instead of credit lines for liquidity management.

In Lins, Servaes, & Tufano (2010), to examine whether and why firms use lines of credit versus non-operational (excess) cash for their corporate liquidity, their data come from a 2005 survey of chief financial officers covering publicly traded and privately owned firms from all over the world. They conduct the survey in collaboration with Deutsche Bank Securities, and send it to approximately 4,000 firms in 48 countries. Without small local firms, the sample comprises the largest companies in their respective countries and industries. Overall, 204 executives answered enough questions regarding topics related to liquidity to allow for their regression analyses. They find that nonoperational cash guards against future cash flow shocks in bad times, while credit lines give firms the option to exploit future business opportunities available in good times.

This article is the first, to my knowledge, to analyze the unused bank lines of credit at both private and public corporations of an emerging economy.

3.1 Financial Covenant

On the one hand, in Sufi 2007, the author finds that firms must maintain high cash flow to remain compliant with the cash flow-based financial covenant by banks that supply credit lines. As a result, firms with low cash flow are less likely to obtain a line of credit, and they rely more heavily on cash in their corporate liquidity management. To provide some insight into the precise friction that makes lines of credit a poor liquidity substitute for cash for some firms, based on Sufi 2007, I hypothesize that:

**H1: Low cash flows makes lines of credit difficult to obtain, and makes firms rely on cash instead of lines of credit in their liquidity management.**

On the other hand, it is also reasonable that EBITDA alone does not determine the access to lines of credit and the magnitude of lines of credit in corporate liquidity management. Different from the result in Sufi (2007), which predicts that most of the credit lines contract use EBITDA as covenant ratio, in Demerjian (2007), there are five different types of ratios—coverage, current, debt to cash
flow, leverage, and net worth—commonly used in covenants. They predict and corroborate that loan contracts include covenants with ratios that are informative of credit risk based on borrower or contract characteristics. More specifically, contracts of borrowers with positive earnings, high profitability, and low volatility earnings are likely to include covenants measured with earnings, such as coverage or debt to cash flow. Debt contracts of borrowers with losses, low profitability, and highly volatile earnings are likely to include covenants measured with shareholders’ equity, such as net worth. In other words, different borrower or contract characteristics determine different covenant ratio.

Additionally, it is also probable that the Brazilian credit lines contract use other covenant instead of accounting ratio, or even use other mechanisms such as contingent-maturity to control credit risk. In de VAB Silva (2013), using a sample of 159 corporate bonds issued on the Brazilian Market, they classify 10 types of covenants as following:

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Accounting-based restrictions</td>
</tr>
<tr>
<td>2</td>
<td>Dividend restrictions</td>
</tr>
<tr>
<td>3</td>
<td>Reduction of capital</td>
</tr>
<tr>
<td>4</td>
<td>Liquidation, dissolution or bankruptcy</td>
</tr>
<tr>
<td>5</td>
<td>Change in core business</td>
</tr>
<tr>
<td>6</td>
<td>Change in company's structure</td>
</tr>
<tr>
<td>7</td>
<td>Transfer of or change in issuer's control</td>
</tr>
<tr>
<td>8</td>
<td>Sale, disposal or transfer of assets</td>
</tr>
<tr>
<td>9</td>
<td>Default</td>
</tr>
<tr>
<td>10</td>
<td>Problems with legal obligations and environmental permits</td>
</tr>
</tbody>
</table>

Source: Suffi 2007

They found that, in the Brazilian bond market, the accounting-based restrictions, liquidation, dissolution or bankruptcy and default, these three types of covenants are used much more frequently than others. Additionally, in de CW Anderson (1999), by analyzing 50 Brazilian indenture agreements of corporate bonds, the author finds that covenants that restrict a debtor’s dividend, investment, and financing policies are seldom observed in Brazilian credit market. Instead, contingent-maturity mechanisms such as periodic renegotiation of contract terms, an issuer’s right to call, an investor’s right to put, and an investor’s right of conversion to equity are common. Given the absence of restrictive covenants and the prevalence of contingent-maturity mechanisms, he concludes that contingent maturity makes Brazilian bonds largely self-executing, less dependent on
costly and unreliable institutional enforcement. In other words, distinct from the American credit market, the restrictive covenants are replaced with contingent-maturity mechanisms in Brazil.

3.2 Information asymmetry and relationship lending

From the firm demand of liquidity aspect, the theoretical literature on lines of credit and banks’ advantages in liquidity provision suggests that firms should rely fully on bank lines of credit in their liquidity management. Holmstrom & Tirole (1998) motivate the use of lines of credit by embedding a moral hazard problem within a three-period model in which firms have a demand for liquidity, that is, they need advance financing. They use and entrepreneurial model of moral hazard in which the value of external claims on the firm is strictly less than the full value of the firm. The wedge between the full value of the firm and the external value of the firm prevents it from financing all projects that have positive net present value. To protect itself against such risks, the firm wants to hold liquid reserves in the form of marketed assets that can be readily sold or by arranging in advance for a line of credit (a long-term loan).

According to Myers & Majluf (1984). Outsiders want to make sure that the securities they purchase are not overpriced, and consequently discount them appropriately. Since outsiders know less than management, their discounting may underprice the securities, given management's information. Therefore, they argue that firms with higher information asymmetries will have a greater dispersion of slack, since these firms have more difficulty accessing capital markets. As a result, lines of credit are committed liquidity insurance that should protect firms against future capital market frictions. Therefore, the more the information asymmetries the firm faces, the more it should rely on bank lines of credit. In other words, from the firm liquidity demand perspective, more information asymmetry to the market and public makes firms rely on lines of credit more in their liquidity management.

However, from the bank credit supply perspective, information asymmetries make it harder to raise outside funds, In Berger & Udell (1995), to study the role of relationship lending in small firm finance, they examine the price and non-price terms of bank lines of credit (L/C) extended to small firms. They use firm AGE (the number of years that current ownership has been in place) and RELATE (the number of years that the firm has conducted business with its current lender) to capture potential information asymmetries faced by the firm. The distinction between the two proxies is that, firm age reflects information that becomes revealed to the market as a whole, that is, a firm’s public reputation. While RELATE reflects private information revealed through the intermediation process only to the lender through the bank-borrower relationship. They find that
borrowers with longer banking relationships pay lower interest rates and are less likely to pledge collateral. Moreover, older firms should be more likely to be known to capital markets and contains less information asymmetries. However, in Sufi (2007), such evidence of information asymmetry using number of years since IPO as proxy is not proved.

Due to the limitation and exclusivity of my database, I use the “firm age since registered in SCR” as a proxy of information transparency and relationship lending. The SCR system, established by the Brazilian national monetary council and administrated by the Brazilian central bank, is a register and query platform which provides information on loans, guarantees, lines of credits granted by financial institutions to legal entities and individuals. That is, the historical transactions of any firm registered in the system are transparent to the financial institutions registered in the SCR system. The proxy of firm age I use in this paper is the years since the firms registered in the SCR, that is, the credit information system of Brazilian central bank. As a result, the longer the firm age is, the more transparency and less information asymmetry the firm has. According to Berger & Udell (1995), which shows that firms with longer banking relationships pay lower interest rates and are less likely to pledge collateral, the older firms might rely more on the favorable credit lines.

Similarly, based on Berger & Udell (1995), I hypothesize that:

**H2: Firms with less information asymmetry to the market and public are more likely to obtain lines of credit, and more likely to rely on lines of credit instead of cash in their liquidity management.**

3.3 Financial Constraint

On the one hand, the credit lines literatures argue that lines of credit are motivated primarily by capital market frictions, and a committed line of credit overcomes these frictions by ensuring that funds are available for valuable projects. In other words, lines of credit should resolve precisely the capital market frictions that motivate firms to hold cash as a liquidity buffer. Therefore, from the firm liquidity demand perspective, small size, low asset tangibility, high capital expenditure ratios, or low net worth makes bank lines of credit more attractive for firms that are vulnerable to the market frictions.

Boot et al. (1987) uses a basic agency problem in a three-period model to motivate corporate demand for lines of credit. If interest rates are too high when investing in the second period, borrowers anticipate a low expected return from the project and thus choose low effort. A line of credit signed in the first period solves this problem by charging an up-front fee and guaranteeing a low rate of interest in the second period. Thus, the line of credit serves as interest rate protection,
which can guarantee that borrowers put in high effort initially. In addition, Kashyap et al. (2002) finds that banks have natural cost advantages in the provision of liquidity given deposit-based financing, which suggest that firms should rely on lines of credit over internal cash.

On the other hand, the literature related to cash holdings rejects the null hypothesis that the lines of credit and bank’s advantages in liquidity provision literature makes: firms should fully rely on bank lines of credit in their liquidity management. In Opler et al. (1999), the author finds that firms with strong growth opportunities, firms with riskier activities, and small firms hold more cash than other firms. To ensure that they will be able to keep investing when cash flow is too low, relative to investment, and when outside funds are expensive, consequently, firms facing financial constraint hold more liquid assets. By contrast, firms that have the greatest access to the capital market, such as large firms and those with credit ratings, tend to hold less cash. Moreover, in Sufi (2007), he proves that lines of credit do not provide sufficient liquidity insurance for all firms in the economy. The access to lines of credit is never immune to the financial constraint. He finds that most of the loans use financial covenant such as coverage, debt to cash flow, net worth, debt to net worth, current ratio, leverage ratio and no cash flow-based covenant. Once the ratio is not satisfied, the borrower is in default of the loan agreement.

In Gilchrist & Himmelberg (1995), they distinguish between groups of financially constrained and unconstrained firms on the basis of size. The argument for size as a good observable measure of financial constraints is that small firms are typically young, less well known, and thus more vulnerable to capital market imperfections. Besides, asset tangibility and net worth are commonly used as informative financial ratio of credit risk of borrower. In de VAB Silva (2013), there is evidence that Brazilian companies with higher levels of growth opportunities and thus more capital expenditures, face more difficulties in obtaining short-term funding. Motivated by the theoretical framework of Sufi (2007) and Almeida et al. (2004), I examine firm characteristics likely to be associated with firms facing a high cost of external relative to internal finance, and hypothesize that:

**H3:** Small size, low asset tangibility, high capital expenditure ratios, or low firm net worth makes lines of credit difficult to obtain, and makes firms rely on cash instead of lines of credit in their liquidity management.

4. Data

For basic financial characteristics data, I began with an internal database of BBM bank. This data between 1990 and 2015, included the basic financial characteristics data of Brazilian public and
non-public firms, which are, were or will be the BBM Bank’s clients. The database was created for
the credit analysis purpose by the BBM bank internally and was named as “balance 2016”. However,
for confidentiality reasons, the name of the firm was replaced with a registered code in
order to protect the interest of BBM Banks’ clients.

Core financial variables are calculated from “balance 2016” and are defined as follows. Book debt
is short-term debt plus long-term debt, all divided by total assets. A measure of assets tangibility is
tangible assets divided by non-cash total assets. The measure of cash flow is EBITDA divided by
non-cash total assets. Net worth—cash adjusted is defined as non-cash total assets less total
liabilities, divided by non-cash assets. Although the SCR goes back to 2004, I focus on the 2011 to
2015 period because the lines of credit data is only available since 1st January, 2012, when the
Brazilian central bank started to require all the financial institutions send their 3040 documents
reflecting their loan portfolio.

I scale cash flow, asset tangibility, net worth with non-cash book assets. I do so because firms are
likely to jointly determine cash holdings and line of credit usage. This joint determination leads to a
mechanical negative correlation between any measure scaled by total assets and the use of lines of
credit. For example, suppose one constructs the measure of tangibility as tangible assets scaled by
total assets. Given that cash is included in total assets, and given that firms without access to a line
of credit hold higher cash balances, this classification of asset tangibility leads to a mechanical
negative correlation with lines of credit. A disadvantage of using non-cash assets in place of total
assets to scale cash flow and asset tangibility is that it can lead to outliers.

I drop any firm-year observation for which any of the variables constructed above are missing. The
final full sample contains 340 firms (752 firm-year observations).

For firms’ utilization of lines of credit, I use the database of document 3046 produced by the
Brazilian Central Bank, which collects information from various banks that operate in Brazil
under the supervision of the Brazilian Central Bank. The SCR goes back to 2004. However, the data
about lines of credit is only available since 2012, when the Brazilian central bank requirement of
limit of credit disclosure came into force. The following information is contained in document 3046:

The firm general information, such as the number of CNPJ (Brazilian National Registry of Legal
Entities used for the fiscal purpose), the year that the firm first appears in the Brazilian central bank
system (I used it as proxy of the age of firms), the number of financial institutions that the firm has
relationship with.
The type of loan transaction, such as export or import financing, rural or agricultural financing, leasing, mortgage loan and other loan types, are also included. There are 20 different types of loan in total in the 3046 document.

The type of transaction of my interest is lines of credit (Limite de crédito), which is defined as the determined, contracted and unused portion of lines of credit. The Brazilian central bank regulates that any determined, contracted and unused credit lines should be attributed to the “lines of credit” type of loan operation, no matter whether that lines of credit is directed to export or infrastructure investment or any other purpose. In particular, the lines of credit are classified into two categories according to maturity: expires within 1 year and expires over 1 year.

In Sufi 2007, he creates two measures to assess the magnitude of lines of credit in corporate liquidity management, that is the bank liquidity to total liquidity ratio. Taking into account mechanical endogeneity concerns that certain types of firms consistently draw down heavily on existing lines of credit, the first measure is the total lines of credit scaled by the sum of total lines of credit and cash. To capture the fraction of liquidity available to the firm in the form of lines of credit, the second measure is the unused lines of credit scaled by the sum of unused lines and cash.

Unfortunately, due to the limitation of database, I only have access to the unused portion of the lines of credit instead of total lines of credit. As a result, I only adopt the second measure to study the available fraction of credit lines liquidity to the firm.

Moreover, the Bank BBM does not operate the lines of credit product. As a result, I do not have the access to the detailed information of the use of lines of credit, such as the used portion of the lines of credit, the total limit approved by the financial institutions, the pricing, the exact maturity data and even financial covenant violation information, of other banks that appear in the Document 3046.

To understand the product of lines of credit better, therefore, I first encountered the definition of lines of credit clarified by the Brazilian Central Bank in its Q&A document of 3046:

What is "Lines of Credit"? It is a contracted and un-used limit in any type or any combined types of loan arrangement, typically attributed to purposes such as overdrafts, credit card, working capital, etc. The lines of credit can become a credit transaction at any time, while it may also never become a credit transaction. For information purposes in the SCR, uncontracted lines of credit do not fall into the set of "lines of credit".

Here is an example given by SCR Brazilian Central Bank: A client has an overdraft limit equal to R$ 30,000.00 (thirty thousand reais). Imagine that the use of the overdraft is R $ 5000.00 (five
thousand reais), then this R$ 5000.00 effectively contracted and used amount will be reported as "loan - overdraft and guaranteed account " and the unused portion of overdraft, R$ 25,000.00 (twenty-five thousand reais), will be reported as "Lines of Credit".

To further understand the characteristics of lines of credit product, I searched the keywords “linha de crédito” and “limite de crédito” on the official site of the Brazilian banks equipped with lines of credit product. I find that most of bank credit lines products are designed for short-term (within one year) use and properties are frequently pledged as collateral. As is shown below, I collected some products available by different Brazilian banks:

1. **Caixa Guaranteed Account- Caixa Econômica Federal bank**

This revolving credit facility provides the Caixa’s clients with liquidity in his Caixa’s bank account, according to the contracted maximum loan balance, to cover possible cash flow needs. There is only predetermined interest rate charged on the drawn amounts. Interest refers only to the amounts used on weekdays, by monthly debiting the account and the guaranteed lines of credit can recover at any time, through credits in guaranteed account. The maturity of the product is 12 months, and the contract is renewable every year. The credit limit depends on the payment capacity of your company.

2. **Overdraft with check or account receivables- Banrisul Bank**

This is a revolving working capital that anticipates the receipt of post-dated check and account receivables from the company's sales. With this product, the company has resources available whenever he needs it; has liquidity to better take advantage of business opportunities; has better management of cash flow. There is no specific allocation requirement for credit and interest is charged only on the used amount at an attractive interest rates.

3. **Working capital with collateral- Banrisul Bank**

This is lines of credit for working capital under real estate collateral, which is in the name of the company or partner. It is designed for companies that need to raise funds with longer terms for payment. Firms can finance of up to 65% of the collateral property value and the payment maturity can be extended to up to 48 months; Payment of installments is realized by direct debiting the account at Banrisul Bank.
This data set is one of the first to contain detailed information on the use of lines of credit by a large sample of public and private firms operating in Brazil. I use this data set to explore why firms rely on cash versus lines of credit for liquidity.

**Table 3**
**Summary Statistics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
<th>St, Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>line of credit variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has line of credit {0,1}</td>
<td>0.866</td>
<td>1</td>
<td>0.341</td>
</tr>
<tr>
<td>Unused line/ (unused line + cash)</td>
<td>0.14</td>
<td>0.045</td>
<td>0.213</td>
</tr>
<tr>
<td>Unused line of credit/assets</td>
<td>0.012</td>
<td>0.002</td>
<td>0.088</td>
</tr>
<tr>
<td>Short-term unused line of credit/assets</td>
<td>0.011</td>
<td>0.002</td>
<td>0.084</td>
</tr>
<tr>
<td>Long-term unused line of credit/assets</td>
<td>0.001</td>
<td>0</td>
<td>0.014</td>
</tr>
<tr>
<td>Firm characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Book debt/assets</td>
<td>0.367</td>
<td>0.346</td>
<td>0.233</td>
</tr>
<tr>
<td>EBITDA/(assets− cash)</td>
<td>0.054</td>
<td>0.058</td>
<td>0.098</td>
</tr>
<tr>
<td>Tangible assets/(assets − cash)</td>
<td>1.065</td>
<td>1.037</td>
<td>0.23</td>
</tr>
<tr>
<td>Net worth, cash adjusted</td>
<td>0.154</td>
<td>0.189</td>
<td>0.402</td>
</tr>
<tr>
<td>Assets − cash</td>
<td>1882.731</td>
<td>534.511</td>
<td>4944.277</td>
</tr>
<tr>
<td>LN (Assets − cash)</td>
<td>6.36</td>
<td>6.244</td>
<td>1.344</td>
</tr>
<tr>
<td>Capital expenditure, cash adjusted</td>
<td>0.064</td>
<td>0.04</td>
<td>0.11</td>
</tr>
<tr>
<td>Firm age (years since registered in SCR)</td>
<td>40</td>
<td>35</td>
<td>28</td>
</tr>
</tbody>
</table>

This table presents summary statistics for non-financial firms from 2012 through 2015. It describes the sample of 340 firms (752 firm-year observations). Capital expenditure, cash adjusted, is the capital expenditure divided by the book value of assets less cash balances. Net worth, cash adjusted, is the net worth less cash balances divided by book assets less cash.

Table 1 contains summary statistics. 86.6% of firm-years have a line of credit between 2011 and 2015, which indicates that credit lines’ popularity among Brazilian firms. Moreover, the majority of lines of credit are short term (within 1 year).

On average, the unused portion of credit lines only represents 1.2% of book assets, much less than the results in Sufi 2007 study of American market, which represents 10% of book assets. In summary, credit lines are widely used by firms, but it only represents a tiny portion of total assets. Different from the traditional measure of information asymmetry, which is the number of years since IPO, the definition of the age of Brazilian company, is the number of years since it registered in the Brazilian Central Bank’s SCR system. The SCR system, established by the Brazilian national monetary council and administrated by the Brazilian central bank, is a register and query instrument.
which provides information on loans, guarantees, lines of credits granted by financial institutions to legal entities and individuals. The longer the history of firms registered in the SCR system, the more transparent the firm financial situation is to the credit market. Moreover, the average book debt assets ratio is relatively high in my sample (36.7%), which implies a higher leverage ratio in Brazil.

In order to assess the importance of lines of credit in corporate liquidity management, based on Sufi 2007, I measure the bank liquidity to total liquidity ratio by calculating the unused line of credit balance scaled by the sum of unused lines and cash, so as to capture the fraction of liquidity available to the firm in the form of lines of credit.

Table 2 provides additional evidence of the importance of credit lines. Firms from all major industries heavily utilize this financial product. In some cases, there are certain firms belongs to none of the general industry categories, as a result, the BBM bank groups those undefined firms into three categories based on the magnitude of default risk of those firms: P20 Brasil (20th percentile of default risk), Risco Brasil (50th percentile of default risk) and P80 Brasil (80th percentile of default risk).

Excluding the three uncommon industries defined by BBM Bank, the fraction of firms with lines of credit is high in all industries (above 83%). At the same time, lines of credit in corporate liquidity management also play a more important role in transportation, communications, and utilities and trade-wholesale sectors, according to their high bank liquidity to total asset ratio. The result is similar with that of Sufi 2007 in the America sample. Besides, the retail, the wholesale trade and the service industry have the highest leverage ratio.

Table 4
Which firms utilize bank lines of credit?

<table>
<thead>
<tr>
<th>Industry</th>
<th>Lines of credit [0,1]</th>
<th>Some debt [0,1]</th>
<th>Debt /assets</th>
<th>Unused line /assets</th>
<th>LT unused line /assets</th>
<th>ST unused line /assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>agriculture,minerals,construction</td>
<td>0.833</td>
<td>0.146</td>
<td>0.340</td>
<td>0.007</td>
<td>0.001</td>
<td>0.006</td>
</tr>
<tr>
<td>manufacturing</td>
<td>0.942</td>
<td>0.204</td>
<td>0.393</td>
<td>0.012</td>
<td>0.001</td>
<td>0.011</td>
</tr>
<tr>
<td>transportation,communications,and utilities</td>
<td>0.904</td>
<td>0.425</td>
<td>0.397</td>
<td>0.012</td>
<td>0.000</td>
<td>0.012</td>
</tr>
<tr>
<td>trade-wholesale</td>
<td>0.921</td>
<td>0.175</td>
<td>0.422</td>
<td>0.011</td>
<td>0.001</td>
<td>0.010</td>
</tr>
<tr>
<td>trade-retail</td>
<td>0.903</td>
<td>0.323</td>
<td>0.406</td>
<td>0.008</td>
<td>0.001</td>
<td>0.008</td>
</tr>
<tr>
<td>services</td>
<td>0.842</td>
<td>0.158</td>
<td>0.432</td>
<td>0.079</td>
<td>0.003</td>
<td>0.077</td>
</tr>
<tr>
<td>Debt outstanding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No debt outstanding</td>
<td>0.852</td>
<td>0</td>
<td>0.373</td>
<td>0.013</td>
<td>0.001</td>
<td>0.012</td>
</tr>
</tbody>
</table>
This table presents data on the use of lines of credit by firms in the sample of 340 firms (752 firm-year observation). It reports cell means for subsamples by industry and by having debt outstanding.

5. Empirical results

In this section, I conduct estimations to examine which firm characteristics influence the decision to utilize lines of credit as opposed to cash in corporate liquidity management. There are two sets of dependent variables. First, I examine a \( \{0,1\} \) indicator variable for whether the firm has a line of credit. For this dependent variable, I examine the effect of firm characteristics on the probability of having a line of credit using maximum likelihood Probit estimation. Second, I examine the bank liquidity to total liquidity ratio, which varies from 0 to 1. For this dependent variable, I examine the effect of firm characteristics on the ratio using linear (OLS) estimation and isolating the sample to only firms that have a line of credit. In all regressions, standard errors are clustered at the firm level and all regressions include year and industry indicator variables.

First, I examine firm characteristics likely to be associated with firms facing a high cost of external relative to internal finance. I use five measures. Based on the Sufi 2007 study, I employ non-cash total assets as opposed to total assets to scale variables. First, firm cash flow is measured as EBITDA scaled by non-cash total assets. I employ EBITDA because it is the most common measure of cash flow used by commercial banks when setting various types of covenants on lines of credit. Second, asset tangibility is measured as tangible assets scaled by non-cash total assets. Third, firm size is measured as the natural logarithm of non-cash total assets. I also include net worth scaled by non-cash assets. As for the growth opportunities proxy, according to Adam (2003), there are 5 widely used proxies:

a. the ratio of the market value of a firm's assets to the book value of its assets (MBA), measured as the ratio of the sum of the book value of debt, the book value of preferred stock, and the market value of equity to the book value of assets at yearend;

b. the ratio of the market value of equity to the book value of equity (MBE), measured as the ratio of the market value of equity to the book value of equity at yearend (Collins and Kothari, 1989);

c. the earnings-to-price ratio (EPR), computed as the ratio of earnings per share divided by closing stock price at yearend (Chung & Charoenwong, 1991);
d. the ratio of a firm’s capital expenditures divided by net plant property and equipment at the beginning of the period (the CAPEX/PPE ratio). The motivation for this variable is that capital expenditures are largely discretionary and lead to the acquisition of new investment opportunities. For example, by developing a mineral reserve, a firm acquires the option to extract the metal. Firms that invest more acquire more investment opportunities relative to their existing assets than do firms that invest less.

CAPX/PPE ratio = capital expenditures / net plant property and equipment at the beginning of the fiscal year

e. the ratio of research and development expenditures to the book value of assets at year-end (R&D).

Since I do not have any market value of assets or equity of any business group, or the R&D expenditures data, I use the CAPEX method scaled by non-cash assets to estimate and control the growth and investments opportunities effect on the usage of lines of credit.

In addition to determining what factors force firms to rely on cash instead of lines of credit, the empirical analysis also attempts to quantify the importance of information asymmetry on the use of lines of credit. Whether certain groups are public or not, whether they are in the Brazilian BM&Fbovespa (main exchange market) indices or not, I do not have access to these kinds of data due to the confidentiality issue of BBM Bank. As a result, I include the natural logarithm of the years since the firm’s register in the Brazilian Central Bank’s SCR (Information System of Credit) as a measure of information asymmetry, supposing that older firms are also more likely to be known to credit markets.

To understand better the correlation between each variable, as well as the potential causality, I conducted the pair-wise correlation. As is shown in Table 5, although the correlation between tangible assets and net worth (-0.2940), and that between net worth and firm size (0.2028) are relatively strong, the correlation between predictors is at reasonable level.

Table 5
Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>EBITDA</th>
<th>Tangible assets (assets − cash)</th>
<th>Ln (assets − cash)</th>
<th>Net worth (net worth, cash adjusted)</th>
<th>Capital expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Tangible assets/ (assets − cash)]t−1</td>
<td>0.0571</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Ln(assets − cash)]t−1</td>
<td>-0.0472</td>
<td>-0.1236</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Net worth, cash adjusted]t−1</td>
<td>-0.0651</td>
<td>-0.2940</td>
<td>0.2028</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Capital expenditure, cash adjusted]_{t-1}</td>
<td>0.0163</td>
<td>0.0525</td>
<td>0.0601</td>
<td>-0.0268</td>
<td></td>
</tr>
<tr>
<td>Ln[Firm age (years since registered in SCR)]_{t-1}</td>
<td>0.0288</td>
<td>0.0290</td>
<td>0.0985</td>
<td>0.0278</td>
<td>0.0881</td>
</tr>
</tbody>
</table>

To avoid the strange results appear such as inflated p values or reversed coefficient signs, I also measured the multicollinearity by testing the level of VIF among independent variables. By theory, VIFs from 5 to 10 need to be seen with caution and VIFs higher than 10 should be solved by eliminating correlated predictors. I find that VIF of all those predictors (including industry and year fixed effect) are smaller than 2, which implies no problem of multicollinearity.

Table 6 reports coefficient estimates from maximum likelihood Probit estimation relating the probability of having a line of credit to various firm characteristics. To make sure a robust result, I add each variable step by step. The Model 8 is the final model including all six variables and the industry and year effect. Consistent with the result in Sufi 2007, size is a strong statistical predictor of the use of bank lines of credit. From the credit line supply perspective, larger firms are easier to have access to credit lines.

Distinct from the Sufi 2007 result, in which firm cash flow has a strong positive effect on the probability a firm utilizes lines of credit, the coefficient estimate suggests that level of cash flow does not predict the probability of obtaining a line of credit. In model 6 and 7, we notice that the result of firm cash flow is not robust since it becomes less and less positively significant when adding more control variables. In other words, there is no causal relationship between the level of cash flow and usage of lines of credit. It is possible that accounting-based covenant in Brazil is not as popular as in the US, and contingent-maturity mechanisms such as periodic renegotiation of contract terms might be prevalent instead.
Table 6
Access to Bank lines of credit and firm characteristics

<table>
<thead>
<tr>
<th></th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
<th>M7 (including industry effect)</th>
<th>M8 (including industry and year effect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[EBITDA/(assets − cash)]_{t−1}</td>
<td>1.661</td>
<td>1.943*</td>
<td>2.243**</td>
<td>2.203**</td>
<td>2.239**</td>
<td>2.300**</td>
<td>1.938*</td>
<td>1.735</td>
</tr>
<tr>
<td></td>
<td>(1.084)</td>
<td>(1.086)</td>
<td>(1.033)</td>
<td>(1.048)</td>
<td>(1.051)</td>
<td>(1.060)</td>
<td>(1.066)</td>
<td>(1.090)</td>
</tr>
<tr>
<td>[Ln (Firm age (years since registered in SCR))]_{t−1}</td>
<td>-0.347***</td>
<td>-0.363***</td>
<td>-0.374***</td>
<td>-0.341***</td>
<td>-0.365***</td>
<td>-0.400***</td>
<td>-0.369**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.131)</td>
<td>(0.138)</td>
<td>(0.136)</td>
<td>(0.136)</td>
<td>(0.135)</td>
<td>(0.131)</td>
<td>(0.156)</td>
<td></td>
</tr>
<tr>
<td>[Ln(assets − cash)]_{t−1}</td>
<td>0.234***</td>
<td>0.248***</td>
<td>0.250***</td>
<td>0.275***</td>
<td>0.280***</td>
<td>0.237***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
<td>(0.063)</td>
<td>(0.063)</td>
<td>(0.065)</td>
<td>(0.069)</td>
<td>(0.069)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Tangible assets/(assets − cash)]_{t−1}</td>
<td>1.152</td>
<td>1.176</td>
<td>0.897</td>
<td>0.835</td>
<td>1.119</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.774)</td>
<td>(0.783)</td>
<td>(0.814)</td>
<td>(0.861)</td>
<td>(0.910)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Capital expenditure, cash adjusted]_{t−1}</td>
<td>-0.762</td>
<td>-0.830</td>
<td>-1.132</td>
<td>-0.999</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.893)</td>
<td>(0.887)</td>
<td>(0.891)</td>
<td>(0.934)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Net worth, cash adjusted]_{t−1}</td>
<td></td>
<td></td>
<td></td>
<td>-0.578*</td>
<td>-0.505</td>
<td>-0.480</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.305)</td>
<td>(0.318)</td>
<td>(0.329)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>752</td>
<td>752</td>
<td>752</td>
<td>752</td>
<td>752</td>
<td>752</td>
<td>752</td>
<td>752</td>
</tr>
<tr>
<td>R2</td>
<td>0.01</td>
<td>0.03</td>
<td>0.07</td>
<td>0.07</td>
<td>0.07</td>
<td>0.08</td>
<td>0.11</td>
<td>0.15</td>
</tr>
</tbody>
</table>

This table 6 reports the estimated marginal effects (or effect of going from 0 to 1 for indicator variables) of lagged firm characteristics on the probability of having a line of credit from maximum likelihood Probit estimation. Regressions include year and industry indicator variables; standard errors are clustered at the firm level.

***, **, * statistically distinct from 0 at the 1.5 and 10% level, respectively.
Table 7

Unused Bank lines of credit of firms with credit lines

<table>
<thead>
<tr>
<th>unused limit/ (unused limit+ cash)</th>
<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
<th>M5</th>
<th>M6</th>
<th>M7 (including industry effect)</th>
<th>M8 (including industry and year effect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[EBITDA/ (assets − cash)]_{t−1}</td>
<td>0.041</td>
<td>0.037</td>
<td>-0.002</td>
<td>0.032</td>
<td>0.032</td>
<td>0.041</td>
<td>0.024</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>(0.178)</td>
<td>(0.179)</td>
<td>(0.161)</td>
<td>(0.150)</td>
<td>(0.149)</td>
<td>(0.150)</td>
<td>(0.153)</td>
<td>(0.153)</td>
</tr>
<tr>
<td>[Ln (Firm age (years since registered in SCR))]_{t−1}</td>
<td>0.018</td>
<td>0.036***</td>
<td>0.038***</td>
<td>0.039***</td>
<td>0.039***</td>
<td>0.039***</td>
<td>0.037***</td>
<td>0.039***</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.012)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>[Ln(assets − cash)]_{t−1}</td>
<td>-0.053***</td>
<td>-0.057***</td>
<td>-0.057***</td>
<td>-0.058***</td>
<td>-0.057***</td>
<td>-0.057***</td>
<td>-0.056***</td>
<td>-0.056***</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.008)</td>
<td>(0.008)</td>
<td>(0.008)</td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.008)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>[Tangible assets/ (assets − cash)]_{t−1}</td>
<td>-0.508***</td>
<td>-0.499***</td>
<td>-0.478***</td>
<td>-0.487***</td>
<td>-0.487***</td>
<td>-0.494***</td>
<td>-0.494***</td>
<td>-0.494***</td>
</tr>
<tr>
<td></td>
<td>(0.081)</td>
<td>(0.080)</td>
<td>(0.086)</td>
<td>(0.089)</td>
<td>(0.089)</td>
<td>(0.088)</td>
<td>(0.088)</td>
<td>(0.088)</td>
</tr>
<tr>
<td>[Capital expenditure, cash adjusted]_{t−1}</td>
<td>-0.130</td>
<td>-0.128</td>
<td>-0.150</td>
<td>-0.176*</td>
<td>-0.176*</td>
<td>-0.176*</td>
<td>-0.176*</td>
<td>-0.176*</td>
</tr>
<tr>
<td></td>
<td>(0.094)</td>
<td>(0.094)</td>
<td>(0.093)</td>
<td>(0.093)</td>
<td>(0.093)</td>
<td>(0.095)</td>
<td>(0.095)</td>
<td>(0.095)</td>
</tr>
<tr>
<td>[Net worth, cash adjusted]_{t−1}</td>
<td>0.025</td>
<td>0.032</td>
<td>0.033</td>
<td>0.033</td>
<td>0.033</td>
<td>0.033</td>
<td>0.033</td>
<td>0.033</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.046)</td>
<td>(0.047)</td>
<td>(0.047)</td>
<td>(0.047)</td>
<td>(0.047)</td>
<td>(0.047)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>Number of observations</td>
<td>651</td>
<td>651</td>
<td>651</td>
<td>651</td>
<td>651</td>
<td>651</td>
<td>651</td>
<td>651</td>
</tr>
<tr>
<td>Number of firms</td>
<td>293</td>
<td>293</td>
<td>293</td>
<td>293</td>
<td>293</td>
<td>293</td>
<td>293</td>
<td>293</td>
</tr>
<tr>
<td>R2</td>
<td>0.01</td>
<td>0.01</td>
<td>0.11</td>
<td>0.16</td>
<td>0.16</td>
<td>0.16</td>
<td>0.17</td>
<td>0.18</td>
</tr>
</tbody>
</table>

This table 7 reports the coefficient estimates from an OLS estimation; The estimation isolates the intensive margin of the bank liquidity to total liquidity ratio by focusing only on firms that have a line of credit. Regressions include year and industry indicator variables; standard errors are clustered at the firm level.

***, **, * statistically distinct from 0 at the 1,5 and 10% level, respectively.
It was proved in Sufi 2007 that high market-to-book firms (firms with more investments opportunities and higher growth rate use less debt generally, and thus have lower probability of using lines of credit. In other words, there should be a negative correlation between the Capex ratio and the probability of having a line of credit. I use the capital expenditure method here instead due to the limitation of the database, however, inconsistent with the study of Sufi 2007 conducted in US, there is no such correlation found in the Brazilian sample.

I also find that the firm age affects the usage of lines of credit negatively, that is, the older firms are less probable to use lines of credit. It is consistent with the theoretical literature of credit lines which argues that lines of credit resolves precisely the capital market frictions that motivate firms to hold cash as a liquidity buffer. The shorter the history of firm in the SCR system, the more information asymmetry the firm faces, the more probable the firm should seek for the credit lines in its liquidity management.

By further using a continuous proxy of lines of credit, the total amount of unused lines of credit, which captures the liquidity available for the firm at the end of the year, as is shown in the table 7, I find the positive correlation between firm age and use of credit lines, and also find that firm size, tangible asset and capital expenditure negatively affect firm’s use of lines of credit. The result is partly consistent with the information asymmetry theory which argues that older firms are well known to the public, suffer less information asymmetry, and thus enjoy more favorable terms in loan contract. As a result, the older the firm age is and the deeper the relationship with banking system is, the more the firm relies on bank liquidity in its liquidity management. Additionally, consistent with the result in de VAB Silva (2013), Brazilian companies with higher levels of growth opportunities and thus more capital expenditures, face more difficulties in obtaining lines of credit.

Moreover, the result is also consistent with the credit lines theoretical literature, which argues that lines of credit are motivated primarily by capital market frictions, and a committed lines of credit overcomes these frictions by ensuring that funds are available for valuable projects. I find that smaller firms with less tangible assets rely more on bank liquidity in the liquidity management.

We notice that the results in the Table 6 and Table 7 are different. However, the result is meaningful and reasonable since the dependent variables in the two models are different. The dependent variable, in table 6, “Firm has line of credit (0,1)” measures the probability of firm using lines of credit or not. While the dependent variable, in table 7, “unused line/ (unused line+ cash) OLS” measures the portion available and the importance of the lines of credit that firm use. As is shown above, inconsistent with Sufi (2007) findings that cash flow is a strong predictor of whether a firm
uses bank lines of credit or cash in corporate liquidity management, I find that, in the Brazilian credit market, other than EBITDA, firm’s tangibility, noncash assets and Capex play a much more important and significant role in the usage of lines of credit for Brazilian business groups, in terms of the significant level and magnitude. This indicates that the channel for the correlation between lagged cash flow and use of lines of credit, the so called “cash flow-based financial covenants on the lines of credit” might not exist in the Brazilian case. Given the finding that the majority of lines of credit in Brazil are short term (within one year), the maturity in general can be seen as a covenant that disciplines the borrower. Because if maturity is short the LOC needs to be rolled over (renewed). The renewal is only done if the borrower behaves well, according to the terms of the contract. Hence, the short maturity of LOC partly (not fully) explains why there is not cash flow covenant in Brazil.

6. Conclusion

Bank lines of credit, or revolving credit facilities, are an instrumental component of corporate liquidity management. Theoretical research on credit lines argues that this financial instrument should resolve future capital market frictions facing firms. Existing research also suggests that banks can provide liquidity to firms more efficiently than reliance on internal cash. However, the literature related to cash holdings shows evidence that instead of using lines of credit, firms with capital market frictions, or financial constraint, choose cash.

In other words, the current market friction (financial constraint) prevents the firms to obtain the lines of credit to resolve the future market friction. The empirical study using United States credit market sample, fills the gap between these two areas: lines of credit are not totally unconditional obligations of banks. Banks use covenant violations to restrict the availability of the line of credit.

In particular, I examine the use and the importance of the lines of credit for firms, and find the wide use of lines of credit in Brazil (86.6% of firm-years have a line of credit between 2011 and 2015), although it only represents a tiny portion of total assets. Moreover, the majority of lines of credit are short term (within one year). The lines of credit is especially widely used in transportation, communications, and utilities and manufacturing, with over 90% of firm-year observations maintaining a line of credit. Furthermore, firms in these sectors, relatively, rely more on lines of credit than cash. In contrast, traditional sectors like agriculture, minerals, and construction, use less
liquidity insurance instruments (83.3% of firm-year observations). Besides, the retail, the wholesale 
trade and the service sectors have the highest leverage ratio.

The principal finding of the articles is that, distinct from the advanced US and Europe credit market, 
the EBITDA accounting-based covenant is not prevalent in Brazil. On the one hand, the short 
maturity of LOC might partly (not fully) explains this phenomenon because if maturity is short, the 
LOC needs to be rolled over (renewed) frequently and discipline the borrower as a result. On the 
other hand, other types of covenant or renegotiation and monitoring mechanisms might be practiced 
instead. Further study might be conducted to understand the usage of covenant in the Brazilian 
credit market. I also find that younger and larger firms have higher probability of using lines of 
credit. Meanwhile, older and smaller firms with less tangible assets, less capital expenditure and 
more banking relationship rely on credit lines more than cash in their liquidity management. To the 
best of knowledge, this is the first paper that proves both the cash theory and liquidity insurance 
theory at the same time.

This article represents one of the first empirical examinations of the use of bank lines of credit 
among Brazilian public and private firm. Meanwhile, there is also limitation on the data since the 
SCR database goes back to 2004 but I only have data about lines of credit this specific product from 
2012 onwards. There are several avenues for future research, three of which I outline here. First, 
researchers could further explore the usage, structure and content of the financial covenant of bank 
credit lines in Brazil, by collecting information such as the used portion of the lines of credit, the 
limit approved by the financial institutions, the pricing, the exact maturity date and even financial 
covenant violation information, as well as the key financial indicators in credit analysis and in the 
lines of credit loan application. Studying the key indicators in financial covenant and its violation 
helps understand the channel for the correlation between firm size, EBITDA and the use of lines of 
credit. Second, the banking relationship and information asymmetry, the main problem facing the 
lending industry, in the Brazilian credit market should be further explored to understand its impact 
on the financial constraint that firms face. Third, I study the LOC mainly from the firms' perspective 
(credit demand side) using firm variables. In further research it would be useful to consider bank 
characteristics (credit supply side factors). Also, as a simplification I use OLS estimation model, 
while for further study, the models could be estimated with more advanced econometric techniques, 
considering the panel structure of the dataset.
7. References


24. Nascimento, Luiz Roberto, and Diretor Comitê Controladoria ANEFAC. "UM ESTUDO EMPÍRICO SOBRE LIMITE DE CRÉDITO."


