THE EFFECT OF DEBT STRUCTURE ON INVESTMENT-CASH FLOW SENSITIVITY: EVIDENCE FOR BRAZIL

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ABSTRACT
We aim to analyze whether the different sources of financing used by companies can reduce their financial constraint and, consequently, the investment-cash flow sensitivity. To meet the objective, this study included a sample of 153 companies in the manufacturing industry, both public and private companies, subdivided between financially constrained and unconstrained firms. The analyzed period comprises the years 2009 to 2018. We chose the investment-cash flow sensitivity model as the basis for the analyzes. The results point out the rejection of the hypotheses that the sources of bank loans, subsidized loans and capital market debt can reduce the financial constraint. On the other hand, further analysis pointed to a possibility that concomitant use of different financing sources (debt heterogeneity) can cause an effect on financial constraints. The present study contributes to the literature in different ways. First, the study innovates by addressing different sources of financing and their relationship to financial constraints, unlike previous studies that are limited to specific sources of funding. Second, the study uses a single sample of companies. We analyzed more than 1300 financial notes considering both public and privately held companies, something barely addressed in previous related studies.

Keywords: Financial Constraint; Financing source; investment-cash flow sensitivity.

1. INTRODUCTION

The effect of financial constraints on firms is something that has been studied for years by several academics. It is known that financial constraint arises due to the presence of information asymmetry between the agents. In other words, this asymmetry is capable of making it difficult for the lender to assess the quality of loans, such as, for example, borrowers' ability to pay (Ambrozio et al., 2016). For this reason, the lender ends up constraining capital to certain companies (Fazzari & Athey, 1987). Thus, companies are considered financially constrained when do not have access to external resources or have them at a higher cost.

As a direct consequence of the financial constraint, certain companies are unable to finance all the investment projects and, therefore, are dependent on the capital generated internally. Fazzari et al. (1988) called this dependency as investment-cash flow sensitivity. It is possible, however, that this effect caused by the financial constraint, the investment-cash flow sensitivity, may vary according to the source of credit used by the firm, as pointed out by Behr, Norden and North (2013). There are different types of credit sources, with characteristics that are also different from each other, it is possible to assume that certain creditors may impose higher (lower) financial constraints on companies reflecting in a higher (lower) investment-cash flow sensitivity.

In recent years, researchers have been dedicated to this issue. We have as an example, studies by Behr et al. (2013), Lazzarini et al. (2015), Srinivasan and Thampy (2017) and Luo,

Zhang and Zhou (2018), which aimed to verify whether certain sources of financing would be able to reduce the financial constraint of firms. However, despite the importance of these surveys, in general, they focus on analyzing specific sources of finance, such as government-controlled banks. Recent studies (e.g. Colla; Ippolito & LI, 2013) have shown that the corporate debt structure is composed in general, of diverse sources of financing. As a result, we lack more empirical evidence that spots to the possible effect caused by different sources of financing on the financial constraint of firms.

The present study focuses on this context, seeking to verify if the different sources of financing can reduce financial constraint and, consequently, firm's investment-cash flow sensitivity. Thus, what we propose is an expansion of the analyzes made by previous studies, thus covering the three main sources of financing for Brazilian companies[1]: banking, subsidized loans and capital market.

To answer the proposed research problem, this study includes a sample of 153 companies (both public and private) of the manufacturing industry. We subdivided the sample between financially constrained and unconstrained companies. The model used for the analysis was the investment-cash flow sensitivity proposed by Fazzari et al. (1988).

Our results showed no empirical evidence that sources of bank loans, subsidized loans and capital market debt contribute to reducing financial constraints. On the other hand, further analysis pointed to a possibility that concomitant use of different financing sources (debt heterogeneity) can cause an effect on financial constraints.

Finally, this research can contribute to: a) expand the empirical knowledge about both financial constraint and the debt structure, especially concerning privately held companies; and b) subsidize the elaboration of strategies by the agents of the credit market to better satisfy the capital requirement of companies.

2. HYPOTHESES DEVELOPMENT

The financial constraint issue has its genesis in the recognition of the existence of information asymmetry between market agents, thus opposing the view of market efficiency addressed in Modigliani and Miller (1958).

Depending on the existing asymmetry, information about borrowers, such their ability to pay or even their investment choices, are not easily accessible to creditors (Ambrozio et al., 2016). Consequently, they end up imposing constraints on the external financing capacity of firms, making them financially constrained. Therefore, companies that do not have access to external resources or have them at a higher cost are considered financially constrained.

According to Fazzari et al. (1988), due to the constraint, companies are unable to finance all the investments and became dependent on the generation of internal resources, that is, more sensitive to cash flow. However, given that there are different types of creditors, whose characteristics also do not differ from each other, it is possible that there are creditors who impose less constrained on companies than others. At least it is this assumption that has been investigated in some studies over the past decade.

Behr et al. (2013) analyze whether the resources of a specific debt structure, termed as "saving banks" (state-owned banks), would be able to reduce the investment-cash flow sensitivity and, consequently, the financial constraint of German small and medium-sized companies. An approach similar to that by Behr et al. (2013) was also used in different contexts by Lazzarini et al. (2015), Srinivasan and Thampy (2017) and Luo et al. (2018).

Despite the importance of the aforementioned research, in general, they focus on the analysis of a specific source of funding such as government-controlled banks. Recent studies, like Colla, Ippolito and Li (2013) and Tarantin Jr. and Valle (2015) have shown that the

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[1] As can be seen in Tarantin Jr. and Valle (2015) and in the descriptive statistics of the present study.

corporate debt structure is, in general, composed of diverse sources of financing. It is known that, in Brazil, for example, there is a greater predominance of bank financing sources, subsidized and capital markets in the debt structure of firms[2]. Thus, we realize the effect of different sources on financial constraints still lacks empirical evidence. From that, a question that can naturally arise is: how could these sources of finance establish a relationship with the financial constraint?

The literature provides evidence that allows hypotheses to be developed in this regard, as shown below.

Regarding banks, one of the fundamental attributes about it is related to their ability to obtain private information from firms (Fama, 1985; James, 1987). Fama (1985) explains that, by having an advantage in monitoring loan contracts, banks have access to private information not available to other investors, reducing the information asymmetry between the lender and the company.

Another aspect that underlines the importance of banks in the credit market refers to the efficiency in monitoring, as pointed out by Diamond (1991). The author stresses the importance of monitoring banks for younger companies which public information is scarce. Monitoring would serve to create a positive credit history, allowing an increase in reputation in the market and, subsequently, access to other sources of finance (Diamond, 1991).

In summary, given the ability to obtain private information, the possibility of establishing a closer relationship with the borrower and the efficiency in monitoring, it is possible that bank credit contributes to reducing the financial constraint of companies. That said, we formulate the following hypothesis:

H_1: Bank debt contributes to the reduction of financial constraints of companies, measured by investment-cash flow sensitivity.

The characteristics attributed to bank credit mentioned above do not represent advantages for all companies, this is pointed out by Faulkender and Petersen (2006). In this regard, we have, as an example, the aforementioned study by Diamond (1991) which shows that only companies with a low reputation tend to benefit from bank credit. The author explains that, at an early stage, bank monitoring is necessary when there is little public information about the company, but those firms with a good reputation in the market tend to use the capital market debt (corporate debt securities) as means of financing.

The study of Faulkender and Petersen (2006) offers important insights on capital market debt. The authors verified empirically that companies with access to the private debt market have a higher level of leverage and they found explanation in two different aspects.

The first aspect concerns a quantitative character, after all, according to Ma, Stice and Williams (2019), one of the main characteristics of the corporate debt market is the possibility of accessing large amounts of resources in a global chain of investors. The second aspect is related to the cost, from this greater number of creditors, we expected a higher competition between them, triggering an offer of resources with a lower cost than those practiced by the private credit market (Marshall, Mccann & Mccolgan, 2016).

In Brazil, Tarantin Júnior and Valle (2015), corroborating the results presented by Faulkender and Petersen (2006), revealed that companies with access to capital market debt are more leveraged. Therefore, in view of the characteristics attributed to capital market credit, the following research hypothesis is formulated[3]:

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[2] According to Tarantin Jr. and Valle (2015) and in the descriptive statistics of this study.

[3] Although it is expected that most companies in the sample, which present access to the capital market are not considered financially constrained, the possibility is recognized that some companies considered constrained, also access capital market debt.

H_2: Capital market debt contributes to reduce financial constraints of companies, measured by investment-cash flow sensitivity.

Regarding subsidized credit, its existence comes from government intervention in the credit market and aims to establish the country's economic and social development (Doctor, 2015). According to Bonomo, Brito and Martins (2015) government intervention in the credit market can have two different implications. The first one is the subsidy for economically viable projects, but which, due to market failures, would not be financed within the private source. The second one concerns the financing of projects that, although not profitable, have positive externalities, thus making it socially desirable.

In addition, subsidized credit also assumes an anti-cyclical character, the loans granted by the government are less sensitive to macroeconomic shocks when compared to those of private banks (Coleman & Feler, 2015).

Therefore, the characteristics intrinsic to subsidized credit, mitigating effect on market imperfections through financing viable projects, to the non-cyclical character and the underlying social objective tend to be important aspects to satisfy the resource need of constrained companies. That said, we formulate the following hypothesis:

H_3: Subsidized debt contributes to reduce of financial constraints of companies, measured by investment-cash flow sensitivity.

The tests used to analyze the hypotheses are presented below.

3. METHODOLOGY

To understand whether different sources of finance can impact companies' financial constraints, we adopted the methodological procedures described in this section.

3.1. Data and Sample

The initial sample of this study is composed of 269 companies of the list "*Melhores e Maiores*" (Best and Bigger Companies in Brazil) of "*Exame*" magazine (2017). The 269 companies represent all companies in the manufacturing sector[4] (publicly-held and privately held) positioned among the 500 companies of "*Melhores e Maiores*" (Best and Bigger).

The choice of the manufacturing industry is based on two distinct aspects. The first is related to the economic importance of this sector in the Brazilian economy. More specifically, recent data from the Brazilian Manufacturing Profile (made available by the National Confederation of Industry) evidence its relevance in i) Brazilian trade balance, more than 70% of exports of goods and services in 2018; ii) in investment in research and development, being responsible for more than 72.2% of business investment in R&D in 2017; iii) Brazilian Federal Taxes, responsible for 34.2% of the total collection in 2018.

The second aspect is related to the fact that the manufacturing industry is the most representative sector concerning the use of intensive capital, as pointed out by Khieu, Chen and Pyles (2014). This characteristic makes the manufacturing industry an appropriate sector for studies that seek to investigate issues related to the investment of firms, such as this research.

We excluded 116 of the 269 companies present in the initial sample. In general, the exclusion occurred because we were not able to obtain the necessary information of variables

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[4] Auto Industry, Capital goods, Consumer goods, Electronics, Energy, Pharmaceutical, Construction industry, Digital Industry, Mining, Pulp and Paper, Chemicals and Petrochemicals, Steel and Metallurgy and Textiles.

in this study. As a result, 153 companies remained, of which 64 are publicly traded and 89 are privately held companies.

We extracted data from the balance sheet, income statement and cash flow statement from the FIPECAFI database ("*Melhores e Maiores*" - Best and Bigger). The data concerning the sources of financing - only available in financial notes - we obtained them from three different sources: i) from the Brazilian Stock Exchange (B3) website for publicly traded companies; ii) from the database of "*Valor Econômico*" (Valor PRO) for most private companies, and iii) FIPECAFI ("*Melhores e Maiores*" - Best and Bigger) for privately held companies whose financial notes are not available on the database of Valor Pro.

The data regarding the sources of financing were hand collected. Altogether, we analyzed more than 1300 financial foot notes for the development of this study.

Data belong to the period from 2009 to 2018. This initial period (2009) was chosen because of the issuance of instruction by the Brazilian Securities and Exchange Commission (*Comissão de Valores Mobiliários*) No. 476, which occurred on January 16, 2009. This was aimed at simplifying and streamlining the process for companies to access the capital market. This instruction reduced the costs of issuing securities and facilitated companies' access to capital market.

3.2. Corporate Debt Structure

To meet the hypotheses proposed in this study, we categorized the debts of the companies in the sample. The choice of debts, as well as the method used to categorize them, is based on Colla et al. (2013), Póvoa and Nakamura (2015), Valle and Albanez (2012) and Valle and Tarantin Júnior (2015).

The types of debt contemplated in this study are: i) Bank debt (*Bank*): "bank debt" was defined as the funds raised through both national and international banking institutions (for example bank credit note, guaranteed account, duplicate discount, transactions, advance on foreign exchange contract, among others); ii) capital market debt (*Capital*): for this category, national and international funds from corporate debt securities (for example, debentures, promissory notes and Credit Rights Investment Fund); iii) subsidized debt (*Subsid*): this category includes resources whose interest rate is subsidized by the government, whether at the federal, state or municipal level (for example resources from the Constitutional Financing Fund of the Northeast and Fund of Financing from the Midwest, both in Brazil) and iv) others (*Others*): in this last category we allocate debts not belonging to the previous classifications.

The categorization of debts was made through access to the information contained in the financial note of the companies. We analyzed each financial note corresponding to each year and for each company to categorize the different types of debts in the 4 categories mentioned above.

In general, each variable (*bank*, *subsid*, *capital* and *others*) represents the participation (in percentage) of a certain debt on the company's total indebtedness. Thus, for each company and year, the sum of the 4 categories is equal to 1 (100%). As higher this percentage than greater is the share of debt in total debt.

3.3. Financial Constraint Measures

We segregated the sample into two distinct groups: i) financially constrained companies and ii) companies not financially constrained. Since financial constraint is not directly observable, empirical studies are based on proxies to classify companies between constrained and unconstrained.

The present study adopted the rating criterion to separate the sample. Also adopted in previous studies such as those by Faulkender and Petersen (2006) and Khieu, Chen and Pyles (2015). Through this criterion, companies that have not (presented) credit rating from at least

one of the top rating agencies (Moody's, Fitch and Standard & Poor's) are considered constrained (unconstrained) over the sample period. However, to establish an even better separation between groups of companies, additionally, we decided to consider financially constrained companies that, in addition to not having a credit rating throughout the study period, also do not have shares traded on Brazilian Stock Exchange (B3).

This adaptation was necessary considering that, as they did not present a credit rating throughout the analysis period, some large publicly traded companies would be positioned within the group of financially constrained companies.

This fact, however, contrasts with the fundamentals that justify the rating criterion. After all, in essence, the rating criterion seeks to segregate companies based on the degree of information asymmetry between them. For this reason, when considering a sample that includes publicly traded and privately held companies, companies with publicly traded capital should not be placed in the group of financially constrained. After all, these companies, in addition to publishing quarterly information audited, follow specific transparency rules established by B3, in addition to being among the best and bigger companies in Brazil of sales volume.

The information about the ratings of the companies was collected through the database available on the website of Professor Tatiana Albanez[5].

3.4. Econometric Model

To analyze the hypotheses, we use the econometric model of investment-cash flow sensitivity as a basis. This model is widely used in financial constraint research such as Fazzari et al. (1988); Almeida and Campello (2010); Behr et al. (2013); and Lazzarini et al. (2015).

We proceeded with some adaptations to the original model, we changed the Tobin's Q variable (proxy for investment opportunities) due to the existence of privately held companies in the sample. We chose to consider the variation in the firm's revenues as a proxy for investment opportunities, according to Ghani et al. (2015).

In addition to the proxy for investment opportunity (SalesGrow), we also adopted the current liquidity (CL) variable as a control. The importance of establishing liquidity as a control is explained in the study by Fazzari et al. (1988). The authors explain that internal liquidity can affect investment to the extent that it can be considered a low-cost source of financing for those companies that need to pay a premium for external resources.

Table 1 provides more details about the calculation of these variables, as well as the studies that included them in their models. We reach the following equation:

$$I_{i,t} = \beta_0 + \beta_1 CF_{i,t} + \beta_2 CL_{i,t} + \beta_3 SalesGrow_{i,t} + e_t \quad (1)$$

With equation 1 as a basis (*I* as investment and *CF* as cash flow), we started to insert variables that relate to companies' sources of financing. With that, interactions were established between the variables of the financing sources and the cash flow. The purpose of these interactions is to analyze whether and how such sources of finance impact financial constraints and, consequently, investment-cash flow sensitivity.

We used dummy variables representing the strong, moderate and weak proportions of each source of financing. Therefore, the variable $Strong\_financ$ presented a value of 1 if the proportion of the source of financing was greater than 66.66% or 0 if it is less. The variable Mod_financ took value 1 if the debt structure presented a proportion between 33.33% and 66.66% or 0, otherwise. The mathematical representation is found in the following equation.

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[5] https://www.tatianaalbanez.com/basesexcel

$$I_{i,t} = \beta_0 + \beta_1 CF_{i,t} + \beta_2 Strong\_financ / Mod\_financ_{i,t}$$
$$+ \beta_3 \big(FC_{i,t} * Strong\_financ / Mod\_financ_{i,t} \big) + \beta_4 CL_{i,t}$$
$$+ \beta_5 SalesGrow_{i,t} + e_t \quad (2)$$

Equation 2, therefore, was estimated for each of the three debt structures (both for the sample of constrained and unconstrained companies). When interacting cash flow (CF) with the variables of the sources (moderate and strong proportion) of financing (banking, subsidized and capital markets). We expected *β3* to be negative and significant. This result indicates that a greater presence of a specific source of financing is related to the reduction of financial constraint and investment becomes less sensitive to the cash flow of firms.

We used panel data with firm's fixed effects as an analysis technique. In the fixed effects model the intercept is a fixed parameter, capable of capturing the differences between the companies in the sample. Given the idiosyncrasy present in the financial decisions of firms, the fixed effects model was more suitable for this study. Table 1 shows all the variables used in the model. We also chose to use the winsorizing[6] the sample (at 1% level) in variables that present higher dispersion from the mean to mitigate the impact of outliers.

Table 1. Model variables

Variable	Variable Code	Description	Baseline studies
Dependent variable			
Investment	$I_{i,t}$	Capex (*capital expenditure*) divided by total assets at the beginning of the period.	Ghani, Martelanc e Kayo (2015) e Srinivasan e Thampy (2017)
Independent variables			
Cash flow	$CF_{i,t}$	Net income plus depreciation and amortization divided by total assets at the beginning of the period.	Sousa and Ottaviano (2017) e Silva, Caixe e Krauter (2019)
Debt Structure	$Bank_{i,t}$	Percentage of bank loan over total loan.	Behr et al. (2013), Lazzarni et al. (2015) and Srinivasan and Thampy (2017)
	$Strong\_Bank_{i,t}$	Dummy with a value of 1 if the bank loan (unsubsidized) is equal or higher than 66% of total loans, and 0 otherwise.	
	$Mod\_Banco_{i,t}$	Dummy with a value of 1 if the bank loan (unsubsidized) is between 33% and 66% of total loans, and 0 otherwise.	
	$Subsid_{i,t}$	Percentage of subsidized loan over total loan.	
	$Strong\_Subsid_{i,t}$	Dummy with value 1 if the subsidized loan is equal or higher than 66% of total loans, and 0 otherwise.	
	$Mod\_Subsid_{i,t}$	Dummy with value 1 if the subsidized loan is between 33% and 66% of total loans, and 0 otherwise.	
	$Capital_{i,t}$	Percentage of capital market debt over total loan.	
	$Strong\_Capital_{i,t}$	Dummy with value 1 if the capital market debt is equal or higher than 66% of total loans, and 0 otherwise.	
	$Mod\_Capitais_{i,t}$	Dummy with value 1 if the capital market debt is between 33% and 66% of total loans, and 0 otherwise.	
Control Variables			
Current liquidity	$CL_{i,t}$	Current Assets divided by Current Liabilities.	Fazzari et al. (1988)

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[6] As it was done in Khieu, Chen and Pyles (2015).

Sales growth	SalesGrow $_{i,t}$	Change in revenue from sales of total assets at the beginning of the period.	Behr et al. (2013) and Srinivasan and Thampy (2017).

Source: Author's own elaboration.

4. RESULTS

4.1. Descriptive Statistics

Table 2 shows the result of the descriptive statistics of the sample of constrained and unconstrained companies.

Table 2. Descriptive statistics

Variable	I	CF	Bank	Capital	Subsid	CL	Sales Grow	Sales GrowDef
Constrained Companies								
Observation	530	530	530	530	530	530	527	448
Mean	0,030	0,083	0.424	0.076	0.429	1,542	0,197	0,2179
SD	0,092	0,124	0.384	0.221	0.387	0,905	0,468	0,532
Minimum	-0,211	-0,565	0.000	0.000	0.000	0,399	-0,434	-0,434
Maximum	0,422	0,936	1.000	1.000	1.000	5,384	2,799	3,178
Unconstrained Companies								
Observation	679	679	679	679	679	679	678	597
Mean	0,025	0,090	0,328	0,324	0,320	1,633	0,107	0,109
SD	0,083	0,088	0,259	0,288	0,261	0,878	0,287	0,317
Minimum	-0,211	-0,249	0,000	0,000	0,000	0,399	-0,434	-0,434
Maximum	0,442	0,860	1,000	1,000	1,000	5,384	2,799	3,178
Mann-Whitney (Prob > |z|)[7]	0,701	0,111	0,019	0,000	0,013	0,006	0,003	0,001

Note: Investment (I) - Capex (capital expenditure) divided by the total assets at the beginning of the period; Cash Flow (CF) - Net income plus depreciation and amortization divided by total assets at the beginning of the period; Bank - Bank loan (unsubsidized) over total loan; Capital Market Debt (Capital) - Capital market debt divided by the total loan; Subsidized Loan (Subs) - Subsidized loan divided by total loan; Current Liquidity (CL) - Current Assets divided by Current Liabilities; Sales Grow - Change in revenue from sales of total assets at the beginning of the period. SD = Standard Deviation.

The results show that, during the analyzed period, the mean of investments by constrained companies is 3%, which represents 0.5 basis points above the average of unconstrained companies (2.5%). Despite this, in general, the Mann-Whitney test presented in Table 2 shows that the difference is not statistically significant. Regarding the variable SalesGrow, the mean for constrained companies is 0.9 basis points above the mean presented for unconstrained companies. This shows that companies considered constrained have, on average, greater growth opportunities than companies that are not financially constrained.

Finally, regarding the variables related to the debt structure, the percentage of bank and subsidized credit is higher for constrained companies (42.4% and 42.9%, respectively) than for unconstrained companies (32.8 % and 32%, respectively). On the other hand, the percentage of capital market debt is higher for unconstrained companies (32.4%) when compared to constrained companies (7.6 %). The following section presents the results of the regressions in panel data.

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[7] This (non-parametric) test was chosen in view of the results by Shapiro-Wilk and Doornik-Hansen who pointed out that the data does not follow a normal distribution (p-value > 0.05). For variables that presented maximum and minimum values that were far from the mean (i.e. investment, cash flow and sales growth), the Mann-Whitney test was performed after application of winsorization.

4.2. Panel Data Regression Analysis

The following tables present the results of the regression in panel data for each of the model variations (equation 2). We perform VIF tests (Variance Inflation Factor) for multicollinearity and White for heteroscedasticity for all estimations. None of the models presented multicollinearity (vif > 5), whereas all of them proved to be heteroscedastic (p-value < 0.000). To mitigate the effects of heteroscedasticity, the regression models were estimated using a robust regression technique for heteroscedasticity (Huber-White Standard Errors).

We obtained the results presented in table 3 employing regression whose econometric model is the one represented in equation 2.

Table 3. Effect of financing sources on the financial constraint (group of companies constrained)

Variables	Capital market		Subsidized		Banking	
CF	**0.226****	0.199	**0.203***	**0.080***	**0.221***	**0.225***
	(0.108)	(0.122)	**(0.118)**	**(0.046)**	**(0.115)**	**(0.129)**
Mod_financ	**0.058***		-0.003		0.012	
	(0.030)		(0.015)		(0.027)	
Mod_financ*CF	**-0.728*****		-0.009		-0.180	
	(0.142)		(0.134)		(0.195)	
Strong_financ		-0.011		-0.020		0.002
		(0.039)		(0.015)		(0.019)
Strong_financ*CF		0.052		0.215		-0.123
		(0.181)		(0.134)		(0.131)
SalesGrow	0.010	0.008	0.008	0.011	0.009	0.009
	(0.013)	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)
SalesGrow_def	**0.025*****	**0.022****	**0.022****	**0.024*****	**0.022*****	**0.0229****
	(0.007)	**(0.008)**	**(0.008)**	**(0.008)**	**(0.008)**	**(0.008)**
CL	-0.008	-0.009	-0.009	-0.006	-0.008	-0.008
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)
Constant	0.014	0.018	0.019	**0.023***	0.016	0.017
	(0.013)	(0.013)	(0.014)	**(0.012)**	(0.014)	(0.016)
Observations	448	448	448	448	448	448
R-squared	0.119	0.088	0.088	0.105	0.095	0.092

Note: Dependent variable: Investment (Capex (capital expenditure) divided by the total assets at the beginning of the period); Robust errors in parentheses. *** significant coefficient at the 1% significance level; ** significant coefficient at the significance level of 5%; * significant coefficient at the significance level of 10%. All models were estimated using robust firms' fixed effects.

According to the results of table 3, in general, firms considered to be constrained have investment-cash flow sensitivity as the coefficient of the CF was positive and statistically significant.

Some variables of interest in this study, the interactions of CF with bank and subsidized sources, were not statistically significant. This suggests that there is no empirical evidence that these sources contribute to reducing financial constraints in Brazil, consequently, causing the rejection of hypotheses 1 and 3.

It is important to mention that the lack of evidence found for the subsidized credit source contradicts the results found in studies such as Behr et al. (2013) and Srinivasan and Thampy (2017). In these studies, the authors found empirical evidence that credits granted by sources linked to the government reduce the financial constraint of companies. On the other hand, to

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some extent, the results are similar to those found by Lazzarini et al. (2015). In their study, the authors find no evidence that BNDES (Brazilian National Bank for Economic and Social Development), a relevant source of subsidized credit, contributes to the reduction of financial constraints.

Similarly, the lack of evidence found for the bank credit source seems to suggest that the characteristics attributed to bank credit (e.g. ability to obtain private information, establish a banking relationship and monitor efficiency) would not be enough to reduce the financial constraint of the sample.

For capital market debt, however, the interaction with a moderate share of the capital market showed a negative and statistically significant impact. In this case, the magnitude of the interaction coefficient shows, for these companies, the moderate proportion of capital market debt turns the investment-cash flow negative.

The relationship between the moderate participation and the investment-cash flow sensitivity was expected, therefore, was also a expected relationship between the strong participation of the capital market debt and the investment-cash flow sensitivity. The non-significance of the strong participation of the capital market debt demands a more detailed analysis of the result. This sheds light on a possible endogeneity problem and the interaction term (Mod_financ*CF) may be capturing an effect of some variable omitted from the model. We covered this matter in the next section.

Table 4 presents the results of the estimates for the group of unconstrained companies.

Table 4. Effect of financing sources on the financial constraint (group of companies unconstrained)

	Capital market		Subsidized		Banking	
CF	0.105	0.039	**0.149***	**0.170****	0.117	0.083
	(0.082)	(0.071)	**(0.081)**	**(0.078)**	(0.087)	(0.075)
Mod_financ	-0.004		0.009		-7.64e-05	
	(0.016)		(0.013)		(0.015)	
Mod_financ*CF	0.007		-0.120		-0.053	
	(0.150)		(0.110)		(0.105)	
Strong_financ		-0.033		**0.045****		**-0.026***
		(0.022)		**(0.016)**		**(0.014)**
Strong_financ*CF		**0.521****		**-0.326****		0.216
		(0.196)		**(0.130)**		(0.174)
SalesGrow	**0.035****	**0.038****	**0.036****	**0.032***	**0.035****	**0.035****
	(0.017)	**(0.017)**	**(0.017)**	**(0.017)**	**(0.017)**	**(0.017)**
SalesGrow_def	**0.022****	**0.021***	**0.021***	**0.024****	**0.023****	**0.022****
	(0.011)	**(0.011)**	**(0.011)**	**(0.011)**	**(0.011)**	**(0.011)**
CL	-0.005	-0.005	-0.006	-0.005	-0.006	-0.006
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Constant	0.017	0.022	0.014	0.008	0.017	0.020
	(0.014)	(0.013)	(0.014)	(0.014)	(0.015)	(0.014)
Observations	597	597	597	597	597	597
R-squared	0.040	0.059	0.043	0.057	0.041	0.045

Note: Dependent variable: Investment (Capex (capital expenditure) divided by the total assets at the beginning of the period); Robust errors in parentheses. *** significant coefficient at the 1% significance level; ** significant coefficient at the significance level of 5%; * significant coefficient at the significance level of 10%. All models were estimated using robust firms' fixed effects.

The results presented for unconstrained companies (table 4) are not similar to those found for the group of constrained companies. Capital Market estimates showed that firms with

stronger capital market dependence tend to have more investment-cash flow sensitivity. These results may be reflecting a specific effect caused by some companies in the group of unconstrained.

As an example, within the group of unconstrained companies, some of them have a substantial share of resources from the capital market in their debt structure. These companies, however, have an average investment of 0.9%, while the average investment of the group of unconstrained companies, as a whole, is 2.5% (see table 2). It is possible, that the result present in estimation is, in a way, skewed by a group of companies that invest below the mean of their peers. On the other hand, according to the results, firms with greater subsidized dependence tended to suffer less investment-cash flow sensitivity.

In general terms, until now, what has been noticed is that there is no empirical evidence that the sources of bank and subsidized financing contribute to the reduction of financial constraint. These results, therefore, lead to the rejection of hypotheses 1 and 3 of this study. Hypothesis 2, the one dealing with capital market debt, could not be rejected. Nevertheless, to investigate a possible endogeneity problem on hypothesis 2 results, we conduct some robustness tests.

4.3. Robustness Tests

First, to verify whether the main results obtained so far are robust to the use of an alternative sample partition criterion, we made new estimates whose criterion was the company size. This criterion has been used by several studies that address the financial constraint theme, among which Almeida and Campello (2010) and Behrn et al. (2013). According to the authors, the use of company size criterion is justified because smaller companies tend to be younger and less known. For this reason, these companies would be less likely to obtain external financing or, they would obtain it at higher costs.

For the size criterion, we ranked all companies in the sample for each year, according to their size (total assets). The companies that were positioned in the last three deciles were considered constraint, and the others were considered as unconstrained (Behr et al., 2013). The results are shown in table 5.

Table 5. Effect of financing sources on the financial constraint (group of companies constrained by the size criterion)

	Capital market		Subsidized		Banking	
CF	**0.128***	0.104	**0.122****	**0.122***	**0.120****	**0.160***
	(0.065)	(0.071)	**(0.061)**	**(0.0642)**	**(0.0563)**	**(0.0817)**
Mod_financ	0.020		-0.006		-0.0311	
	(0.024)		(0.017)		(0.0227)	
Mod_financ*CF	**-0.389****		0.0284		0.0851	
	(0.158)		(0.113)		(0.115)	
Strong_financ		-0.025		-0.002		0.017
		(0.029)		(0.025)		(0.013)
Strong_financ*CF		0.167		0.014		-0.073
		(0.116)		(0.138)		(0.115)
SalesGrow	0.029	0.025	0.024	0.025	0.029	0.026
	(0.021)	(0.023)	(0.022)	(0.022)	(0.022)	(0.022)
SalesGrow_def	0.018	0.014	0.014	0.014	0.013	0.013
	(0.014)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)
CL	0.012	0.012	0.0113	0.011	0.011	0.012
	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Constant	-0.016	-0.013	-0.013	-0.014	-0.009	-0.024

	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.018)
Observations	304	304	304	304	304	304
R-squared	0.063	0.052	0.049	0.049	0.064	0.053

Note: Dependent variable: Investment (Capex (capital expenditure) divided by the total assets at the beginning of the period); Robust errors in parentheses. *** significant coefficient at the 1% significance level; ** significant coefficient at the significance level of 5%; * significant coefficient at the significance level of 10%. All models were estimated using robust firms' fixed effects.

From table 5 onwards, we noted that, in general, the results were robust even with an alternative criterion of sample partition. We continue rejecting hypotheses 1 and 3 because we could not find evidence that banking and subsidized capital reduce investment-cash flow sensitivity of constraints firms. Furthermore, we still not rejecting hypothesis about the capital market (hypothesis 2).

To obtain a better understanding of the capital market debt results, we sought to analyze in more detail the group of constrained companies that have a moderate share of the capital market debt in their debt structure. We aim to find out if there is an omitted variable whose effect is being captured by the interaction term.

Through this analysis, we found that this group of companies, among all the companies in the constrained group, are those that have a more heterogeneous debt structure. In other words, they are companies that have participation of the three main sources of financing in their debt structure (banking, subsidized and capital markets).

As an example, on average, these companies have a 32% share of bank debt, 17% of subsidized debt and 48% of capital market debt. Among the constrained companies, no other group of companies has such a heterogeneous configuration of their debt structure. Thus, one of the possible explanations is that it would not be the moderate participation, per se, that is causing the effect on the financial constraint, but more heterogeneous participation of the debt structure.

From this assumption, we proceed with some tests based on Colla, Ippolito e Li (2013) about homogeneity and heterogeneity of debt structure or, in other words, the degree of debt specialization (Herfindahl-Hirschman Index - HHI). To measure it, the authors added the squares of each debt category and divided them by the total debt of company i at time t, as shown in equation 3.

$$SQ_{it} = \Sigma \left(\frac{Debt\ x_{it}}{Total\ Debt_{it}}\right)^2 \ (3)$$

"Debt X" represents all different debt types that, in Colla et al. (2013), was 7. To obtain IHH, the following calculation must be made:

$$IHH = \frac{SQ_{it} - 1/n}{1 - 1/n} \ (4)$$

The "n', on equation 4, represents the number of all different debt types of firms. According to Colla et al. (2013), when HHI is 1, the firm's debt structure is composed just by one debt type (for instance, 100% of bank loan). And, when HHI is 0, firms have different kinds of debt on their debt structure. Following Póvoa e Nakamura (2014), we consider HHI values above 0.7 as indicative of homogeneous debt structure, while value bellow 0.7, indicative of heterogeneous structure.

We create a dummy variable (Debt_Heterogeneity) to capture debt heterogeneity from the firm's debt structure. We assign value 1 to firms that HHI was bellow than 0.7 and had some participation in each of the three debt sources, and 0 otherwise.

We estimate a panel data regression with distinct separation criteria: rating criterion (column 1) and company size criterion (column 2). Table 6 presents the results.

Table 6. Debt Heterogeneity and Investment-Cash Flow Sensitivity

	Rating Criterion	Size Criterion
CF	**0.242****	**0.135****
	(0.106)	**(0.066)**
Debt_Heterogeneity	0.034	0.055
	(0.022)	(0.036)
Debt_Heterogeneity*CF	**-0.738*****	**-0.619****
	(0.141)	**(0.266)**
CL	-0.007	0.012
	(0.005)	(0.007)
SalesGrow	0.009	0.027
	(0.013)	(0.021)
SalesGrow_def	**0.026*****	0.019
	(0.007)	(0.014)
Constant	0.010	-0.017
	(0.014)	(0.016)
Observations	448	304
R-squared	0.137	0.073

Note: Dependent variable: Investment (Capex (capital expenditure) divided by the total assets at the beginning of the period); Robust errors in parentheses. *** significant coefficient at the 1% significance level; ** significant coefficient at the significance level of 5%; * significant coefficient at the significance level of 10%. All models were estimated using robust firms' fixed effects.

As predicted, the relationship between debt heterogeneity and investment-cash flow sensitivity is and statistically significant. This result reinforces the assumption that was the debt heterogeneity effect was being captured by the moderate Capital Market variable.

A possible explanation for this result is found in Jadiyappa, Saikia and Parikh (2019). According to the authors, the heterogeneity of the debt structure is an ideal strategy for managers to overcome the difficulties imposed by financial constraints. This happens, according to the authors, considering that, in general, the financial constraint limits the company's ability to obtain all the necessary resources from a single source. Hence the need to seek resources through different sources.

Moreover, the magnitude of the interaction coefficient (Debt_Heterogeneity*CF) shows, for these companies, the debt heterogeneity turns the investment-cash flow negative. Probably these companies increase, on average, their investments on reduced cash flow periods to improve future outcomes. Nevertheless, this assumption should be addressed, with more details, in future research.

In summary, all the results found, lead us to reject each hypothesis developed before. That is, we could not find consistent evidence that bank loans, subsidized loans, or capital market credit contribute to reducing financial constraints and, consequently, lower investment-cash flow sensitivity. Furthermore, the relationship between financial constraint and debt heterogeneity/homogeneity, briefly addresses, is still an open question for future research.

5. FINAL REMARKS

We aimed to empirically investigate whether the different sources of financing are capable of reducing financial constraint and, consequently, the investment-cash flow sensitivity of firms.

In general, the first results of the study showed that there is no empirical evidence that sources of bank and subsidized financing contribute to reducing financial constraints, rejecting the hypotheses (1 and 3) previously established. On the other hand, given the significant association between moderate participation in capital market and investment-cash flow sensitivity, it was not possible, initially, to reject the hypothesis (2) that the capital market debt reduces the financial constraint of companies.

However, a more detailed analysis showed the constrained companies, that have moderate participation in the capital market debt, also have relevant participation from other sources of financing. So, we suppose that the effect on the financial constraint was being caused, in fact, by further diversifying the debt structure.

To test this assumption, we conduct some further estimates adding a variable that represents the firm's debt heterogeneity. As a result, companies that have a higher heterogeneity of the debt structure reduce the investment-cash flow sensitivity. In fact, for these companies, the debt heterogeneity turns the investment-cash flow negative, probably increasing, on average, their investments in periods when they have reduced cash flow.

We already mentioned that this study has some limitations. The first one concerns the small number of companies. Having analyzed only 153 companies, we should be cautious to generalize the results found here. The second limitation is related to a possible selection bias, considering that the sample is composed of companies considered the best and bigger in Brazil in terms of sales volume, which can imply these are the lower financial constraint firms of Brazil. Despite these limitations, it is also necessary to recognize the difficulty of obtaining information from privately held companies, including in Brazil, even more information that appears only in financial foot notes.

Finally, we emphasize that the results found here open opportunities for future research. Studies that seek to further investigate the relationship between heterogeneity and financial constraint or even, that propose to establish a better understanding of the negative investment-cash flow sensitivity can offer important contributions to the literature.

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