

The impact of crises on investments and financing of Brazilian companies: an approach in the context of financial constraints

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ABSTRACT

The purpose of this paper is to investigate the impacts of financial crises on investments and financing of constrained and unconstrained Brazilian firms, specifically analyzing the impact of the 2008 subprime crisis and the 2015 Brazilian economic crisis. For this purpose, the companies were classified as constrained or non-constrained by the criterion of the existence or non-existence of ratings, using quarterly data between Q1 2007 and Q3 2016, and adopting the panel analysis as the method. The results indicate that only the Brazilian crisis of 2015 had a negative impact on corporate investments, with this impact being greater on constrained firms, with evidence that cash was more relevant to these firms. Regarding the impact of crises on leverage, the 2008 subprime crisis showed a greater negative impact on the leverage of constrained firms, accompanied by an increase in the proportion of short-term debt, mainly to these companies.

KEYWORDS

financial crisis, investment, financing, financial constraint, informational asymmetries

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1. INTRODUCTION

Given the context of financial constraints, which is the greater limitation of certain companies' access to credit in comparison to others, authors such as Campello, Graham and Harvey (2010), Duchin, Ozbas and Sensoy (2010) and Driver and Muñoz-Bugarin (2019) proposed the study of how crises, usually characterized by shocks in credit, impact factors such as corporate investments and financing, showing distinct effects on constrained and unconstrained companies. In this context, examining the Brazilian context through the lens of the aforementioned studies, two financial crises occurred in Brazil recently. These are the subprime crisis of 2008 and the economic crisis of 2015, which led to the following questioning: *Were there significant impacts from the 2008 and 2015 financial crises on investments and financing of constrained and unconstrained Brazilian companies?*

The approach of this study refers, in essence, to the existence of informational asymmetries, in which some economic agents have more information than others. Fazzari, Hubbard and Petersen (1988), Calomiris and Hubbard (1990) and Hubbard (1998), among other authors, raised arguments that companies do not have a common resource supply curve, so some have easier access to credit compared to others, leading to the context of financial constraints, where the supply of resources is different for companies - companies may be more or less constrained to credit.

In times of financial crisis, problems arising from informational asymmetries are intensified, undermining the channeling of resources to holders of the best investment opportunities (Mishkin, 1992). Mainly with the subprime crisis of 2008, evidence pointed out that, with the negative credit supply shock, its effects were different among companies. In these cases, on the one hand, for authors like Campello et al. (2010) and Duchin et al. (2010), the crisis proved to impact investments of financially constrained companies more sharply compared to unconstrained firms, since constrained access to resources tends to be intensified in credit contraction periods, mainly to constrained firms. On the other hand, Driver and Muñoz-Bugarin (2019) pointed out that the financial crisis mainly impacted larger (less constrained) companies, that became more sensitive to financial constraints in times of crisis.

With regard to the impacts of crises on financing, authors such as Leary (2009) and Akbar, Rehman and Ormrod (2013) argue that mainly constrained companies experience greater negative impacts on their financing in times of negative credit supply shocks, as access to resources becomes more difficult. As for the impacts of crises on the maturity of debt, Paula, Oreiro and Basilio (2013) pointed out that as constrained companies typically rely more on bank loans, with lower maturity, these companies tend to go through an increase in the proportion of short-term debt in relation to long-term debt crises, since banks tend to seek to reduce risks and end up shortening the maturity of their loans. On the other hand, Akbar et al. (2013) noted that short-term debt tends to be reduced in times of crisis, impacted by falling credit supply.

According to Ivashina and Scharfstein (2010), the 2008 crisis was triggered in the United States by the credit boom and consequent bank panic, along with the collapse of subprime mortgages. The Brazilian crisis of 2015 involved, among other factors, political instability, rising inflation and interest rates, and falling GDP. For example, in the fourth quarter of 2015, GDP fell by almost 6 percentage points against the same period of 2014, indicating its worst performance since the last two decades, according to Instituto Brasileiro de Geografia e Estatística (IBGE) data. Given the proportions of the crisis, whose effects were very evident in the economy, compared

to the 2008 crisis, which began in another country, questions arise and should be answered by the research question raised at the beginning of this paper, whose main objective is to investigate the impacts of the 2008 and 2015 financial crises on investments and financing of constrained and unconstrained Brazilian companies. For this purpose, we use the panel data analysis method, using the rating criterion to classify companies into constrained and unconstrained, so companies that had a rating by risk agencies (Standard & Poor's, Moody's and/or Fitch) in both crises were considered unconstrained, while the absence of rating led to the classification of constrained.

The results showed that constrained and unconstrained companies were impacted in different ways, both in the 2008 and 2015 crises. We obtained evidence that only the 2015 crisis had a negative impact on corporate investments, with this impact being greatest on constrained firms. Analyzing the impact of crises on leverage, there is evidence that the 2008 crisis had a major negative impact on constrained firms, accompanied by an increase in the proportion of short-term debt mainly to these companies.

2. LITERATURE REVIEW

2.1. IMPERFECT MARKETS, INFORMATION ASYMMETRY AND FINANCIAL CONSTRAINS

Discussions on investment and financing extend from the seminal work of Modigliani and Miller (1958), whose idea is that, assuming perfect markets, investments are independent of financial characteristics such as liquidity, leverage or dividend payments. Subsequently, the development of new theories and models led to the questioning of Modigliani and Miller's (1958) position. At the same time, market imperfections were considered as factors that could interfere with corporate decisions. These imperfections, or financial frictions, are linked to the existence of information asymmetries.

In the credit rationing literature regarding information asymmetries, Jaffee and Russell (1976) pointed out that credit rationing emerges as a market response to adverse selection, where lenders are unable to distinguish honest borrowers, who pay debts, and the dishonest, who do not pay debts whenever default costs are low. Whereas in Jaffee and Russell (1976) credit is rationed to the extent that borrowers receive less than desired loans, Stiglitz and Weiss (1981) explored the idea that not all businesses that need credit are able to do so.

Facing sustained approaches to informational asymmetry theories, Fazzari and Athey (1987) pointed out that, if the firm has sufficient operating cash flow to finance its investments, they may end up avoiding the foreign capital market, where credit rationing may exist. The connections between informational asymmetry, financial constraints, and investments, proposed by Fazzari and Athey (1987), were the precursor to the seminal contributions by Fazzari et al. (1988) in the field of financial constraints involving the financing of corporate investments.

Fazzari et al. (1988), when studying the influence of financial characteristics on corporate investments, argued that, unlike perfect markets, market imperfections exist, making external resources and internal business resources into imperfect substitutes. This idea arises from differences in the costs of such financing, which occur due to the presence of informational asymmetries. In other words, the costs of external financing are higher, i.e., the costs of issuing new debt and equity differ from the opportunity cost of financing generated by cash flows and retained earnings, as they involve, among other factors, transaction costs and asymmetric information.

2.2. FINANCIAL CRISES, INVESTMENTS AND FINANCING

Exploring the impacts of resource friction on capital structure decisions, Leary (2009) argued that the expected response to loan shocks depends on firms' access to different segments of the capital markets. Thus, when faced with a contraction in lending, companies without access to public debt markets would need to find alternative sources to avoid capital constraints, including, for example, internal resources. This substitution would result in lower (higher) leverage following a contraction (expansion) in the loan offer.

In turn, Lemmon and Roberts (2010) analyzed how shocks in the supply of credit not only affect the financing of companies, but also investment. The evidence by Lemmon and Roberts (2010) pointed out that the substitution between bank debt and alternative sources of capital, such as cash balances, was limited in times of credit supply shock, almost a one-on-one decline in net investment with a decline in net debt issues.

In order to investigate and compare the investment plans, financial policies, and corporate spending of constrained and unconstrained firms during the 2008 crisis, Campello et al. (2010) interviewed CFOs from companies in various countries. The results indicated that constrained firms planned larger investment cuts compared to unconstrained firms, and the 2008 financial crisis did not affect the cash level of unconstrained firms. Further, the evidence is consistent with the view that constrained firms build cash reserves as a way to prepare against potential credit supply shocks.

Interested in the effects of credit supply during the 2008 crisis, Duchin et al. (2010) stressed that negative shocks in the supply of external financing, coupled with the presence of financial frictions, can hinder investments if firms have no financial slack, with these effects being particularly severe on firms that face higher costs to raise external resources. In this sense, when investigating the relationship between financial constraints, cash reserves, and investments, before and after the crisis, the results showed that investments fell for both firms with and without financial constraint after the crisis, although the decline was greater for constrained firms. Moreover, cash withholdings are cited as a precaution when credit is lower and companies are constrained.

Focusing on the impact of credit supply shocks during the 2008 crisis on UK private investment and financing, Akbar et al. (2013) explain that these companies are characterized by high information asymmetry and face higher external financing costs, and may worsen in times of economic downturn. Thus, these companies are naturally more constrained and tend to prefer, in times of slowdown, internal financing.

That said, the authors analyzed how private companies minimized the effects of bank credit contraction through alternative sources of financing such as domestic resources and issuance of shares. Evidence showed that, for these companies, short-term financing was most affected by the 2008 financial crisis, as they issued more shares and retained more cash as a precaution. In addition, the inability of private companies to obtain external credit caused them to cut their investments.

On the other hand, Driver and Muñoz-Bugarin (2019) investigated the effects of financial constraints on investments by UK companies, considering the size of the companies, seeking to reflect the effects of the 2008 crisis. The authors obtained evidence that the effects of credit constraints on large and small companies were different during the crisis, and for larger (less constrained), the disadvantages were greater. Larger firms' sensitivity to financial constraints emerged during the crisis period, while, for smaller companies, the effect was perennial and did not increase during the crisis.

In Brazil, Oliveira and Cunha (2012) pointed out that companies with greater financial constraints rely more on their own resources than less constrained ones. Regarding the supply of resources during times of financial crisis, Paula et al. (2013) analyzed the evolution of the credit market in Brazil, emphasizing the role of public banks, especially that of Banco Nacional de Desenvolvimento Econômico e Social (BNDES), during periods of financial instability and credit contraction. The authors observed the expansion of companies' productive capacity and investment decisions from mid-2007, increasing demand for corporate credit, served by the retail banking sector (working capital) and BNDES, with long-term financing.

Given the discussions that constrained firms investments are more affected by crises compared to unconstrained company investments (Campello et al., 2010; Duchin et al., 2010), and especially the constrained firms, which supposedly face greater difficulties in accessing external credit, rely more on cash to mitigate the effects of credit shocks and finance their investments (Duchin et al., 2010). We raise the following hypotheses to be tested in this study:

H1: Financial crises impact the investment of constrained firms more strictly than unconstrained firms;

H2: The relationship between investments and cash in crisis is more relevant for constrained firms than for unconstrained firms.

Concerning the impacts of crises on corporate financing, authors such as Leary (2009) and Akbar et al. (2013) mention that the leverage of narrower firms would be more negatively impacted by negative credit supply shocks. Moreover, Paula et al. (2013) argue that, in economically unstable periods, the trend is for banks to seek to reduce their risk by shortening the maturity of their loans and the reduction of longer-term credit supply, riskier than short-term credit supply, which would have a greater impact on short-term debt, especially from unconstrained firms.

That said, we raise the following hypotheses:

H3: Financial crises have more significant negative effects on the leverage of constrained firms compared to unconstrained firms;

H4: Crises cause an increase in the proportion of the short-term debt of constrained firms more sharply than that of unconstrained firms.

3. RESEARCH METHOD

To meet the objective of the present study, we considered two moments of crisis in Brazil: the subprime crisis of 2008 and the Brazilian financial and political crisis of 2014, 2015 and 2016 (called the crisis of 2015 in this paper), times of slowdown (such as the crisis of 2008) and even contraction in the supply of resources for companies (such as the crisis of 2015), as shown in Figure 1.

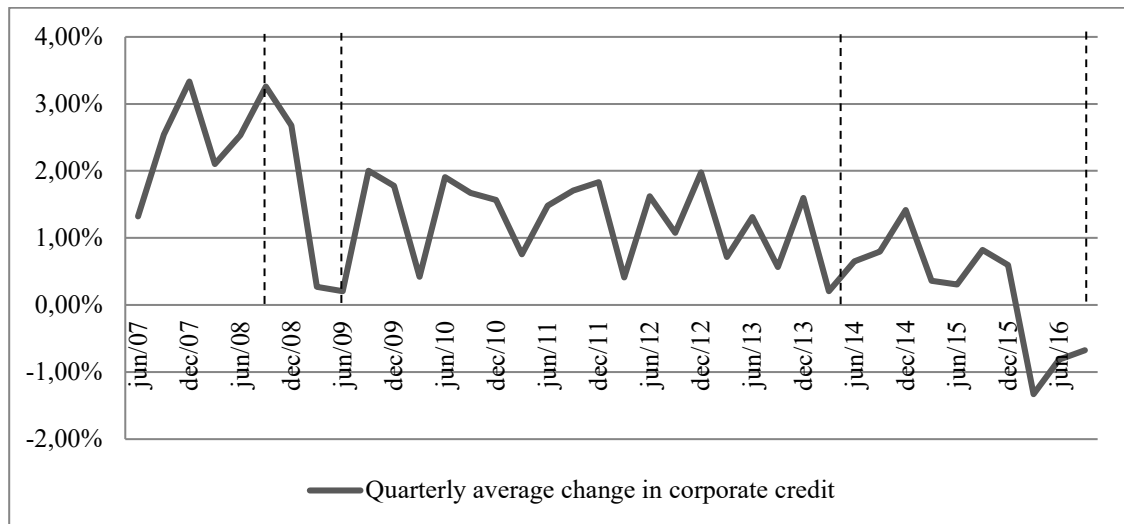


Figure 1. Quarterly average variation of corporate credit balance in Brazil.

Source: Self elaboration based on information from the Central Bank of Brazil (www.bcb.gov.br).

Starting mainly from the variations in the credit supply to determine the crisis quarters investigated in this study, the 2008 crisis involves the period between the fourth quarter of 2008, considered the milestone of the subprime crisis with the fall of Lehman Brothers, cited as the beginning of the crisis by CODACE (Business Cycle Dating Committee), and the second quarter of 2009, given the slowdown in credit levels Brazil over that period, as shown in Figure 1. The crisis of 2015 comprises the period between the second quarter of 2014, considered the initial milestone of the crisis by CODACE, and the third quarter of 2016, which captured the step decrease in economic activity in Brazil in this period along with the credit balance contraction, from then on, as seen in Figure 1.

3.1. DATA AND SAMPLE

The data from this study was collected in the Economatica® software, quarterly, between the first quarter of 2007 and the third quarter of 2016.

Initially, companies with no required quarterly information were excluded, as well as companies whose capital stock was less than 10 million BRL, in 2007 values, at the beginning of the period, to eliminate very small firms, as we find in Duchin et al. (2010). The final overall investment model sample is composed of 203 publicly traded non-financial Brazilian companies, actively registered with the Securities Commission (CVM) in 2016. In turn, the general sample of the financing model is composed of 192 companies, respecting the same characteristics mentioned above.

3.2. FINANCIAL CONSTRAINS MEASURES

To analyze the impacts of financial crises on investment and financing decisions of segregated Brazilian companies, according to their financial constraint, we use the criteria of the existence or non-existence of ratings for the separation of firms, whose advantage is evaluating the indication of the market, by an external agent, as for the credit quality.

Just as in Duchin et al. (2010), in this study the financial constraint of firms was determined based on observations from the years prior to the 2008 and 2015 crises, avoiding selection problems endogenous to company decisions. Therefore, for the classification of financial constraints for

companies, we adopted information from 2007 (year immediately prior to the 2008 crisis) and 2013 (years immediately preceding the crisis of 2014/2015/2016).

The existence or otherwise of a rating was used by Lemmon and Roberts (2010) and Duchin et al. (2010). The argument is that companies without ratings by a risk assessment agency, such as Standard & Poor's (S&P), Moody's and Fitch, have a greater financial constraint than firms whose debt was valued, as the assessment indicates the credit quality of these companies, minimizing informational asymmetries.

For the classification of the companies, the rating data of the companies was collected from the "Rating of Listed and Closed Companies" 1994-2017" made available on Professor Tatiana Albanez's Finance Research Portal. From this data, we listed companies that were rated by at least one of the risk agencies in both 2007 and 2013. Companies that necessarily had a rating in both 2007 and 2013, were classified as unconstrained. The other firms – both unrated companies in both years and companies rated in only one year – were classified as constrained.

It is worth mentioning that, in addition to the criterion of whether or not a rating was in play, additional analyzes were performed classifying the companies by their investment grade (non-investment grade and investment grade). This information is also found in the previously mentioned database. In this case, comparisons were made between investment grade firms and non-investment grade firms with no rating – the last two groups were analyzed together. The results using both criteria led to the same conclusions. Additionally, we made estimates by fixed double effect panel, also leading to the same conclusions. Supplementary material containing the robustness tests mentioned can be found in the Figshare scientific repository or can be provided by the authors.

3.3. DEPENDENT VARIABLES

The dependent variable for the study of the impact of crises on investments is represented by the following indicator, based on Duchin et al. (2010):

$$Invest_t = CAPEX_t / TA_t$$

where Invest: Investment; CAPEX: Capital expenditures, involving net acquisitions of property, plant and equipment, quarterly; TA: Total Assets.

The dependent variables for the study of the impact of crises on financing are as follows:

$$Lever_t = Total\ Debts_t / TA_t$$
$$DebtST_t = Debts\ ST_t / Total\ Debts_t$$

where Lever: Leverage; Total Debt: sum between short and long term debt; TA: Total Assets; DebtST: Short Term Debts. The leverage variable was built based on Leary (2009), Lemmon and Roberts (2010) and Akbar et al. (2013).

3.4. INDEPENDENT VARIABLES

The main independent variables in this paper are the crises, specifically the crises of 2008 and 2015. Crisis variables are represented by dummies in the models, with a value of 1 for quarters during crisis (between the fourth quarter of 2008 and the second quarter of 2009 and between

the second quarter of 2014 and the third quarter of 2016) and zero for the other quarters between 2007 and 2016.

a) Investments

In the literature studying the impacts of crises on corporate investments, there is evidence that crises adversely affect corporate investments. However, these effects may differ between companies: impacts may be stronger on constrained firms, as the credit constraint for these firms is further intensified in periods of credit contraction (Campello et al., 2010; Duchin et al., 2010).

Still, in the financial constraint and investment literature, it is common to include the variable Cash, representing the internal resources to the companies. In this sense, we added this variable as an independent variable in the investment model, calculated as the ratio of cash to total assets over a period. For constrained firms, the relationship between investments and cash in the crisis is expected to be positive and stronger compared to unconstrained firms. The argument is that, for constrained firms, cash would mitigate the effects of the credit supply shock, linked to the impact on investments.

b) Financing

Regarding impacts on leverage, there is evidence that crises negatively impact the leverage of constrained firms, while unconstrained firms are not as impacted (Leary, 2009; Akbar et al., 2013). The argument is that access to resources by firms with greater financial constraints in times of negative credit supply shocks becomes even more difficult.

Regarding the impact of crises on the participation of short and long term debt in relation to total debt, there are ambiguous relationships pointed out by the literature: positive, with the argument that banks seek to mitigate risk and reduce the maturity of their loans and financing, thus increasing the proportion of short-term debt (Paula et al., 2013), or negative, on the grounds that the short-term debt tends to be reduced in times of crisis, impacted by the drop in bank credit supply, mainly from constrained firms, whose debts are mostly from bank resources due to limited access to alternative sources (Akbar et al., 2013; Bremus, 2015).

3.5. CONTROL VARIABLES

a) Investments

In the investment model, the proxy used to control investment opportunities (or growth opportunities) is defined by the Market-to-Book variable (asset at market value by asset at book value). We expect a positive relationship between investment opportunities and investments, so the greater the investment opportunities, the greater the investments for both constrained firms and unconstrained firms.

b) Financing

In the financing model, as well as in Leary (2009), we use control variables commonly used in capital structure literature in order to control the companies' demand for financing. These variables were added according to arguments by Rajan and Zingales (1995) and Frank and Goyal (2009), with variables being profitability, tangibility, size and growth opportunities.

The profitability variable was calculated by the ratio between EBITDA and total assets, and the expected ratio is ambiguous: a negative relationship indicates corporate preference for domestic

financing over debt and a positive relationship indicates that resource providers would prefer to lend to more profitable companies.

The tangibility variable was calculated as the ratio of fixed assets to total assets, and the ambiguous relationship between tangibility and leverage was expected: a positive relationship indicates the role of collateral in minimizing agency costs and a negative one indicates lower share issuance costs.

Size, in turn, was calculated based on the natural logarithm of corporate assets, expecting an ambiguous relationship between size and leverage: positive relationship indicates that larger companies tend to be more diverse and less likely to go bankrupt, and negative indicates investor preference for stocks due to access to information from larger companies.

Finally, as in the investment model, growth opportunities were measured by the market-to-book index, with a negative relationship being expected, as companies with future growth prospects would use a larger share of equity financing.

Table 1 shows the construction of investment and financing model variables:

Table 1
Construction of Variables

Investments		
Variables	Acronym	Proxy
<i>Dependent Variables</i>		
Investment	Invest	CAPEX/ Total Assets
<i>Independent Variables</i>		
Crisis	Crisis 2008 Crisis 2015	Dummy 1 for Crisis and 0 for other periods
Cash	Cash	Cash and cash equivalent/Total Assets
Crisis*Cash	Crisis*Cash	Crisis*(Cash and cash equivalent/Total Assets)
<i>Control Variable</i>		
Investment Opportunities	M/B	Assets at Market Value/Assets at book value
Financing		
Variables	Acronym	Proxy
<i>Dependent Variables</i>		
Leverage	Lever	Total Debts /Total Assets
Short Term Debts	DebtST	Debt ST/Total Debt
<i>Independent Variables</i>		
Crisis	Crisis 2008 Crisis 2015	Dummy 1 for Crisis and 0 for other periods
<i>Control Variable</i>		
Profitability	Profit.	EBITDA/Total Assets
Tangibility	Tangib	Fixed assets /Total Assets
Size	Size	Ln Assets
Growth Opportunities	M/B	Assets at Market Value/Assets at book value

The general forms of Investment models (Invest) and Financing (Fin) to be studied are presented below for each company i in each quarter t :

$$Invest_{i,t} = f(Crisis + Crisis * Cash_{i,t-1} + M/B_{it})$$

$$Crisis + Profitability_{it} + Tangibility_{it} + Fin_{i,t} = f$$

The models of the study of the impacts of crises on corporate investments are as follows:

$$Invest = Crisis + Crisis * Rest + Cash + Cash * Rest + M/B \quad (1)$$

$$Invest = Crisis2008 + Crisis2008 * Rest + Crisis2015 + Crisis2015 * Rest + Crisis2008 * Rest * Cash + Crisis2015 * Rest * Cash + M/B \quad (2)$$

where *Invest* represents the Investments, *Crisis* is the crisis dummy, *Crisis*Cons*, *Crisis2008*Cons* and *Crisis2015*Cons* represent dummies from the 2008 and 2015 crisis for the constrained firms dummy. The variables of each crisis and the financial constraint dummy were interacted with the cash (in t-1). *M/B* represents the investment opportunities in the period t. As for the study of models of financing of firms on crisis impacts are as follows:

$$Lever = Crisis + Crisis * Rest + Profit + Tangib + B \quad (3)$$

$$Lever = Crisis2008 + Crisis2008 * Rest + Crisis2015 + Crisis2015 * Rest + Profit + Tangib + B \quad (4)$$

$$DebtST = Crisis + Crisis * Rest + Profit + Tangib + B \quad (5)$$

$$DebtST = Crisis2008 + Crisis2008 * Rest + Crisis2015 + Crisis2015 * Rest + Profit + Tangib + B \quad (6)$$

where *Lever* represents leverage, *DebtST* represents the proportion of short-term debt, *Crisis* is the crisis dummy, *Crisis*Cons*, *Crisis2008*Cons* and *Crisis2015*Cons* represent dummies from the 2008 and 2015 crisis for the constrained firms dummy, *Profit* is profitability, *Tangib* is tangibility, *Size* is size and *M/B* represents growth opportunities (all variables in period t).

3.6. ANALYSIS TECHNIQUES

We adopted descriptive analysis and panel data analysis as our methodological tools. In the models, dummies were included for the constrained group of firms, and unconstrained firms were taken as the basis for the regression model, as adopted by Aldrighi and Bisinha (2010). In other words, the companies included in the regression showed their differential in relation to unconstrained firms, which are those that were unconstrained in the 2008 crisis that remained unconstrained in the 2015 crisis.

To ensure more consistent estimators, this study used the fixed effects estimation method, just as it was in Duchin et al. (2010), with estimations with robust standard errors grouped by firm being made.

4. RESULTS ANALYSIS

Table 2 presents the descriptive statistics of the investment model:

Table 2
Descriptive Statistics of Investment

		Investments		
			Variables	
		Investment	Cash	M/B
All Firms	N° of Obs.	6097	6097	6097
	Mean	0.016	0.098	0.820
	Standard Deviation	0.037	0.112	0.918
	Min.	-0.734	0.000	0.003
	Max.	0.866	0.889	8.977
Constrained Firms	N° of Obs.	4259	4259	4259
	Mean	0.014	0.098	0.857
	Standard Deviation	0.038	0.121	1.002
	Min.	-0.558	0.000	0.003
	Max.	0.866	0.889	8.977
Unconstrained Firms	N° of Obs.	1838	1838	1838
	Mean	0.019	0.099	0.733
	Standard Deviation	0.034	0.089	0.677
	Min.	-0.734	0.000	0.007
	Max.	0.479	0.707	5.361

Notes. Sample of 203 firms; investment: CAPEX divided by total assets; cash: cash and cash equivalents divided by total assets; M/B: investment opportunities calculated by the market-to-book index - asset at market value divided by asset at book value; n° of obs: number of observations; min.: minimum; max.: maximum.

Analyzing all companies, the quarterly average investment is 1.6%. When analyzing the samples of constrained and unconstrained companies, we observed that the average investment of unconstrained firms (1.9%) is larger than constrained firms (1.4%). We also note that the cash levels of the constrained and unconstrained companies are not considerably different, 9.8% and 9.9%, respectively. Regarding investment opportunities, as represented by the market-to-book, constrained firms presented higher means than unconstrained firms.

Table 3 refers to the descriptive statistics on financing.

The 192 companies in the sample that made up the financing analysis have a leverage mean of 30.8%. We noted that unconstrained firms are on average more indebted than constrained firms. These numbers may reflect the argument of easier access to loans and financing by unconstrained firms compared to constrained firms.

Moreover, constrained firms had a higher proportion of short-term debt than long-term debt when compared to unconstrained firms. According to Leary (2009), smaller companies, considered more constrained, rely more on short-term debt, usually bank credits, due to risk aversion by banks. Additionally, constrained firms have lower profitability, tangibility, and size, as well as a higher market-to-book.

Table 3
Descriptive Statistics of Financing

		Financing						
		Variables						
		Lever	DebtST	DebtLT	Profit	Tangib	Size	M/B
All Firms	N° of Obs.	5726	5726	5726	5726	5726	5726	5726
	Mean	0.308	0.379	0.621	0.025	0.278	14.916	0.765
	Standard Deviation	0.169	0.260	0.260	0.044	0.225	1.742	0.819
	Min.	0.000	0.000	0.000	-0.863	0.000	8.835	0.002
	Max.	0.982	1.000	1.000	0.851	0.912	20.652	7.958
Constrained Firms	N° of Obs.	3882	3882	3882	3882	3882	3882	3882
	Mean	0.286	0.454	0.546	0.023	0.271	14.181	0.784
	Standard Deviation	0.177	0.271	0.271	0.050	0.211	1.440	0.887
	Min.	0.000	0.000	0.000	-0.863	0.000	8.835	0.002
	Max.	0.982	1.000	1.000	0.851	0.912	18.155	7.958
Unconstrained Firms	N° of Obs.	1844	1844	1844	1844	1844	1844	1844
	Mean	0.354	0.221	0.779	0.029	0.294	16.462	0.724
	Standard Deviation	0.139	0.139	0.139	0.028	0.251	1.238	0.651
	Min.	0.034	0.000	0.000	-0.580	0.000	13.376	0.007
	Max.	0.897	1.000	1.000	0.214	0.909	20.652	5.361

Notes. 192 firms sample; leverage: total debt divided by total assets; DebtST: short term debt - ratio of short-term debt to total debt; DebtLT: long-term debt - ratio of long-term debt to total debt; profitability: relationship between EBITDA and total assets; tangibility: relationship between fixed assets and total assets; size: natural log of total assets; M/B: investment opportunities calculated by the market-to-book index at market value divided by assets at book value; n° of obs: number of observations; min.: minimum; max.: maximum.

Table 4 shows the evolution of the main variables of this study, analyzing the behavior of companies segregated into constrained and unconstrained before the 2008 crisis, in the 2008 crisis, between the 2008 and 2015 crises, and in the 2015 crisis. To analyze whether the differences in means are statistically significant, the mean differences test (t-test) was applied.

There was a decrease in investments and cash in this period, from both constrained and unconstrained firms, however, there was a statistically significant difference in investments between groups of companies, while cash presented a statistically significant difference in means in the 2015 crisis. Regarding leverage, firms showed an increasing trajectory in all periods analyzed, showing significant difference between corporate leverage in the 2008 crisis. Regarding debt maturity, it is observable that the proportion of short-term debt to the total indebtedness of constrained firms is higher than that of unconstrained firms, considering that, as it is for leverage, there is a statistically significant difference in the 2008 crisis between firms.

Table 4
Share of Variables by Period

	Investment	Cash	Leverage	Debt ST	Debt LT
Constrained Firms					
Before Crisis 2008	3.6%	19.3%	23.8%	45.2%	54.8%
Crisis 2008	1.9%	13.0%	26.4%	50.0%	50.0%
Between Crises	1.4%	9.5%	28.2%	44.8%	55.2%
Crisis 2015	0.9%	7.3%	31.3%	45.9%	54.1%
Unconstrained Firms					
Before Crisis 2008	3.3%	13.6%	31.1%	22.0%	78.0%
Crisis 2008	2.1%	12.0%	35.7%	21.8%	78.2%
Between Crises	1.7%	9.8%	35.2%	21.9%	78.1%
Crisis 2015	1.5%	7.6%	37.6%	22.8%	77.2%
All period					
Statistic <i>t</i>	-1.269	1.052	-11.243	44.324	-44.324
Crisis 2008					
Statistic <i>t</i>	-0.401	0.935	-11.761***	17.118***	-17.118***
Crisis 2015					
Statistic <i>t</i>	-5.071	-1.279*	7.120	26.939	-26.939

Notes. Analysis of 203 (192) of sample of investment firms (financing). ***, ** and * represent statistical significance at the levels of 1, 5 and 10%, respectively.

4.1. STATISTICAL RESULTS – INVESTMENTS

Table 5 presents the statistical results of the impacts of crises on investments.

From the statistical results, we noted that the impact of the 2008 crisis on constrained firms was not statistically different from the impact on unconstrained firms, possibly due to the fact that it has its initiation in a country other than Brazil, and the companies were investing relatively more at that time, as shown in table 4.

The crisis of 2015 negatively and significantly affected the investments of companies in general (as can be seen the coefficients of the variable Crisis 2015), with the negative impact being even greater for constrained firms compared to unconstrained firms (reference group in regression). Major declines in the investments of constrained firms in times of crisis are in line with evidence in the literature (Campello et al., 2010; Duchin et al., 2010), as access to resources by these companies becomes even more difficult.

Considering the importance of cash in mitigating the effects of crises on corporate investments, the relationship between cash and investments was significant, positive, and only statistically higher for constrained firms compared to unconstrained firms in the 2015 crisis. This result is consistent with Duchin et al. (2010), who got evidence that the relationship between cash and investment in the crisis is stronger for constrained firms, following the precautionary idea of cash, since these companies would have access to external resources made difficult especially in times of crisis and would rely more on their internal resources.

Thus, the results allow us to conclude that, at the same time as the 2015 crisis caused an observable fall in investments of constrained firms, the investments from these companies were more sensitive to cash at that time because of the greater difficulty in accessing external resources in crisis.

Table 5
Impact of Crises on Investments

Dependent Variable: Invest = CAPEX/ Total Assets				
	Equation (1)		Equation (2)	
	Coef.	p-val FE, RC	Coef.	p-val FE, RC
<i>Crisis</i>	-0.002	0.103		
<i>Crisis*Cons</i>	-0.001	0.472		
<i>Crisis 2008</i>			0.002	0.593
<i>Crisis 2008*Cons</i>			-0.002	0.581
<i>Crisis 2015</i>			-0.004	0.034
<i>Crisis 2015*Cons</i>			-0.005	0.064
Cash	0.019	0.650		
Cash*Cons	0.045	0.34		
Crisis2008*Cons*Cash			0.014	0.242
Crisis2015*Cons*Cash			0.036	0.005
M/B	0.003	0.128	0.004	0.083
Constant	0.009	0.002	0.014	0.000
N° observations		6097		6097
N° companies		203		203
Prob > F		0.000		0.000
R ² within		0.024		0.013
R ² between		0.013		0.041
R ² overall		0.015		0.017
Estimation		Fixed Effects		Fixed Effects
<i>Breusch and Pagan</i>				
Chi2(1):		280.91		282.42
Prob > Chi2:		0.000		0.000
<i>Chow</i>				
Statistic F		3.11		2.96
Prob > F		0.000		0.000
<i>Hausman</i>				
Chi2(5):		37.55		12.15
Prob > Chi2:		0.000		0.096

Notes. Invest: CAPEX divided by total assets; crisis: 2008 and 2015 crisis dummies; cons: constrained firms; crisis*cons: interaction between crises and constrained firms; crisis 2008: *dummy* 1 between the fourth quarter of 2008 and the second quarter of 2009, and zero otherwise; crisis 2015: *dummy* 1 between the second quarter of 2014 and the third quarter of 2016, and zero otherwise; crisis2008*cons and crisis2015*cons: interaction between the crises of 2008 and 2015 and constrained firms; cash: cash and cash equivalents divided by total assets; cash*cons: interaction between cash and constrained firms; crisis2008*cons*cash and crisis2015*cons*cash: interaction between crises of 2008 and 2015, constrained firms and cash; M/B: market-to-book- asset at market value divided by asset at book value; coef.: coefficients; p-val FE, RC: coefficient significance level for fixed effects regression with clustered robust standard errors; n° observations: number of observations; Prob > F: significance level of the model; Breusch and Pagan: p-value of the test LM of Breusch-Pagan; Chow: p-value of the test F Chow; Hausman: p-value of the Hausman's test; R² within: coefficient of explanation of the effects of variation over time for a given individual; R² between: coefficient of explanation of the effects of variation between individuals; R² overall: coefficient of general explanation of the model.

Table 6 presents the results of the impact of crises on corporate leverage:

Table 6
Impact of Crises on Financing

	Dependent Variable: Lever = Total Debt/Total Asset			
	Equation (3)		Equation (4)	
	<i>Coef.</i>	<i>p-val FE, RC</i>	<i>Coef.</i>	<i>p-val FE, RC</i>
<i>Crisis</i>	0.006	0.566		
<i>Crisis*Cons</i>	0.008	0.478		
<i>Crisis 2008</i>			0.011	0.337
<i>Crisis 2008*Cons</i>			-0.026	0.078
<i>Crisis 2015</i>			0.006	0.644
<i>Crisis 2015*Cons</i>			0.015	0.299
Profit	-0.139	0.031	-0.134	0.031
Tangib	-0.015	0.615	-0.012	0.701
Size	0.030	0.009	0.026	0.026
M/B	-0.047	0.000	-0.048	0.000
Constant	-0.107	0.532	-0.035	0.836
N° of observations		5726		5726
N° of companies		192		192
Prob > F		0.000		0.000
R ² within		0.140		0.146
R ² between		0.040		0.041
R ² overall		0.061		0.064
Estimation	Fixed Effects		Fixed Effects	
<i>Breusch and Pagan</i>				
Chi2(1):		44762.19		44974.68
Prob > Chi2:		0.000		0.000
<i>Chow</i>				
F Statistics		96.17		96.77
Prob > F		0.000		0.000
<i>Hausman</i>				
Chi2(5):		50.56		14.67
Prob > Chi2:		0.000		0.066

Notes. Lever: leverage, - total debt divided by total assets; crisis: 2008 and 2015 crisis dummies; cons: constrained firms; crisis*cons: interaction between crises and restricted companies; crisis 2008: dummy 1 between the fourth quarter of 2008 and the second quarter of 2009, and zero otherwise; crisis 2015: dummy 1 between the second quarter of 2014 and the third quarter of 2016, and zero otherwise; crisis2008*cons and crisis2015*cons: interaction between the crises of 2008 and 2015 and constrained firms; profit: profitability- relationship between EBITDA and total assets; tangib: tangibility - relationship between fixed assets and total assets; size: size - natural log of total assets; M/B: market-to-book- asset at market value divided by asset at book value; coef.: coefficients; p-val FE, RC: coefficient significance level for fixed effects regression with clustered robust standard errors; n° of observations: number of observations; Prob > F: significance level of the model; Breusch and Pagan: p-value of the LM testing by Breusch-Pagan; Chow: p-value if the Chow F test; Hausman: p-value of Hausman's test; R² within: coefficient of explanation of the effects of variation over time for a given individual; R² between: coefficient of explanation of the effects of variation between individuals; R² overall: coefficient of general explanation of the model.

The results showed that the 2008 crisis had a more negative and significant impact on the leverage of constrained firms in relation to unconstrained firms, in line with Leary (2009) and Akbar et al. (2013). The impacts of the 2015 crisis on leverage were not significantly different between constrained and unconstrained firms.

The non-significant impacts of the 2015 crisis on corporate leverage raise some possibilities for interpretation. On the one hand, as shown in Figure 1, the supply of credit to Brazilian companies was considerably reduced in the 2015 crisis, which, following studies like Leary (2009), would lead to an expected negative relationship between crises and leverage. On the other hand, at least two particularities could counteract this expected negative relationship with Brazilian companies: the countercyclical performance of BNDES and the increase in foreign currency debt.

As observed by Sant'anna, Junior and Araujo (2009), in the crisis of 2008 the countercyclical performance of public banks, especially BNDES, offset the slowdown in private bank credit operations, avoiding further reductions in the volume of credit granted to firms. Additionally, according to Oliveira and Cunha (2012), access to BNDES financing is easier for less financially constrained firms, which would explain the outcome of this study for the 2008 crisis.

Furthermore, as disclosed by CEMEC (2016), the indebtedness of publicly traded Brazilian companies increased between 2010 and 2016, evidencing the increase in the participation of foreign currency debts in the composition of total corporate indebtedness. In this context, in times of crisis, whose exchange rate tends to increase, it is expected that the balance of foreign currency debt will become even larger. Therefore, it is possible to hypothesize that the absence of significant effects of crises on corporate leverage can be explained by the combination of compensatory factors, such as the drop in credit supply on the one hand and, on the other, the effects of countercyclical performance of public banks and the increase in foreign currency debt.

Analyzing the control variables profitability, tangibility, size, and market-to-book, we observed a negative sign for the profitability and market-to-book variables and a positive sign for the size variable, with tangibility being the only non-significant variable to explain firms' leverage.

On the impacts of crises on the proportion of short-term debt, Table 7 shows their results.

The results presented in Table 7 show that the 2008 crisis had a more significant positive impact on the proportion of short-term debt of constrained firms compared to unconstrained firms, corroborating the idea by Paula et al. (2013) that, in times of crisis, banks seek to reduce the maturity of corporate lending to reduce risk, such that if the debts of restricted companies come mainly from bank resources, given the greater difficulty of access to alternative sources – as mentioned by Leary (2009) and Akbar et al. (2013) – the sensitivity of these firms' short-term debts to crises marked by credit supply shocks would be greater.

Moreover, the 2015 crisis impacted the proportion of short-term debt held by both constrained and unconstrained firms, not being statistically different between both groups of firms.

It is worth drawing attention to the interpretations of the 2008 crisis results analysis. At that moment, facing the process of convergence of national and international accounting standards brought with the Law nº 11.638, 2007, the transition toward which began to occur in 2008, certain adjustments are now reflected in the financial statements of that year. As accounting parameters are used in this study to construct the variables used in the analyzes, there may be confounding factors impacting the estimates.

Table 7
Impact of Short-Term Debt Crises

Dependent Variable: DebtST – Debt ST /Total Debt				
	Equation (5)		Equation (6)	
	<i>Coef.</i>	<i>p-val FE, RC</i>	<i>Coef.</i>	<i>p-val FE, RC</i>
<i>Crisis</i>	0.029	0.007		
<i>Crisis*Cons</i>	0.000	0.983		
<i>Crisis 2008</i>			-0.005	0.776
<i>Crisis 2008*Cons</i>			0.055	0.019
<i>Crisis 2015</i>			0.038	0.010
<i>Crisis 2015*Cons</i>			-0.014	0.504
Profit	-0.124	0.070	-0.125	0.067
Tangib	-0.072	0.071	-0.067	0.094
Size	-0.063	0.000	-0.063	0.000
M/B	0.006	0.649	0.006	0.641
Constant	1.333	0.000	1.332	0.000
N° of observations		5726		5726
N° of firms		192		192
Prob > F		0.000		0.000
R ² within		0.029		0.032
R ² between		0.439		0.436
R ² overall		0.301		0.302
Estimation	Fixed Effects		Fixed Effects	
<i>Breusch and Pagan</i>				
Chi2(1):		20372.51		20424.44
Prob > Chi2:		0.000		0.000
<i>Chow</i>				
F statistics		32.31		32.26
Prob > F		0.000		0.000
<i>Hausman</i>				
Chi2(5):		24.00		24.95
Prob > Chi2:		0.001		0.0016

Notes. DebtST: short term debt - short-term debt divided by total debt; crisis: 2008 and 2015 crisis dummies; cons: constrained firms; crisis*cons: interaction between crises and constrained firms; crisis 2008: dummy 1 between the fourth quarter of 2008 and the second quarter of 2009, and zero otherwise; crisis 2015: dummy 1 between the second quarter of 2014 and the third quarter of 2016, and zero otherwise; crisis2008*cons and crisis2015*cons: interaction between 2008 and 2015 crises and constrained firms; profit: profitability - relationship between EBITDA and total assets; tangib: tangibility - relationship between fixed assets and total assets; size: size- natural log of total assets; M / B: market-to-book - asset at market value divided by asset at book value; coef.: coefficients; p-val FE, RC: coefficient significance level for fixed effects regression with clustered robust standard errors; n° of observations: number of observations; Prob > F: significance level of the model; Breusch and Pagan: p-value of the LM testing by Breusch-Pagan; Chow: p-value if the Chow F test; Hausman: p-value of Hausman's test; R² within: coefficient of explanation of the effects of variation over time for a given individual; R² between: coefficient of explanation of the effects of variation between individuals; R² overall: coefficient of general explanation of the model.

5. FINAL CONSIDERATIONS

The aim of this study was to investigate the impacts of the 2008 and 2015 crises on investments and financing of constrained and unconstrained Brazilian firms. Investments were represented by corporate capital expenditures and financing was represented by leverage and debt maturity.

The investment model sample consisted of 203 publicly traded Brazilian firms and the financing model sample comprised 192 firms, using quarterly data between Q1 2007 and Q3 2016, capturing the 2008 and 2015 crises. Companies were segregated ex ante from crises in constrained and unconstrained, based on the criterion of rating or not.

Evidence showed that investments by constrained firms were negatively impacted by the 2015 crisis compared to unconstrained firms. In addition, the relationship between investments and cash in the 2015 crisis was positively more relevant for constrained firms, compared to unconstrained firms. Larger impacts of crises on investments of constrained firms and the greater relevance of cash to these companies in times of crisis are consistent with the analysis by Duchin et al. (2010).

With regard to financing, the results indicated that the 2008 crisis had a negative and significant impact on the leverage of constrained firms over unconstrained firms, as in Leary (2009) and Akbar et al. (2013). As for the maturity of the debts, according to Paula et al. (2013), the proportion of short-term debt to total debt for constrained firms seemed to increase more than for unconstrained firms in the 2008 crisis alone.

Evidence shows that financial crises are likely to have significant impacts on firms' investments and financing, which may differ between companies, especially taking into account factors related to greater or lesser ease in obtaining external resources, reflected in the approach to financial constraints. This evidence brings contributions to the finance literature and can drive strategies by companies themselves, as precautionary practices for possible credit supply shocks, and even for credit providers in times of financial instability.

One of the limitations of this study is the use of publicly traded companies in the sample. Some are classified as restricted and this may cause some bias in the analysis, as they are naturally less restricted than private companies which are not included in the sample. In addition, the rating was used as an indication of financial constraint, but there are other metrics capable of indicating this rating.

As a suggestion of future research, one can further study the recent crisis of 2015, considered one of the worst recessions in Brazil. In addition, we understand that there should be further studies on the financial restriction criteria that would be pertinent to the Brazilian reality.

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