

# FINANCIAL CONSTRAINTS, COLLATERAL PRICES, AND CORPORATE INVESTMENT: EVIDENCE FROM BRAZIL

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**Abstract.** Corporate finance theory points out collateral as a contract instrument that reduces asymmetric information problems and increases value for debtors in default states. During credit expansions, high collateral prices could increase borrowing capacity of firms, especially for those that were financially constrained before the boom period. In this paper, we exploit a real estate prices boom during the 2000s in Brazil to study the role of collateral on corporate financing and investment. Our results suggest that the credit boom of the second half of the 2000s alleviated financial constraints in Brazil, especially for small, less tangible publicly traded firms, ending up to increase corporate investment (weak evidence) and long term debt financing (strong evidence).

**Keywords and phrases.** Financial Constraints; Credit Multiplier; Collateral; Corporate Investment.

**JEL Classifications.** G30, G31, G32

**Resumo.** A teoria de finanças corporativas aponta o colateral como um instrumento contratual que reduz a assimetria de informações e aumenta o valor esperado dos credores em estados da natureza onde a firma vai à falência. Durante expansões de crédito, preços mais altos dos ativos colateralizáveis podem aumentar a capacidade de endividamento das firmas, especialmente para aquelas que estavam restritas financeiramente no período anterior. Neste artigo, nós exploramos um *boom* nos preços dos imóveis durante os anos 2000 para entender o papel do colateral nas decisões de financiamento e investimento das firmas de capital aberto brasileiras. Os resultados sugerem que o *boom* de crédito observado na segunda metade dos anos 2000 aliviou restrições financeiras no Brasil, especialmente para empresas menores e com menor grau de tangibilidade dos ativos, cujo aumento no investimento corporativo (evidência fraca) e no financiamento de longo prazo (evidência forte) foi relativamente maior.

**Palavras-chave.** Restrições Financeiras; Multiplicador do Crédito; Colateral; Investimento corporativo.

**Classificação JEL.** G30, G31, G32

**Área de submissão n. 8:** Microeconomia, Métodos Quantitativos e Finanças.

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# 1 Introduction

An important topic in finance research is whether firm-level financial constraints shape corporate investment and how it interacts with the business cycle (Ersahin & Irani, 2015). Evidence from the global financial crisis of 2007-2008 shows that the credit channel affects firms according to the extent that they are exposed to the external shock in the credit market (Almeida *et al.*, 2012), and that constrained firms are likely to end up cutting investments, selling assets, and bypassing investment opportunities (Campello *et al.*, 2010). Financially constrained firms can also impose negative externalities on its industry peers, thus amplifying economic downturns (Carvalho, 2015). However, little attention has been given to the opposite side of the story: how does constrained firms' investment behaves when access to credit becomes easier in a poorly developed credit market, and how does it interact with economic expansions? These are questions that, to the best of our knowledge, are not well answered in the literature.

One important factor that can limit corporate borrowing when firms have imperfect access to external financing is the value of collateral assets (pledgeable assets). According to (Almeida & Campello, 2007) model, financially constrained firms could invest below the optimal level because the value of pledgeable assets (such as cash, receivables, inventory, and net property, plant and equipment - PPENT) does not support enough borrowing. During credit booms, the value of collateral assets (such as real estate) can increase significantly, allowing firms to borrow a larger amount for further investment in pledgeable assets. This multiplier effect can integrate credit and economic cycles, amplifying both firm financing and investment growth.

It is important to note that this theoretical relation between tangibility - proxy for firms' collateral assets - and firm's investment is mediated by the ability of firms to access external finance, i.e., it should be expected to be meaningful only to financially constrained firms. If a firm is ex-ante unconstrained, we should expect no strong response of investment because these firms could easily access equity and loan markets even before the structural change in the economy. Changes in the supply of credit are thus more likely to affect small, cash-flow dependent firms, whose investment is potentially limited by the inability of accessing external finance.

In this paper, we focus on an ex-ante incipient credit market such as Brazil, where most firms were likely to face severe credit constraints before the credit deepening process verified on the late 2000's (Araujo *et al.*, 2012). Because of the country's institutional background, collateral assets assume an important role in shaping bank lending, notably because of information asymmetry problems that arise from low debtors rights (see, for example, Stiglitz & Weiss, 1981; Hart & Moore, 1995; Kiyotaki & Moore, 1997). Lower collateral values, such as property, plant, and equipment - pledgeable assets - can thus limit corporate borrowing, while the credit expansion observed in the country alleviated some of the market frictions and lead the economy to an "above-trend" growth (Carvalho *et al.*, 2015).

Our identification strategy relies on the enactment of the Law 11.101/2005, the "New Bankruptcy Law", which increased debtor rights and firm access to external finance (Araujo *et al.*, 2012). This regulatory change allows us to use a Difference-in-Difference (DID) methodology to estimate the impact of the law on different categories of firms. Specifically, we use this exogenous source of variation in collateral prices to test the theoretical argument exposed by (Almeida & Campello, 2007), which, intuitively, predicts that when firms have imperfect access to credit (financial constraints), changes in firm's ability to obtain external finance may also increase investment. One such source of borrowing capacity is the value of collateral - commonly proxied in the literature by assets tangibility. By mitigating contractibility problems, we should

expect a larger effect of collateral prices on external finance access on countries where debtors are not well protected, such as Brazil. Debt collateral is one of the most common enforcement instruments used around the world. In a state of nature where the borrowing firm defaults, lender collateral gives the ability to the lender to seize tangible assets belonging to the debtor (Araujo *et al.*, 2012)

To sort firms on financial constrained and unconstrained groups, we consider the recent Farre-Mensa & Ljungqvist (2016) critique. While some classical measures of financial constraints are still used in the literature of financial constraints (payout ratio, total assets, bond ratings, Kaplan and Zingales' and other indexes, etc.), this paper puts serious doubts on what these variables really measure. The authors find that these measures usually fail in classifying firms that are plausibly constrained, both in debt markets (using natural experiments of 43 staggered increases in corporate income taxes triggered by individual US States) and equity markets (analyzing "equity recycling"<sup>1</sup> on firms). For each of five standard constraints measures, they find that the average "constrained" firm is able to borrow more in response to an increase in state corporate income tax rates and to simultaneously raise equity and increase payouts to shareholders. The authors conclude that these measures could be identifying young and fast-growing firms, rather than capturing financial constraints. Considering their critique, we choose to use firms' total asset as our sorting criteria for financial constraints, which is also consistent with prior studies in the literature (see, for example, Kirch *et al.*, 2014).

Our results show that following the enactment of the New Bankruptcy Law, real estate prices and overall credit in Brazil indeed started to rise faster. For financially constrained firms (bottom 40% of Total Assets, in each year of our sample), we estimate that the low-tangibility group (bottom 40% of its industry fixed assets / total assets) increased investment around 3.0 percentage points (p.p.) more than the high-tangibility group (top 40% of its industry fixed assets / total assets), comparing means before (2002-2004) and after (2005-2008) the exogenous change in collateral prices. We show that this effect is even stronger for firm financing: the average firm in the low-tangibility group increased total debt / total assets around 6.6 p.p. more than the average firm belonging to the high-tangibility group, and this difference is statistically significant at 5%. Finally, this leverage effects on low-tangibility firms are focused on and increase on long-term debt (debt maturing in one year or after), since the low-tangibility group increased the share of long-term debt on total debt around 11.6 p.p. then the high-tangibility group, and this is statistically significant at 1%.

Taken together, our results suggest that the credit boom of the second half of the 2000s alleviated financial constraints in Brazil, especially for smaller, less tangible publicly traded firms, ending up to increase long-term financing and boosting corporate investment. Although we find consistent evidence for the multiplier effect exposed in Almeida & Campello (2007), our results suggest a primary role of banks alleviating collateral requirements, potentially because of the higher supply of credit and better growth opportunities in the economy. In this sense, our evidence supports the idea that the relaxing collateral requirements dominated the multiplier effect during the 2000s credit expansion in Brazil.

Our research connects to at least two research topics. Empirical evidence on the determinants of leverage (Frank & Goyal, 2009; Harris & Raviv, 1991; Masulis & Trueman, 1988; Titman & Wessels, 1988) support the idea that firms that produce steady cash flows and have easily redeployable assets that can be pledged as collateral can afford high debt-equity ratios. In contrast, risky firms with little current cash flows and firms with intangible assets (e.g., R&D and advertising) tend to have low leverage. Our evidence suggests that this wedge can be tightened with credit rights reforms that increase collateral values and access to credit.

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<sup>1</sup>Grullon *et al.* (2011) defines equity recycling as the tendency of firms to pay out and raise equity simultaneously.

Our results are also related to policy experiments using a tax rate reduction in favor of small and medium-sized firms. A recent study on French companies also supports the idea that financial constraints decrease in firm size, as capital accumulation grew more in more productive, small firms affected by the reform (Bernini *et al.*, 2016). Other recent research shows that a within-firm change in financial constraints can also affect export value, as financially constrained firms reduce their export by 35% relative to financially unconstrained ones (Secchi *et al.*, 2014). Our study suggests that smaller, less tangible firms are also benefited from a legal reform that strengthened debtor rights in a previously opaque credit market, such as Brazil before 2005.

The rest of the paper is described as follow. In section 2 we discuss the role of collateral in corporate finance, and why it matters especially for emerging economies. In section 3 we describe the credit cycle of the 2000's in Brazil and also its reflects on the value of typically used collateral, such as real estate. In section 4, we describe the data and method that we use. Finally, in section 5, we summarize our results and its main implications on both micro and macroeconomic perspectives, and then we conclude the paper in section 6.

## 2 The role of collateral on corporate financing and investment

Academic studies about the relationship between investment decisions and funding constraints begin with the paper of Fazzari *et al.* (1988). In this study, the authors propose that in the case of firms facing funding constraints, investment decisions are related to the availability of internal resources, and not just the availability of profitable investment opportunities. The study shows, from positive and significant coefficients, the relationship between investment, as the dependent variable, and current and lagged cash flow as independent variables. Note the fact that the cash flow displays explanatory power higher than Tobin's Q. The authors end up validating the hypothesis that the importance of cash flow on the resources invested is higher in companies with low-profit distribution of dividend.

Since the publication of this study, the theme has been consolidated as one of the most important research topics in financial economics, gaining emphasis in academia through publications both in the international (Kaplan & Zingales, 1997; Cleary, 1999; Almeida *et al.*, 2004; Cleary, 2005; Cleary *et al.*, 2007; Almeida & Campello, 2007; Ersahin & Irani, 2015, among others) and national literature (see, for example, Terra, 2003; Kirch *et al.*, 2014).

Our research, however, is marked out in the model presented by Almeida & Campello (2007). Assuming that imperfections and information asymmetries restrict the ability of firms to take resources and, consequently, to invest, factors that minimize these issues would eventually facilitate their access to lending resources, loosening this restriction. Thus, the authors began to consider the tangible assets subject to garnishment, facilitating access to credit, whereas a larger share of tangible assets would be perceived as an increase in available collateral of the company, making potential funding providers more likely to grant credit to the company. In turn, access to credit would allow greater investment condition in new tangible assets, which could allow new funding and so on. Companies without credit restriction, however, would not be or would be little affected by asset tangibility.

### 2.1 Pledgeable income and its link with collateral

A prospective borrower faces a number of choices. One of them refers to the contract's guarantees - it can be unsecured (lender lending "against cash flow") or secured debt (lenders are lending "against assets"). Pledging assets as collateral

is an important instrument to mitigate moral hazard problems and thus reduce interest rates. The model of [Almeida & Campello \(2007\)](#) shows that the value of pledgeable assets can bind firm investment for financially constrained firms.

The model stipulated by [Almeida & Campello \(2007\)](#) assumes presented by [Hart & Moore \(1995\)](#) that human capital can not be alienable, which allows deriving the implication that the attachable assets of the company are limited, as well cash flow for investments. The economy has two periods, 0 and 1, and the period 0, the company needs to access a particular production technology  $f(I)$ , which will generate output in time 1. It is assumed a ratio of external financing ( $B$ ) to make the project viable. As lenders have no control over the return of the project, it is quite common that start to limit their exposure to the firm value in liquidation, which may be associated with the collateral of the loan agreements. Thus, the resource to be captured ( $B$ ) shall be limited by the tangibility degree ( $\tau$ ) of Investment ( $I$ ):

$$B \leq \tau I \quad (1)$$

In addition to the funds raised, the company may also have own resources ( $W$ ) that can be used to finance investment ( $I$ ). Like this:

$$I \leq W + \tau I \quad (2)$$

The optimal level of investment ( $I^{FB}$ ), such that  $f(I^{FB}) = 1$ . If no restriction between own resources and funds raised, the company will be satisfying  $I^{FB}$ . However, investment is limited ( $I^* < I^{FB}$ ), when:

$$\tau < \tau^*(W, I^{FB}) = \max\left(1 - \frac{W}{I^{FB}}, 0\right) \quad (3)$$

If the firm's resources are limited, the level of investment is determined by the available budget. Thus, the optimal investment level is given by:

$$I(W, \tau) = \begin{cases} \frac{W}{1 - \tau} & \text{if } \tau < \tau^*(W, I^{FB}) \\ I^{FB} & \text{if } \tau \geq \tau^*(W, I^{FB}) \end{cases} \quad (4)$$

The sensitivity of investment to cash flow is given by:

$$\frac{\partial I(W, \tau)}{\partial W} = \begin{cases} \frac{1}{1 - \tau} & \text{if } \tau < \tau^*(W, I^{FB}) \\ 0 & \text{if } \tau \geq \tau^*(W, I^{FB}) \end{cases} \quad (5)$$

Where the sensitivity of investment to cash flow is increasing as the degree of tangibility on investment. However, with a high degree of tangibility enough, the investment can become disconnected from the company's cash flow, as well as the degree of tangibility will not impact on the sensitivity of the investment in case of no credit restriction companies.

In this sense, [Almeida & Campello \(2007\)](#) present the following proposition:

**Proposition** (Almeida & Campello, 2007). *The cash flow sensitivity of investment,  $\frac{\partial I}{\partial W}$ , bears the following relationship with asset tangibility:*

- i) *At low levels of tangibility,  $\tau < \tau^*(W, I^{FB})$ , the firm is financially constrained and  $\frac{\partial I}{\partial W}$  increases in asset tangibility.*
- ii) *At high levels of tangibility,  $\tau \geq \tau^*(W, I^{FB})$ , the firm is financially unconstrained and  $\frac{\partial I}{\partial W}$  independent of asset tangibility.*

From this proposal, the model estimated by [Almeida & Campello \(2007\)](#) was:

$$\text{Investment}_{i,t} = \beta_1 Q_{i,t} + \beta_2 \text{Cash Flow}_{i,t} + \beta_3 \text{Tangibility}_{i,t} + \beta_4 (\text{Cash Flow} \times \text{Tangibility})_{i,t} + \sum_i \text{firm} + \sum_t \text{year} + \varepsilon_{t,i} \quad (6)$$

Analyzing the behavior of companies during the period 1971-2000, the study found that a higher tangibility of company assets reduces the possibility of financial constraint, validating the idea that the positive effect of cash flow on investment grows with reducing the degree of asset tangibility. In practice, the estimates obtained positive and significant coefficients for the relationship with constrained firms and low coefficients and, in most cases, not significant in the case of unconstrained firms.

Still in [Almeida & Campello \(2007\)](#) analysis, evaluated the credit multiplier as a driving relationship between tangibility mechanism of assets and sensitivity of investment to cash flow. With the change in asset prices over time, the credit offer ends ranging jointly, given the movements of the collateral value. Thus, the tangibility effect on companies in the investment sensitivity to cash flow being expanded during periods of economic boom, when the valued assets serve as collateral for making capabilities that will serve to further investment in assets. In times of economic recession, with falling asset prices, companies end up having less sizable assets, which generates fewer guarantees for new lines of credit, containing credit for new investments. The study proves that this credit multiplier has first-order effect on companies' investment decisions.

## 2.2 Non-collateral debt financing: lending on cash

In a perfect market, according to the theory proposed by [Modigliani & Miller \(1958\)](#), investment decisions would merely be affected by the investment opportunities of firms, since the resources would be optimally used and all credit demand would be supplied by supply. In this context, collateral assets are not relevant because interest rates would clear the market, even in the presence of bankruptcy risk.

In the real world, however, market incompleteness and asymmetric information can lead the economy to a credit rationing situation ([Stiglitz & Weiss, 1981](#)): adverse selection, moral hazard, and limited enforcement in case of default cause the exclusion of some individuals on the market, even if they are willing to pay the market value of lending.

Asymmetric information about firms' prospects between insiders and outsiders (potential investors) can create a substantial cost differential between internal and external funds ([Myers & Majluf, 1984](#); [Greenwald \*et al.\*, 1984](#), and so on). The break-even  $q$  value for a new investment project is higher than unity ( $1 + \Omega > 1$ ), where  $\Omega$  is the premium necessary to compensate new investors for the risk of investing inadvertently in lemons<sup>2</sup> ([Fazzari \*et al.\*, 1988](#)). Given this context, this asymmetric information causes "credit rationing" for some borrowers ([Stiglitz & Weiss, 1981](#)).

To minimize this uncertainty, lenders seek to avoid purely loans based on cash flow and not backed by assets, that is when the expectation of receiving the money back is purely based on the assessment that the borrower will be able to generate enough cash flow. In the case of default, the lenders can not repossess (seize) specified assets. In this case, firms can be credit rationed if they do not have enough pledgeable assets to get credit, and [Tirole \(2010\)](#) establishes the following hypothesis, which we will take to our study:

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<sup>2</sup>Some papers in corporate finance adopted the term "lemon", originally proposed by [Akerlof \(1970\)](#), to describe bad type firms.

H1: Credit rationing is more binding for firms with less tangible assets or assets that have a lower value in liquidation (Tirole, 2010).

### 3 Credit cycles and collateral prices in Brazil

#### 3.1 Credit evolution in Brazil

With the implementation of the Real Plan, in 1994, and the consequent economic stabilization from the control of inflation, Brazil opened space for the growth of the loan portfolio, which subsequently sustain economic growth cycle early 2000. Initially, however, restructuring programs of the financial system, such as PROER - Incentive Program for Recovery and Strengthening of the National financial system, PROES - Incentive Program for the Reduction of the State Public Sector in Banking and PROEF - Strengthening Program Federal Financial Institutions, eventually leading to a credit retraction, which fell from 34% of GDP in December 1995 to 26% of GDP in December 2002 (Mora, 2014).

As can be seen in Figure 1, the credit expansion cycle started with the acceleration of applications with funding of free resources, to the detriment of earmarked resources that little grew during this period from 2002 to 2008 and only from 2009 it began to have significant growth rates. From observation of the division between funds invested in Individual and Corporations related applications with free funds, we can check that, given the optimistic expectations of a recovery in employment and household income, the initial growth happens in the Individuals segment, passing from 6.1% in 2002 to 13% in 2008. Meanwhile, credit to companies remained stagnant until 2005, starting their growth cycle from 2006 and reaching 15.7% of GDP in 2008.

Tabela 1: Relation between credit and GDP: Period 2002-2008

Note: This table presents the evolution of different credit operations in the Brazilian Financial System, as reported by the Brazilian Central Bank (BCB). Earmarked funds refer to financing regulated by National Monetary Council (CMN) or linked to earmarked resources, mainly destined to housing, rural and infrastructure sectors. Non-earmarked refers to financing and loans which rates are freely negotiated between financial institutions and borrowers, i.e., market rates. In non-earmarked operations, financial institutions have autonomy to decide loans destination. We also use BCB's classification of outstanding credit according to the type of customer (non-financial corporations - Corporations - and households - Individuals). Finally, we separate banks in public and private, and the latter in national and foreign, depending on the ownership.

Account	2002	2003	2004	2005	2006	2007	2008
Non-Earmarked Resources	16.3	15.0	16.4	18.8	21.0	24.8	28.7
Individuals	6.1	5.9	7.1	8.9	10.0	11.9	13.0
Corporations	10.1	9.1	9.2	9.9	11.0	12.9	15.7
Earmarked resources	9.8	9.6	9.3	9.5	9.9	10.3	11.7
<b>Total Credit</b>	<b>26.0</b>	<b>24.6</b>	<b>25.7</b>	<b>28.3</b>	<b>30.9</b>	<b>35.2</b>	<b>40.5</b>
Public banks	9.8	9.8	9.9	10.4	11.3	12.0	14.7
Private Banks	16.3	14.8	15.8	17.8	19.6	22.0	25.8
National	9.7	9.5	10.2	11.5	12.8	15.4	17.3
Foreign	6.5	5.3	5.6	6.3	6.8	7.8	8.5
<b>Total Credit</b>	<b>26.0</b>	<b>24.6</b>	<b>25.7</b>	<b>28.3</b>	<b>30.9</b>	<b>35.2</b>	<b>40.5</b>

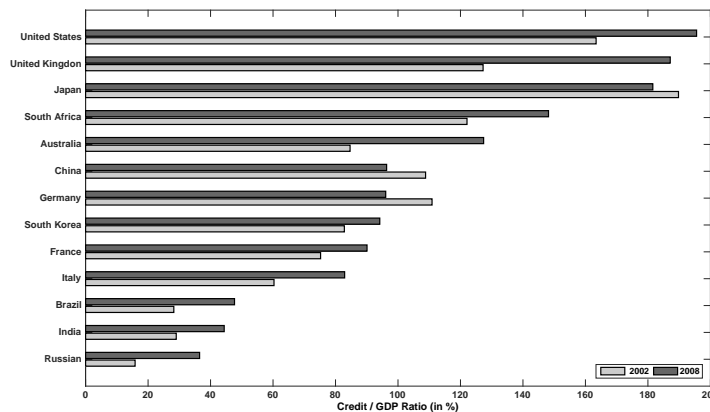
Still based in Figure 1, it is possible to observe that growth is sustained by the appetite of private institutions, and more specifically, by national capital banks. These institutions, which had a portfolio of 16.3% to GDP in 2002, increased



a portfolio of credit amounted to 25.8% of GDP in 2008. Although public banks have very significant participation in the current context in Brazil, the growth of these occurs in the period following analyzed here, that is from 2009.

Thus, the loan portfolio, which represented 26% of GDP in December 2002, showed broad growth, reaching, according to Central Bank data (Table 1), 40.5% of GDP in December 2008. However, even after this large growth, the credit portfolio in Brazil still represented a low ratio to GDP compared the world’s major economies. According to the Financial Development and Structure Dataset World Bank, presented in Table 2, the credit / GDP ratio, which was 28.24% in 2002, reached 47.67% in 2008, while reached 195.58% in the United States and even in developing economies such as China and South Africa already was 96.36% and 148.18%, respectively.

Figura 1: **Domestic Credit to Private Sector by Country - 2002 and 2008**



Sant’anna *et al.* (1994) also point out that the expansion of credit between 2004 and 2008 was accompanied by a major change in market profile both with respect to the extension of deadlines as regarding the fall in interest rates. According to Central Bank data, the average term of the loans, which was 222 calendar days in January 2004, spent 379 days in December 2008, an increase of 70.6% over a period of five years. In turn, the interest rate, which revolved at a level of 45% from 2004 to 2006, came to about 35% between 2007 and 2008.

In Figure 2, we show the Credit-GDP ratio evolution from 1996m3 to 2016m3. Visual analysis suggest that credit growth changed its slope in 2004/2005, following an expansionary economic period of that last 61 months.<sup>3</sup>

### 3.2 Collateral prices in Brazil

To evaluate the time series of pledgeable assets’ price in Brazil, we analyze the Residential Real Estate Collateral Value Index (IVG-R). This index is released by the Brazilian Central Bank and it is calculated with data extracted from the SCR real estate loans to households. This data comprise loans in which the collateral is composed of liens on residential real estate or real estate mortgage. The value of each property backed as collateral is estimated at the time of the granting of credit.

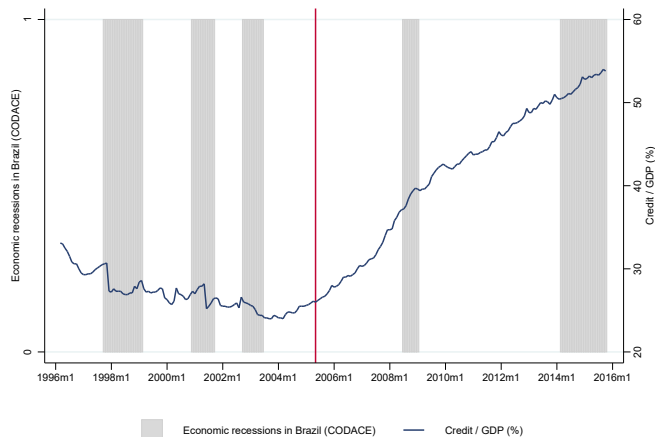
The IVG-R considers the assessed value of the properties pledged as collateral for loans in a given month, from a sample of about 160 thousand households. The collection is made up of properties located in the eleven metropolitan

<sup>3</sup>This is the largest expansionary period dated in Brazil since data is available (1980). An average expansionary period lasts 28.7 months, while an average recession lasts 15.8 months (CODACE, 2010)



Figura 2: Credit / GDP evolution in Brazil, 1996-2016

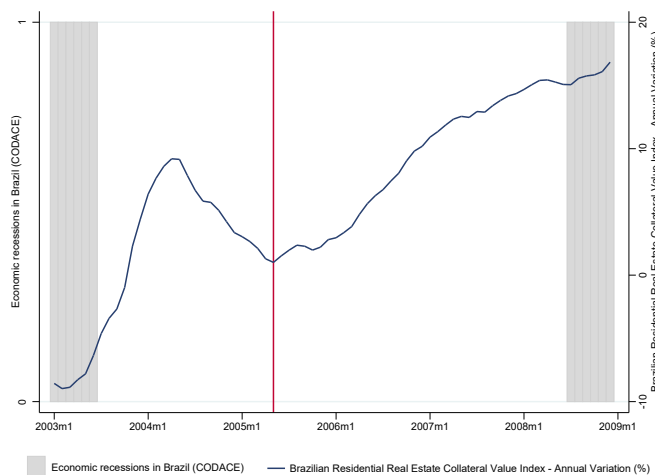
Note: This figure shows the evolution of Total Credit / GDP (%) in Brazil (series number 20,622 of the Time Series Management Series, maintained by the Brazilian Central Bank). We plot a vertical red line in 2005m5, when took effect Law n. 11.101/2005, the "New Bankruptcy Law". Shaded areas represent economic recessions in Brazil as dated by the Business Cycles Dating Committee (CODACE).



regions considered in calculating the National Index of Consumer Price (IPCA): Belém, Belo Horizonte, Brasília, Curitiba, Fortaleza, Goiânia, Porto Alegre, Recife, Rio, Salvador and São Paulo.

Figura 3: Brazilian Residential Real Estate Collateral Value Index, annual growth (%)

Note: This figure shows the evolution of the Brazilian Residential Real Estate Collateral Value Index, calculated by the Brazilian Central Bank (series number 21,340 of the Time Series Management Series, maintained by the Brazilian Central Bank). We plot a vertical red line in 2005m5, when took effect Law n. 11.101/2005, the "New Bankruptcy Law". Shaded areas represent economic recessions in Brazil as dated by the Business Cycles Dating Committee (CODACE).



As Figure 3 shows, starting on 2005, we can observe an expansion period on the growth of assets value used as collateral on domestic lending. This acceleration in the growth rate of asset prices occurs exactly in the same period that credit growth accelerated, as seen in the previous session. This increasing value on this type of assets can affect corporate investment through the credit multiplier, as the larger value of pledgeable assets would allow greater access to credit. With more access to credit, companies can execute new investment projects, which generates more pledgeable assets.<sup>4</sup>

<sup>4</sup>This is the multiplier effect, that could potentially be stronger for firms with more tangible assets. In a macroeconomic point of view, this

## 4 Methodology and Data

### 4.1 Definition of tangibility and investment

Defining asset tangibility is not an easy task. Most countries allow secured debt transactions involving “immovable assets” (eg., land and buildings), while “movable assets” (like machinery and equipment) comprise about half of total fixed assets around the world (Alvarez de la Campa, 2011). We built our baseline measure of tangibility based on the most used proxy in the literature (see, for example, Vig, 2013; Campello & Larrain, 2016), the ratio of total fixed assets (net property, plant and equipment – “movable” + “immovable” assets) to total assets.<sup>5</sup>

$$\text{Tangibility} = \frac{\text{Fixed Assets}}{\text{Total Assets}} \quad (7)$$

Almeida & Campello (2007) use three different measures of tangibility. One is based on a firm-level measure of expected liquidation values according to Berger *et al.* (1996). Using data from the proceeds of discontinued operations reported by a sample of Compustat firms over the 1984-1993 period, this empirical paper finds that a dollar of book value yields, on average, to a 72 cents in exit value for receivables, 55 cents for inventory, and 54 cents for fixed assets. Almeida & Campello (2007) use these coefficients to estimate a firm-level and time variant “liquidation value”:

$$\text{Tangibility}_2 = 0.715 \cdot \text{Receivables} + 0.547 \cdot \text{Inventory} + 0.535 \cdot \text{Capital} \quad (8)$$

The second measure of asset tangibility used by Almeida & Campello (2007) is based on the high-cyclicality of durable goods industry sales. They use a durable/nondurable industry dichotomy to create a measure of assets redeployability, i.e., the extent to which an asset can be (easily or not) sold in the secondary market. The authors include all durable goods industries (except SICs 32 and 38) plus SIC 30, that are assigned with value “1”, and “0” otherwise (all other industries - non-durable). Their motivation is that assets of firms operating in non-durables industries are perceived as more liquid by lenders.

In this study, we use in our baseline regressions the Campello & Larrain (2016) measure of tangibility (Equation (7)), since we are interested in the value increasing of real estate assets (immovable assets) and not in other financial items that can be pledged as collateral, such as receivables or inventory. However, we keep in mind that we have different measures of tangibility available in the literature.

Our core investment variable is based on Almeida & Campello (2007) and Kirch *et al.* (2014): Investment equal to the ratio between capital expenditures and lagged capital stock (PPENT). We also consider an alternative measure of investment based on Campello & Larrain (2016): the change in fixed assets scaled by lagged fixed assets. Since these variables are highly correlated, we use in our baseline the regressions of the first investment definition.

### 4.2 Data and sample

We start our database collecting Compustat Global Annual Fundamental data for Brazilian publicly traded companies’ balance sheet. In order to match this financial data with stock price information, we merge the Compustat dataset with the Center for Research in Security Prices (CRSP)’s daily price securities, using Global Company Key (GVKEY) and

higher prices of collateral could amplifying corporate investment growth.

<sup>5</sup>Although Campello & Larrain (2016) also calculate tangibility for U.S. firms using “movable” and “immovable” assets separately, Compustat Global does not comprise this information about the individual components of fixed assets outside the U.S.

fiscal year as matching variables. The price information we import from the CRSP database is the average price of each firm’s stock in a given year. To guarantee that we would lose the minimum number of observations during the matching procedure, we do not impose a minimum number of trading days for each stock in the CRSP database<sup>6</sup>.

We also collect aggregate credit information and the Residential Real State Collateral Value Index from Central Bank of Brazil (Central Bank Time Series Management System). Our sample period surrounds the New Bankruptcy Law in Brazil (Law 11,101/2005), going three years forward and three years backward (i.e., 2002-2008). To mitigate the influence of outliers, we winsorize each continuum variable in the 5% and 95% thresholds, respectively. Following this procedure, we drop firms that did not have at least two year-observations during the period 2002-2008. We also follow Almeida & Campello (2007) and Kirch *et al.* (2014) and drop observations (firm-year) that: a) had property, plant and equipment (PPENT) lower than R\$5 million, in values of July 2016;<sup>7</sup> b) had asset growth in the year higher than 100%, which typically occurs when firms is involved in mergers and acquisitions (M&A activities); c) were outside the 2 digit SIC range 20-39, that represents manufacturing firms<sup>8</sup>.

Our final sample comprises 1,473 firm-year observations (Table 2), divided in "Constrained" and "Unconstrained" subsamples: if a firm in a given year belongs to the top 40% of total assets in its industry (SIC 2 digits), then it is considered unconstrained; and constrained if in the bottom 40%. We use this criterion to separate firms that potentially face low financial frictions (large firms) from those that faces higher financial frictions (small and medium firms), which is consistent with the criteria used in Almeida & Campello (2007) and Kirch *et al.* (2014).

Table 2 shows that our sample has a sufficiently large number of high and low-tangibility firms in most of the manufacturing sector. We have a larger fraction of firms from Chemicals and Allied Products (12.2%), Food and Kindred Products (11.8%), and Primary Metal Industries (11.0%). Industries that had not at least three firms in the sample were dropped from the sample.

### 4.3 Model Specification

To quantify the effect of collateral prices on firm outcomes, we start by estimating a standard difference-in-differences specification using the validity of the law number 11,001/2005, the "Bankruptcy Law", as an exogenous variation in the price of collateral:

$$Y_{is,t} = \alpha_i + \alpha_t + \beta_1 \cdot \text{Post}_t + \beta_2 \cdot \text{High Tangibility}_{is} + \beta_3 \cdot (\text{Post}_t \times \text{High Tangibility}_{is}) + \varepsilon_{is,t} \quad (9)$$

Where  $Y_{is,t}$  represents the outcome of interest (Debt/Total Assets, Long-Term Debt/Total Debt, and Investment/Total Assets),  $\text{High Tangibility}_{is}$  is a dummy variable that equals one if the firm is in the top 40% of its industry’s tangibility (Fixed Assets/Total Assets) distribution, and zero if it is in the bottom 40%;  $\text{Post}_t$  is a dummy variable that equals one if in the year 2005 or after (this period is determined by the Brazilian New Bankruptcy Law - Law n. 11,101, passed on congress on February 9th, 2005 and took effect three months after) and 0 in years before 2005; to control for firms’ time-invariant characteristics we include a full set of firm fixed effects ( $\alpha_i$ ), as well as year fixed effects ( $\alpha_t$ ) to control for

<sup>6</sup>Even though to calculate the average year price we do not consider missing observations, after the merging process we ended up losing 101 companies (firms for which there was no price or information on the number shares available on the CRSP database). Because our sample is already relatively small, we decided to use the non-merged database in our baseline regressions, using market information such as Tobin’s Q only in robustness checks.

<sup>7</sup>We inflate all continuous variables to July 2016 through the national Consumer Price Index - IPCA.

<sup>8</sup>We therefore excludes of the sample firms from the agriculture sector, mining, and also services, such as those firms from the financial industry, typically excluded in empirical corporate finance studies because of its singularities in capital structure and other financial aspects.

Tabela 2: Stratification of our observations by industry and financial constraint status, 2002-2008

Note: This table reports the number of observations in our final sample, from 2002 to 2008, by industry (SIC 2 digits). The data come from the Compustat Global Database and initially comprises all Brazilian publicly traded firms. Constrained (non-constrained) firms are those in the bottom (top) 40% of firm size (proxied by total assets) in a given industry-year.

Industry	Constrained	Non-constrained	Total	Percent	Cummulative
Food and Kindred Products	77	77	154	11.76	11.76
Tobacco Products	12	0	12	0.72	12.48
Textile Mill Products	62	62	124	8.8	21.28
Apparel, Finished Products from Fabrics & Similar Materials	51	51	102	6.64	27.92
Lumber and Wood Products, Except Furniture	16	11	27	1.68	29.6
Paper and Allied Products	39	39	78	4.64	34.24
Printing, Publishing and Allied Industries	11	7	18	1.2	35.44
Chemicals and Allied Products	91	91	182	12.16	47.6
Petroleum Refining and Related Industries	22	11	33	2.08	49.68
Rubber and Miscellaneous Plastic Products	22	18	40	2.56	52.24
Leather and Leather Products	14	11	25	1.36	53.6
Stone, Clay, Glass, and Concrete Products	29	29	58	3.44	57.04
Primary Metal Industries	79	79	158	11.04	68.08
Fabricated Metal Products	59	59	118	8.24	76.32
Industrial and Commercial Machinery and Computer Equipment	60	60	120	8.64	84.96
Electronic & Other Electrical Equipment & Components	31	31	62	4.16	89.12
Transportation Equipment	63	63	126	8.72	97.84
Measuring, Photographic, Medical, & Optical Goods, & Clocks	14	9	23	1.44	99.28
Miscellaneous Manufacturing Industries	12	0	12	0.72	100
Total	765	708	1,473	100	100

time-varying economic shocks. Finally,  $\varepsilon_{is,t}$  is the error term, with standard errors clustered at the firm level (following Petersen, 2009). Our coefficient of interest is  $\beta_3$ , which measures the pre-post difference in the outcome of firms belonging to the high tangibility group, relative to the pre-post difference of firms in the low tangibility group.

Equation 10 estimates the DID controlling for firms and year fixed effects, however, it does not control for other firm and industry characteristics that can simultaneously affect the outcome of interest. To deal with that, we include in Equation 10 a set of control variables, with turns our DID equation similar to Campello & Larrain (2016):

$$Y_{is,t} = \alpha_i + \alpha_t + \beta \cdot (\text{Post}_t \times \text{High Tangibility}_{is}) + \gamma X_{is,t} + \varepsilon_{is,t} \quad (10)$$

where  $X_{is,t}$  is a vector of firm-level controls that include size, profitability, leverage, and overall tangibility. We use specifications (9) and (10) in the main empirical results of the paper.

## 5 Results

### 5.1 Descriptive statistics

Table 3 presents the descriptive statistics by financial constraint status. Numbers referrers to constrained (Panel A), unconstrained (Panel B) and all firms in the sample (Panel C). As previously stated, the separation of constrained and unconstrained firms is due to within industry total assets (firm size). For this reason, average constrained firm' size (LN Total Assets = 5.15) is lower than the average non-constrained firms' size (LN Total Assets = 7.51), even though firms are in the same industry.

The investment of the two groups has a sensible difference. While the group of constrained firms presents investment

Tabela 3: Descriptive statistics by financial constraint status and total, 2002-2008

Note: This table reports the descriptive statistics (by financial constraint status) of the firms in our final sample, from 2002 to 2008. The data come from the Compustat Global Database and initially comprises all Brazilian publicly traded firms. Constrained (non-constrained) firms are those in the bottom (top) 40% of firm size (proxied by total assets) in a given industry-year.

<b>Variables</b>	Mean	Median	Std Dev	Minimum	Maximum	# of Obs.
Panel A: Financial Constrained Firms						
Firm Investment	0.17	0.11	0.21	0.00	2.11	655
Tangibility <sub>1</sub>	0.40	0.37	0.21	0.02	0.90	765
Tangibility <sub>2</sub>	0.80	0.86	0.18	0.13	1.00	765
Size	5.15	5.08	1.29	2.07	9.41	765
Capital	0.40	0.37	0.21	0.02	0.90	765
Cash	0.08	0.03	0.11	0.00	0.75	765
Δ Cash	0.00	0.00	0.08	-0.79	0.29	765
Cash Flow	-0.03	0.05	0.36	-3.25	0.86	646
Total Debt	0.59	0.25	1.22	0.00	12.35	765
Δ Total Debt	0.15	0.02	1.87	-10.04	39.66	765
Short Term Debt	0.61	0.63	0.31	0.00	1.00	735
Long Term Debt	0.39	0.37	0.31	0.00	1.00	735
Panel B: Financial Unconstrained Firms						
Firm Investment	0.21	0.16	0.23	0.00	3.50	655
Tangibility <sub>1</sub>	0.38	0.38	0.17	0.03	0.87	708
Tangibility <sub>2</sub>	0.82	0.86	0.14	0.10	1.00	708
Size	7.51	7.36	1.46	4.33	12.64	708
Capital	0.38	0.38	0.17	0.03	0.87	708
Cash	0.13	0.11	0.11	0.00	0.65	708
Δ Cash	0.01	0.01	0.08	-0.42	0.53	708
Cash Flow	0.08	0.09	0.11	-1.09	0.35	655
Total Debt	0.31	0.3	0.18	0.00	1.68	708
Δ Total Debt	0.03	0.02	0.12	-0.61	0.56	708
Short Term Debt	0.47	0.44	0.26	0.00	1.00	704
Long Term Debt	0.53	0.56	0.26	0.00	1.00	704
Panel C: Total						
Firm Investment	0.18	0.14	0.19	0.00	3.50	1310
Tangibility <sub>1</sub>	0.39	0.38	0.19	0.02	0.87	1473
Tangibility <sub>2</sub>	0.81	0.86	0.16	0.10	1.00	1473
Size	6.25	6.23	1.73	2.07	12.64	1473
Capital	0.39	0.38	0.19	0.02	0.90	1473
Cash	0.10	0.07	0.10	0.00	0.75	1473
Δ Cash	0.01	0.00	0.08	-0.79	0.53	1473
Cash Flow	0.05	0.07	0.13	-3.25	0.86	1301
Total Debt	0.30	0.26	0.22	0.00	12.35	1473
Δ Total Debt	0.09	0.02	1.41	-10.04	39.66	1473
Short Term Debt	0.55	0.53	0.30	0.00	1.00	1439
Long Term Debt	0.45	0.47	0.30	0.00	1.00	1439

Source: Authors' elaboration.

of 17% of lagged fixed assets, the group of unconstrained firms features 21% of lagged fixed assets, a difference of 4% of assets, and the group formed by all companies obtained an average of 19% of fixed assets. Likewise, the median of the unconstrained group (0.11) was also lower than the unconstrained group (0.16).

Regarding the tangibility, we calculate two measures, namely the relationship between fixed assets and total assets (Tangibility<sub>1</sub>) and the ratio of the sum of cash, accounts receivable, inventories, and fixed capital to total assets (Tangibility<sub>2</sub>). The results of the two groups were very similar, being that the group of constrained firms (0.40) obtained Tangibility<sub>1</sub>

slightly higher than the group of unconstrained firms (0.38), while the unrestricted group (0.82) obtained  $Tangibility_2$  slightly higher than constrained group (0.80).

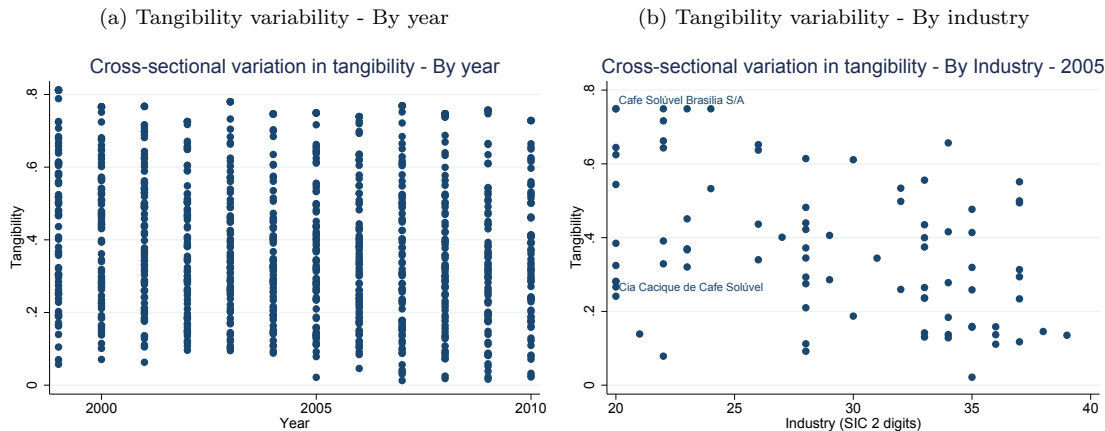
With regard to debt, the group of constrained firms showed more debt in relation to total assets, with an index of 0.59 compared to 0.31 of the group of unconstrained firms and 0.45 for the whole group. Interesting to note that in the period, the average change in debt was 0.15 for constrained firms against 0.03 of unconstrained companies, clearly demonstrating that companies of the first group contracted more debt than the second. Similarly, the group of unconstrained firms demonstrated to maintain a higher cash with an index of 0.13 against 0.08 of constrained firms.

In turn, with respect to the debt profile, we found that constrained firms had the most concentrated debt in the short term than the unconstrained firms. The first group had 61% of the debt in the short term and 39% long term, while the second got 47% in the short term and 53% long term.

## 5.2 Firms' heterogeneity in tangibility

Figure 4 shows the cross-sectional variation of our baseline tangibility measure for the whole sample of firms, by year and just before the implementation of the “New Bankruptcy Law” in Brazil, that triggered the expansion cycle on credit and real estate prices. Figure 3a shows that the variation on firms' tangibility is observed across the years. Moreover, Figure 3b reveals that there is both a substantial degree of cross-sectoral variation on the average firm tangibility (SIC 2 Digits on manufacturing firms) and of cross-sectional variation on firms belonging to a given industry (similar pattern are found in East European countries, as shown in [Campello & Larrain \(2016\)](#)).

Figure 4: Tangibility (Fixed assets / total assets) distribution, by year and by industry (sic 2 digits)



This observed cross-sectional variation in firms' tangibility within industries is crucial to our empirical strategy. By focusing on the high and bottom fraction of tangibility in firm-industry groups, our approach requires enough cross-sectional variation in the tangibility. By doing so, our goal is to control for common industry shocks that affect firms in a given industry, but that can be very different from industry to industry. For example, Brazilian food industry (SIC2=20) have benefited from both increasing local private consumption and increasing foreign demand for these goods, such as poultry meat, industrialized soy products, among others. However, other industries did not have the same positive macroeconomic shocks: Tobacco products (SIC2=21), for example, was prejudiced by the imposition of increasing restrictions on tobacco

consuming. In other words, by focusing on firms with different tangibility in the same economic activity (industry), we control for specific industry shocks.

We highlight in Figure 4(b) two firms that are very similar in its activities and mix of products: Cafe Solúvel Brasilia S/A and Cia Cacique de Cafe Soluvel. Both are coffee producers, which is an important item in the Brazilian food industry. We can plausibly argue that both firms are exposed to the same macroeconomic and investment opportunities shocks. However, one firm had in 2005 a fixed assets / total assets very different from the other. We explore these differences in the potential use of collateral to access external finance across companies to estimate the effect of the booming collateral prices on debt financing and investment.

### 5.3 Are there differences in investment and firm financing between the two groups?

Exploiting the observed cross-section variability in tangibility, we analyze mean and median of our three independent variables (investment, debt / total assets, and long-term debt - total debt), by period (before and after the expansion credit cycle) and by group (low vs high-tangibility). In Figure 5, we show the evolution of these variables between the high and low-tangibility groups.

The graphical evidence suggests that the low-tangibility group increased more than proportionally its investment, total debt and long-term debt / total debt after 2005. If we look at the numbers (Table 4), we can see that the post-pre difference in investment is 5.3 p.p. and 8.3 p.p. for the high and low-tangibility firms, respectively. The t-test for differences of means confirms that these differences are statistically significant at 1%. However, when we look at the difference of the differences (row and column "Difference" of Panels A, B and C in Table 4), we conclude that the control group (low-tang) increased its investment 3.0 p.p. more than the treatment group (high-tang). This difference is economically relevant (around 17.7% considering the pre-event investment mean of the low-tang group) albeit not statistically different of zero by the standard t-test. We find more prominent results in total debt (Panel B), where the control group increased in 6.6 p.p. its total debt -total assets ratio relative to the treatment group. This difference is statistically significant (5%) and economic sizeable: a 27% increase in leverage considering the pre-treatment level of the control group.

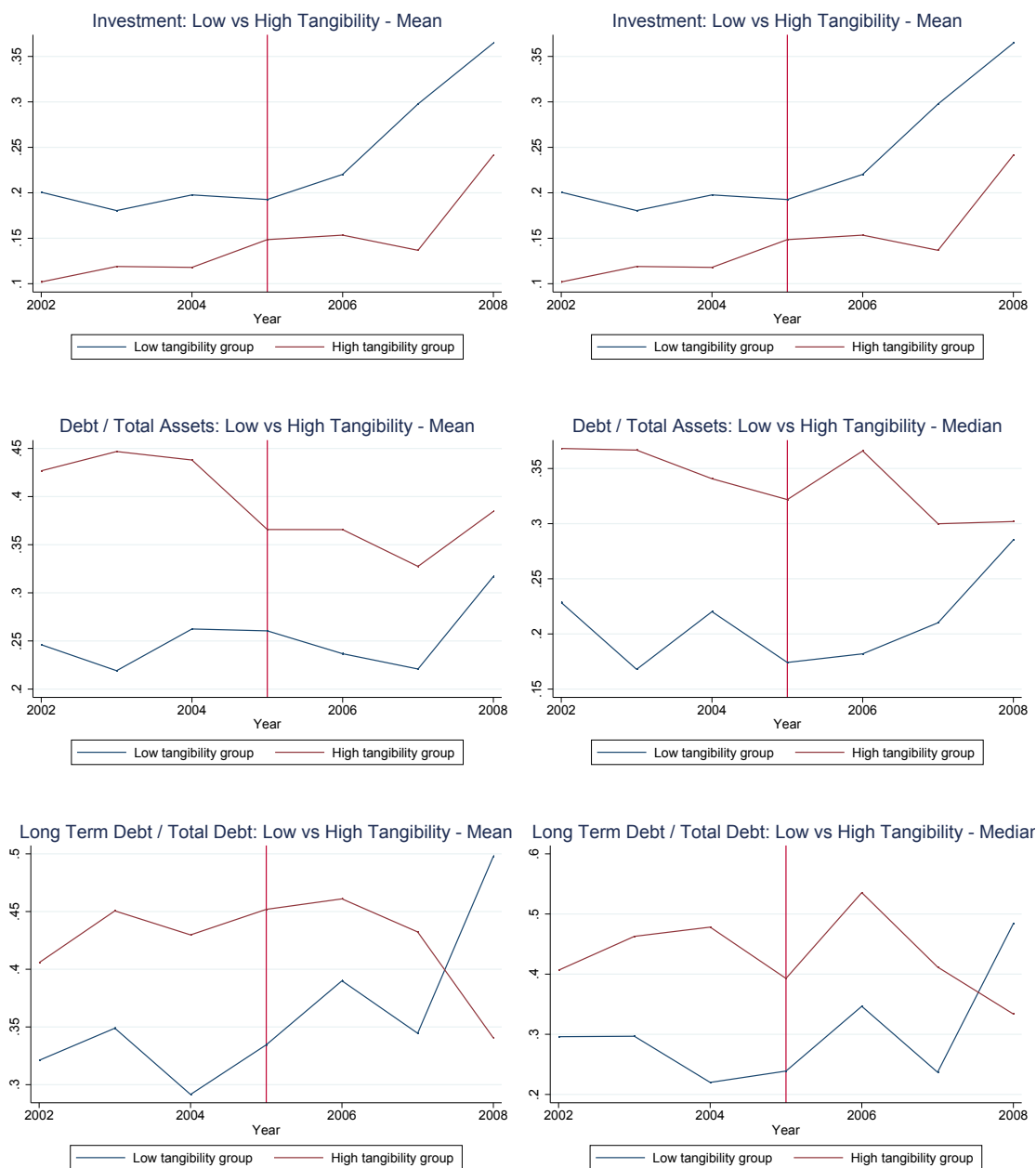
One could also note that we find the larger difference between the two groups in the composition of debt. Before 2005, the average firm in the high-tangibility group had 43.2% of its debt in long-term debt (LTD). Meanwhile, the average low-tangibility firm had only 34.7% of its debt in LTD. After the bankruptcy law and the expansion cycle in the credit market, the former firms seem to have benefited the most of this new macroeconomic environment: a meaningful increase of 11.6 p.p. (33% of the pre-event average) relative to the high-tangibility group. This empirical evidence is particularly important because it implies one heterogeneous effect of the credit cycle on Brazilian firms: less tangible firms, potentially facing more financial frictions before the credit boom, effectively increased its long-term debt, which interest rates are normally lower and the higher maturity allows the firm to best manage its investment decisions over the business cycle.

### 5.4 Discussion of results

Our study starts from the division of the firms into two groups (financial constrained and financial unconstrained) according asset size criterion. From these groups we distinguish the first results, which include: (i) companies constrained had investment level lower than the unconstrained, validating anticipated by the literature (Kirch *et al.*, 2014; Bernini *et al.*, 2016); (ii) the two groups showed similar degree of tangibility; (iii) the financial constrained firms had concentrated debt



Figura 5: Mean and median of our core independent variables, by year and by low-high tangibility groups



in the short term, while financial unconstrained firms had most of the long-term debt; (iv) the financial constrained firms presented a debt evolution much higher than the unconstrained firms. Regarding this last item, we understood that constrained firms, which had very little access to credit in the initial period, have access to credit easier from the credit expansion. Although this issue draws attention, it corroborates with results of other studies. In evaluating Mexico's industrial sector from 1984 to 1994, the authors found that, over a period of credit expansion, financial constraints appear to have been eased especially for smaller firms (Gelos & Werner, 2002). The same results were found by Bernini *et al.* (2016) evaluating the financial market in France.

Later, in our sample of financially constrained firms (bottom 40% of Total Assets, in each year of our sample) we find

Tabela 4: Results of the difference-in-difference estimations, by variable and period, 2002-2008

Note: This table reports the results of the basic empirical strategy. We divide our financial constraints sample of firms into two groups, based on its within sector tangibility. Treatment group is formed by companies belonging to the top 40% of its industry's fixed assets / total assets. Control group consists of firms at the bottom 40% of its industry's fixed assets / total assets. Time variables are defined by the effectiveness of the Law 11,101/2005, the "New Bankruptcy Law" (it started to vigerate in Brazil by May 12th, 2005). Therefore, After refers to the period 2005 to 2008 and Before refers to the period 2002 to 2004. In all Panels, we calculate the average of each referred variable pre and post-law, i.e., we have the averages Before and After the event. Each Panel refers to a different dependent variable, as described above. The difference in differences in each Panel is the variable of interest. \*\*\*, \*\*, and \* implies significance at the 99%, 95% and 90% levels, respectively.

Variables	Before	After	Difference	N
Panel A: Firm Investment				
Treat	0.102	0.154	0.053***	326
Control	0.177	0.260	0.083***	420
Difference			-0.030	
Panel B: Total Debt / Total Assets				
Treat	0.400	0.355	-0.045*	391
Control	0.244	0.265	0.021	482
Difference			-0.066**	
Panel C: Long Term Debt / Total Debt				
Treat	0.432	0.405	0.027	386
Control	0.347	0.436	-0.089***	452
Difference			-0.116***	

that the low-tangibility group (bottom 40% of its industry fixed assets / Total assets) increased investment around 3.0 percentage points (pp) more than the high-tangibility group (top 40% of its industry fixed assets / Total assets), comparing means before (2002-2004) and after (2005-2008) the credit expansion cycle. This variation is meaningful economic: 17% Increase in investment for the low-tangibility group relative to the high-tangibility group, considering the pre-event mean (17.7%).

Although some evidence is shown that the credit boom facilitated investment for firms with a low fraction of pledgeable assets, our results are stronger (statistically and economically) for firm financing. The average firm in the low-tangibility group increased total debt / total assets around 6.6 p.p. more (27% of increase considering the pre-event average) than the average firm belonging to the high-tangibility group, and this difference is also statistically significant (5%). This result suggests that collateral played a major role in firms access to debt before the credit expansion, and that the higher supply of credit that followed the New Bankruptcy Law allowed less tangible firms to increase access credit markets.

Besides the increase in total debt, an important finding of our empirical estimations is that the composition of debt changed significantly more to the low-tangibility group. The average low-tangibility firm increased the share of long-term debt on total debt after 2005 around 11.6 p.p. (33%) more relative to an average high-tangibility firm. More than statistically significant (1%), this result is economically sizable: a 1/3 increase in the fraction of long-term debt on total debt to low-tangibility firms relative to high-tangibility firms after 2005 indicates a qualitatively meaningful improvement on the access of corporate credit in Brazil, especially for firms that were potentially out of the market before the credit expansion cycle.

In summary, our study points to an easier access to credit for low-tangibility firms, which enabled the increasing the

investment of this group's firms. This result ends up supporting the idea [Guermazi \(2014\)](#), who evaluated the credit expansion in Tunisia over the period of financial liberalization, for 1999 to 2005, and found that, although the tangibility of assets play an important role in the investment behavior of companies, the sensitivity of investment in relation to tangibility lost strength over the credit boom. On the other hand, such a conclusion is not definitive, and studies such as [Gelos & Werner \(2002\)](#) found that the importance of collateral in the credit decision did not reduce over the credit expansion in the period evaluated in the Mexican market.

## 6 Conclusion

Our macro evidence shows that following the enactment of the New Bankruptcy Law (Law n. 11.101/2005), real estate prices and overall credit in Brazil indeed started to rise faster, especially to individuals. We exploit this new expansion cycle in both credit and real estate prices to estimate how firms' financing and investment reacted to this new economic environment. We sort firms accordingly to its ex-ante likelihood on being financially constrained, i.e., the extent to which a given firm faces difficulties to raise external finance. We then compare how firm financing and investment behaves relative to a counterfactual firm in the same industry (SIC 2 digits), in order to control for industry specific economic shocks.

In our sample of financially constrained firms (bottom 70% of Total Assets, in each year of our sample) we find that the low-tangibility group (bottom 40% of its industry fixed assets / total assets) increased investment around 3.0 percentage points (p.p.) more than the high-tangibility group (top 40% of its industry fixed assets / total assets), comparing means before (2002-2004) and after (2005-2008) the credit expansion cycle. This variation is economic meaningful: a 17% increase in investment for the low-tangibility group relative to the high-tangibility group, considering the pre-event mean (17.7%).

Although some evidence is shown that the credit boom facilitated investment for firms with a low fraction of pledgeable assets, our results are stronger (statistically and economically) for firm financing. The average firm in the low-tangibility group increased total debt / total assets around 6.6 p.p. more (27% of increase considering the pre-event average) than the average firm belonging to the high-tangibility group, and this difference is also statistically significant (5%). This result suggests that collateral played a major role on firms access to debt before the credit expansion, and that the higher supply of credit that followed the New Bankruptcy Law allowed less tangible firms to increase access credit markets.

Besides the increase in total debt, an important finding of our empirical estimations is that the composition of debt changed significantly more to the low-tangibility group. The average low-tangibility firm increased the share of long term debt on total debt after 2005 around 11.6 p.p. (33%) more relative to an average high-tangibility firm. More than statistically significant (1%), this result is economic sizable: an 1/3 increase in the fraction of long term debt on total debt to low-tangibility firms relative to high-tangibility firms after 2005 indicates a qualitatively meaningful improvement on the access of corporate credit in Brazil, especially for firms that were potentially out of the market before the credit expansion cycle.

Taken together, our results suggest that the credit boom of the second half of the 2000s alleviated financial constraints in Brazil, especially for smaller, less tangible publicly traded firms, ending up to increase long term financing and boosting corporate investment.

Although we find consistent evidence for the multiplier effect lead by the collateral channel and exposed in [Almeida & Campello \(2007\)](#), our results suggest a primary role of banks alleviating collateral requirements, potentially because of

the higher supply of credit and better growth opportunities in the economy. In this sense, our evidence supports the idea that the relaxing collateral requirements dominated the multiplier effect during the 2000s credit expansion in Brazil.

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