

BNDES loans and the financial constraints of Brazilian publicly traded companies

Brazilian
publicly traded
companies

567

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Abstract

Purpose – The purpose of this paper is to analyze whether companies that contracted loans from the Brazilian National Bank for Economic and Social Development (BNDES) between 2002 and 2014 were able to invest more than companies that did not. The literature on financial constraints, particularly that based on the investment-cash flow sensitivity model, is among the most studied and controversial in the area of finance, and the discussion on the role of development banks is equally controversial.

Design/methodology/approach – The main econometric model of this study was based on the investment-cash flow sensitivity model, with the incorporation of a binary variable that captures the role of the BNDES. This model is applied to a sample of companies listed on the B3 from 2002 to 2014.

Findings – This study shows that loans from the BNDES amplify the effects of cash flow on investments, generating a kind of credit multiplier. An important role of development banks is to reduce the financial constraints typical of developing countries.

Research limitations/implications – The use of the cash flow sensitivity model in companies that contracted loans from the BNDES is a relevant instrument to test the effect of the BNDES on companies with financial constraints.

Practical implications – The contracting of BNDES loans by companies can affect both capital structure and cash generation, particularly in companies or years in which there was financial constraint.

Social implications – Due to the nature of the BNDES as a development bank, there are ramifications in terms of the generation of employment and income inherent to the mission of this type of institution. Knowing the multiplier effect on the cash flow potential of companies has a direct impact on their preservation, enabling them to maintain and expand the supply of jobs.

Originality/value – This study is the first to integrate two important areas of study. From the theoretical perspective, this study provides evidence on the relationship between the BNDES and company financial

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constraints that open new avenues of research. From the managerial point of view, the evidence of the multiplier effect is highly important for the management of the capital structure and cash flow of companies.

Keywords Development banks, Cash flow, Bank loans, Financial constraint

Paper type Research paper

1. Introduction

After the Second World War, many countries experienced economic and social devastation. The economies devastated by these conflicts needed reconstruction. The world powers that polarized the political-economic influences of the time – such as the USA and the Union of Soviet Socialist Republics (USSR) – also collaborated to finance the restoration of many countries. Such restoration occurred largely through public banks.

In a planned economy, in which the state was the center of the production and organization of the country's wealth – as in the USSR – the state bank was part of the system. However, in capitalist economies, the creation of public banks was not the rule. Even so, many public banks were founded as development banks and helped in the organization of government strategies. In this context, a long-term capital flow for restoring economic growth and development was provided by public banks (Svejnar, 2002). In the context of economic recovery, development banks were to fulfill their role and then become extinct because their low interest rates should not compete with private banks. However, many public banks continued to operate in countries such as Germany, Japan, Canada, Brazil and China (Ferraz, Além, & Madeira, 2013; Hermann, 2011).

The importance and effectiveness of public development banks have not attained consensus among scholars. In poor countries, with low *per capita* income, the preservation of development banks is important for long-term sources of funds. Industries related to the implementation of basic sanitation infrastructure, energy matrices and logistical structures for the flow of wealth can be financed by development banks (Armendáriz de Aghion, 1999; Hermann, 2011; Torres & Zeidan, 2016). However, countries with interventionist governments and with low guarantees of property rights have shown slow economic development despite the presence of development banks. This contrast can be observed in countries without a large state presence in banks (La Porta, Lopez-de-Silanes, & Shleifer, 2002; Megginson, 2005) and raises an important question about the role of development banks in reducing the financial constraints faced by companies.

In this context, the objective of this study is to analyze whether companies that contracted loans from the Brazilian National Bank for Economic and Social Development (BNDES) between 2002 and 2014 were able to invest more than companies that did not. The results of analyzing the companies listed on the B3 (the Brazilian stock exchange) show that companies that borrowed from the BNDES were able to make greater investments. In addition, and more importantly, BNDES loans amplify the effects of cash flow on investments, generating a kind of credit multiplier. In other words, the BNDES multiplies the investment capacity of each monetary unit of cash flow generated by the company. This last result is the main contribution of this article.

The article consists of five parts, including the Introduction in Section 1, Theoretical Framework in Section 2, Methodological Procedures in Section 3, Results and Final Considerations in Sections 4 and 5, respectively.

2. Theoretical framework

2.1 *The role of development banks in national economies*

Development banks are financial institutions that are generally sponsored by national or transnational governments that own its capital. The primary objectives of development

banks are related to the provision of long-term capital for a country's industries and the implementation or expansion of the national infrastructure. Thus, development banks offer loans in the market or participate in the capital of private companies (Torres & Zeidan, 2016).

The emergence of development banks is often linked to the reconstruction of a country after a crisis or war. Luna-Martínez and Vicente (2012) conducted a global survey on national development banks and their characteristics, noting that more than 88% were formed after the Second World War.

In addition to the national development banks, there are large development banks for continental geographic areas. For example, the World Bank, together with other transnational development banks, is member of the group of multilateral development banks. In this context, five institutions help promote the world economy: the World Bank, the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development and the Inter-American Development Bank (Nelson, 2015).

The life cycle of development banks is linked to the development of a country, enabling them to monitor and promote the growth and development of industry and infrastructure. Once they have fulfilled their role, they then transition to indirect operations and move toward their natural extinction (Hermann, 2011; Torres & Zeidan, 2016).

Development banks arise to meet the needs of developing countries due to the scarcity of long-term capital in the promotion of industrialization and to promote the consequent development of the country. Moreover, they play a particularly positive role in poor countries by providing long-term credit for the development of industry and infrastructure (Hermann, 2011; Torres & Zeidan, 2016). Because they supply long-term resources, development banks are seen as promoters of national wealth and knowledge acquisition in long-term financial management (Armendáriz de Aghion, 1999).

The presence of development banks in poor countries can be beneficial, as long as they operate without exercising leadership in the financial market. These public banks can complement the performance of private banks. In addition, they absorb some of the risks of infrastructure projects, enabling the development of countries in which there are institutional and financial market gaps (Torres & Zeidan, 2016).

In developed countries, development banks follow the growth and development of the economy. In this case, there is an increase in *per capita* income, greater domestic savings, lower risk aversion and capital allocation to medium- and long-term assets. These benefits help alter the degree of market incompleteness, allowing it to reach different sectors than under poor economic development conditions. To meet a new market configuration, development banks must readjust to the new needs of the country. Thus, even economic and financial development requires new operating strategies for these banks. In Europe and Japan, for example, these institutions took on new functions in addition to the needs of the financial market (Armendáriz de Aghion, 1999; Hermann, 2011).

Although the performance of development banks has a positive side, they can nonetheless bring adverse effects to the country when there is majority state ownership in financial institutions that promote the economy (Luna-Martínez & Vicente, 2012). In their study, the authors provide a profile of the participation of state capital in development banks. In 74% of 90 banks surveyed in 2009, the capital was 100% state-owned; in 21%, the state held between 50 and 99% of the capital; and in 5%, the government owned less than 50% of the capital.

The marked presence of the state is more frequent in the development banks of poor or developing countries that experience low *per capita* income, the presence of interventionist governments and low protection of property rights. After the 1970s, it was found that

countries with this profile, even if they had development banks, showed slower economic development than countries with little government intervention in banks. This difference may have been caused by the predominance of political decisions in lending at the expense of technical decisions. Development banks began to grant credit based on political influences, which may have resulted in low efficiency and, consequently, slow and lower economic development (La Porta et al., 2002).

Although state ownership may be important in a country's developmental period, over time, the strong presence of governments in development banks can lead to corruption. A possible indicator of corruption is the selection of projects with negative net present value (NPV) to receive funds from public banks (Armendáriz de Aghion, 1999).

2.2 The Brazilian National Bank for Economic and Social Development

The founding of the BNDES in 1952 is in line with the theories of origin of development banks, such as the offer of support to the development of countries that do not have sufficient sources of long-term financing (Paiva, 2012). The BNDES is among the development banks with the highest asset value (Ferraz et al., 2013; Luna-Martínez & Vicente, 2012).

In keeping with the theory of development banks, the BNDES has provided the Brazilian market with increasing financial disbursements since its foundation. The period from 2004 to 2010 marked an acceleration of BNDES loan disbursements in the credit market (Figure 1).

Companies with long-term capital needs sought BNDES loans in this period. According to Lazzarini, Musacchio, Bandeira-de-Mello, and Marcon (2015), the BNDES was not sought only by companies with poor financial performance. Many companies that contracted loans had characteristics that enabled them to seek resources in the private market. Bonomo, Brito, and Martins (2015), for example, show that the companies that received BNDES loans

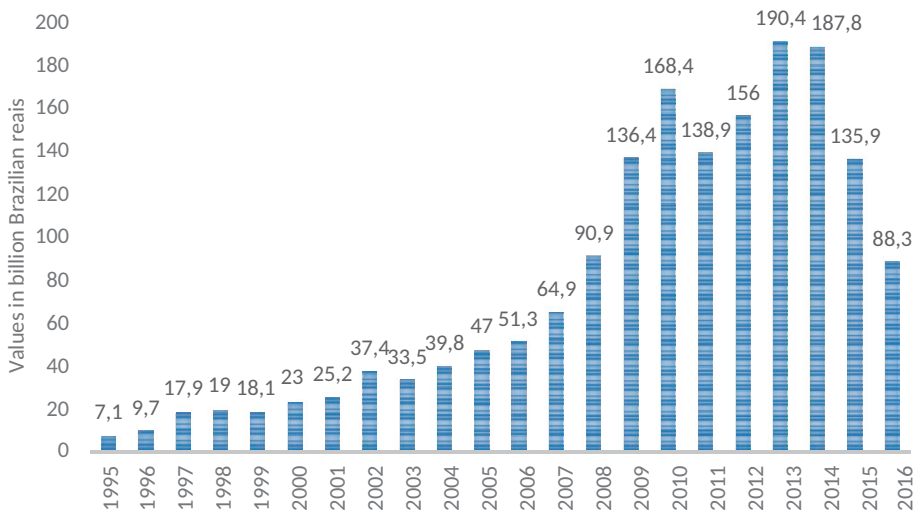


Figure 1.
Current annual
BNDES
disbursements,
excluding the capital
market

Source: www.bndes.gov.br

were larger and older and had lower risk. Therefore, they could also have been served by the private banking market.

It is important to note that side effects may occur in BNDES loaning to companies in which there is public capital, known as “crony capitalism” (Torres & Zeidan, 2016). One aspect of this distortion is the finding that some companies that contracted BNDES loans directed the resources to investments that created jobs in regions of electoral interest to political candidates allied with the federal government in election years. In other words, political decisions can influence loans from state banks that, in turn, lend resources to companies located in regions of electoral interest (Carvalho, 2014). Thus, the creation of jobs leads the electorate to see the public administration as effective, which may increase their chances of reelection.

Regardless of the characteristics of the companies and the political motivations that involve BNDES operations, the use of BNDES loans would enhance the investment capacity of companies, which leads to our first hypothesis:

- H1.* Companies that borrowed from the BNDES invested more due to greater access to an external resource.

2.3 Financial constraints and the credit multiplier

To check only whether companies that borrowed from the BNDES invested more – the focus of *H1* – may be insufficient. After all, there is arguably a positive mechanical relationship between borrowing and investing. Therefore, our study proposes that investments are higher in companies that have borrowed from the BNDES because they amplify the effects of each monetary unit of cash flow, creating a kind of credit multiplier. This effect has already been observed in, for example, tangibility (Almeida & Campello, 2007). However, no study was found that analyzed the multiplier effect of BNDES on investments. This analysis, therefore, constitutes the main contribution of this article.

Financial constraints are identified when a company does not have many options to seek external resources to finance its investments in production structure, such as machinery, real estate and other tangible assets, and depends more on its cash flow generated in the business. In the absence of financial constraints, even if the company has an available and sufficient cash flow generated by the business itself, it can choose whether to use this internal resource or seek external sources of financing, such as loans or capital, through the issuance of shares. In other words, in the presence of financial constraints, company investments depend much more on internal sources of funds. In the absence of restrictions, investments have multiple sources, and the company can choose where it will obtain its financial resources from (Fazzari, Hubbard, & Petersen, 1988; Kaplan & Zingales, 1995).

The presence of financial constraints is related to information asymmetry because creditors can decrease their credit supply or protect themselves by raising interest rates and requiring more real guarantees based on the extent to which information is unknown or distorted. The same occurs between business owners (investors) and executives; if the information is unclear, there may be difficulties in obtaining external financial resources. From this perspective, lenders and investors charge more when there is no abundant or clear information about companies and their management (Almeida & Campello, 2010; Fazzari et al., 1988).

Fazzari et al. (1988) propose a methodology to measure a company’s financial constraints based on the investment-cash flow sensitivity model. The authors state that a company’s investments are influenced by its cash flow and by its investment opportunities (e.g. Tobin’s *Q*). A company that is not financially constrained would invest according to its investment

opportunities regardless of internal cash flow generation, since this company would have the ability to seek external resources, either through loans or by issuing new shares. However, a company with more restricted access to the foreign market would depend more on its internal cash generation. As a result, the sensitivity of the investment to cash flow would be greater in financially constrained companies.

Kaplan and Zingales (1997) disagree with Fazzari et al. (1988) when arguing that cash flow is not an adequate measure of financial constraint. They used the same sample as Fazzari et al. (1988) and reclassified the companies by types of financial constraint, according to the analysis of accounting reports, through considering the debt-to-capital ratio, interest payment, dividend distribution and excess cash. These authors concluded that companies without financial constraints showed greater sensitivity of investment to cash flow.

Another approach that furthered the discussions was that of Cleary, Povel, and Raith, (2007) and Guariglia (2008). Their studies found that the relationship between investments and cash flow followed a “U” curve, which reconciled the conclusions of Fazzari et al. (1988) and Kaplan and Zingales (1997). The model assumes that companies can be classified based on indicators of internal resources or external resources. In young and small companies, there is a tendency for the relationship between cash flow and investments to be negative; the opposite trend occurs in larger and mature companies. Thus, in a sample, different relationships between the sensitivity of investments and cash flow could be found.

In terms of the Brazilian market, four studies are relevant to the investigation of the financial constraints of Brazilian companies. Terra (2003) found that all companies in the sample had financial constraints, with lower intensity for large and multinational corporations. Aldrighi and Bisinha (2010) expected that smaller companies would experience greater financial constraint, but that was not confirmed. As the size of companies increased, there was a greater sensitivity of investments to cash flow availability. Crisóstomo, Iturriaga, and González (2014) found that the presence of nonfinancial companies in the ownership structure of other companies contributed to the reduction of financial constraint. Ghani, Martelanc, and Kayo (2015) did not find differences in information asymmetry between public and private companies. A possible interpretation of the result would be the intense interference of credit with an increase in the supply of loans by mixed-capital and state-owned banks, which would interfere in the cash flow relationship of companies and their investments. This statement leads to the issue of financial constraint and government interference via state financial institutions, such as the BNDES.

In line with Kiyotaki and Moore (1997), Almeida and Campello (2007) argue that a company’s degree of tangibility can ease its financial constraints. Companies with a higher value of tangible assets can offer greater guarantees to creditors and, therefore, would have a greater supply of potential credit. Investors, in general, would operate under that same principle, seeking investments with real and tangible guarantees. In this context, Almeida and Campello (2007) found evidence that tangibility increases the ability of cash flow to generate new investments, which the authors call a credit multiplier, but only in financially constrained companies. Starting from the premise that the BNDES mitigates financial constraint by granting subsidized loans aimed at economic and social development, our second and main hypothesis is the following:

- H2.* BNDES loans not only increase investments by the company but also amplify the effect of cash flow on these investments.

2.4 Forms and modalities of Brazilian National Bank for Economic and Social Development financial support

The BNDES provides financial resources in the form of direct or indirect financial support. A loan is classified as a direct operation when the BNDES does not use the services of banks and other financial institutions in the market (accredited network). The financial resources and the operation and administration of credit are entirely carried out by the BNDES. In contrast, loans in the indirect form include the participation of banks and other financial institutions in the market.

Indirect operations, in turn, can be automatic or nonautomatic. In automatic operations, the accredited financial institution receives the loan application, analyzes it and approves the loan. Then, it requests the BNDES to ratify the operation and release financial resources. In nonautomatic operations, the accredited bank receives the loan application, and there is a prior consultation with the BNDES regarding the approval or denial of credit.

Due to the complexity and high value involved in direct and nonautomatic operations, it is reasonable to assume that they are related to projects that would be difficult to finance using only the cash flow generated internally by companies. Therefore, such projects would require the supply of external resources subject to the financial constraints of the companies. Thus, it is expected that the sensitivity of the investment to cash flow is higher in cases involving direct or nonautomatic operations, generating our third hypothesis:

- H3.* Credit operations that involve direct and more active participation of the BNDES involve companies with greater financial constraints.

3. Methodological procedures

3.1 Description of the data and statistical procedures

To perform the analyses, data for publicly traded companies whose shares were traded on the São Paulo Stock Exchange (Bovespa) in the period from 2002 to 2014 were extracted from Economática®. Financial company-years (banks, investment funds, financial institutions) with total assets of less than US\$5m, in which the current liabilities or total debt was greater than the total assets and where Tobin's Q was less than zero or greater than 10, were excluded. The sample in the present study, after the data treatment, comprised 406 companies and 3,140 company-year observations. The values were inflated by the Extended National Consumer Price Index (IPCA) until 2014.

The initial sample was compared with information provided by the BNDES regarding loans granted from 2002 to 2014. The loans were presented in the direct, indirect, automatic and nonautomatic forms and modalities on the BNDES website.

To create the list of companies that contracted loans from the BNDES, each National Registry of Legal Entities (CNPJ) for the companies selected in Bovespa for the study was consulted. After data treatment, a subsample of the BNDES comprising 193 companies and 862 company-year observations with loan contracts was obtained.

Another aspect analyzed in this study was the forms and modalities of support through funding. The variables involved are *DIR* (measures the direct or indirect forms) and *AUT* (measures the automatic or nonautomatic modalities), which show how the 862 company-year observations with BNDES contracts were distributed in the period.

Given the selected observations and subsamples of BNDES observations, the outliers were treated by winsorization (in the 5th and 95th percentiles) of the variables involved in the analytical models. The Breusch–Pagan homoscedasticity test was performed.

3.2 Model variables

Financial constraints were analyzed using an adapted investment-cash flow sensitivity model [equation (1)], discussed by Almeida and Campello (2007), and the models used for the study of companies in Brazil, according to Terra (2003) and Ghani et al. (2015). The model assumes that the investments (*INV*) made by a company in a given period are dependent on Tobin's *Q* (*Q*) of the company at the beginning of the period, cash flow (*CF*) and the presence of tangible assets (*TANG*):

$$INV_{i,t} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 CF_{i,t} + \beta_3 TANG_{i,t} + \delta X_{i,t} + \sum_i firm + \sum_t year + u_{i,t} \quad (1)$$

Investments (*INV*) are defined by the value of the variable *Capex* (*capital expenditure*) divided by the total assets at the beginning of the period (Brown & Petersen, 2009). The *proxy* for investment opportunities is given by the lagged Tobin's *Q* (Q_{t-1}), which is defined by the sum of the total assets with the market value of the company's shares minus the net equity value, and the result is divided by the total assets (Almeida & Campello, 2007). The *CF* uses as *proxy* the Earnings Before Interests, Taxes, Depreciation and Amortization (EBITDA) value divided by the total assets at the beginning of the period (Almeida & Campello, 2010; Fazzari et al., 1988; Kaplan & Zingales, 1997). The *TANG* variable is the *proxy* for the level of tangible assets of the company and is calculated by the value of fixed assets divided by the total assets at the beginning of the period (Almeida & Campello, 2010; Farre-Mensa & Ljungqvist, 2016). The control variables are represented by the vector $X_{i,t}$.

If financial constraint is present, a positive and significant relationship between the variables *INV* and *CF* is expected. The variable Q_{t-1} , when positive and significant, indicates that the value of the company can influence its investments. Regarding the *TANG* variable, it is expected that when it is positive and significant, the investments will be higher due to the greater presence of tangible assets in the company-year. The companies in the sample are identified by index *i* and the years (2002 to 2014) by index *t*.

In the aforementioned model, the following control variables ($X_{i,t}$) were included: company size (*SIZ*), variation in share capital (*SC*) and variation in long-term debt (*DBT*). The variable *SIZ* is a proxy for company size and is calculated by the natural logarithm of annual net sales (Almeida & Campello, 2010). The variables *SC* and *DBT* were adapted from Brown and Petersen (2009) to capture the influences of resources external to the company. The variable *SC* represents the variation in the share capital of the company-years and is calculated by the natural logarithm of the share capital; it is a proxy for the capture of external resources by issuing shares. The variable *DBT* is the variation in long-term debt, calculated by the natural logarithm of long-term loans and financing of company-years; it is a proxy for obtaining external resources through third-party capital.

It is expected that in the presence of financial constraints, the variable *SIZ* is significant and negative. In smaller companies, there is greater information asymmetry and lower real guarantees and therefore greater difficulty in finding financial resources (Almeida, Campello, & Weisbach, 2004; Gilchrist & Himmelberg, 1995). Regarding the *SC* and *DBT* variables, it is expected that they capture the influence of external resources to finance the company's investments; in this case, the variables would be positive and significant.

3.3 Variables of Brazilian National Bank for Economic and Social Development loans

To assess the behavior of the variable of investment (*INV*), relative to BNDES loans, variables related to the contracting of BNDES loans are included in the model. The dummy variable *BNDES* takes the value 1 for the years in which the companies contracted loans from the BNDES and 0 for the years in which no loans were contracted.

From the variable that measures financial constraint (*CF*), an interaction variable was created: *CF * BNDES*. This variable captures the effect of the credit multiplier on the company-years that contracted loans from the BNDES. It is expected that its coefficient, when significant and positive, shows that companies that have contracted BNDES loans are able to multiply the effect of cash flow on their investments. Equation (2) includes the BNDES interaction variable in the initial model:

$$\begin{aligned}
 INV_{i,t} = & \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 CF_{i,t} + \beta_3 TANG_{i,t} + \beta_4 CF * BNDES_{i,t} \\
 & + \delta X_{i,t} + \sum_f firm + \sum_t year + u_{i,t}
 \end{aligned} \quad (2)$$

Regarding the form of BNDES loans, the variable *DIR* was created, which can take continuous values between 0 and 1. It takes a value of 1 when all contracts were performed, directly, by a company in a specific year with the BNDES. When all contracts were indirect, the variable takes the value zero. If in the same year there were contracts in both forms, the variable takes on values between 0 and 1, weighted according to the annual loan value of each form.

The same dynamic was applied to the loaning modality: automatic or nonautomatic (*AUT*).

In the data analysis, pooled ordinary least squares (OLS) regressions were generated, in addition to analyses with fixed and random effects estimators (Gujarati & Porter, 2011; Wooldridge, 2011). However, considering that the Hausman test indicated the results generated by the fixed effects as the most appropriate, only the results generated by this estimator were reported. The concern with endogeneity problems is always present in regression models such as those developed in our article. The endogeneity related to omitted variables, for example, is a source of concern. In this context, the fixed effects transformation presents a series of benefits in the estimation by incorporating the effects of unobserved heterogeneities and, thus, addresses an important limitation of the OLS related to the biases caused by variables omitted from the model. In addition, another important problem related to linear models concerns heteroscedasticity, which is corrected in this article through the application of robust errors. Despite all the care taken in the data treatment, it is always important to remember that some limitations related to the endogeneity of the model may still persist. For example, the independent variables of the model, such as Tobin's Q and cash flow, may be endogenous not only to investment (which would generate a reverse causality effect) but also to other variables such as company size, profitability, debt, among others.

4. Results

4.1 Descriptive statistics

Table 1 shows statistics related to the dependent variable (*INV*), main independent variable (*CF*) and control variables in the model. Comparing the means of the main model variables, Student's *t* test shows that in the subsamples of company-year observations with and without BNDES loans, there are six variables with different

means. The variable Q_{t-1} has statistically equal means in the subsamples with and without BNDES, with a confidence level of 95%. An important result of Table 1 concerns the investment variable. The companies that contracted loans from the BNDES invested significantly more than the companies that did not contract loans, which corroborates *H1*. The former had a mean of 8.99% investment in total assets, while the latter invested 7.18%. The control variables *CF*, *TANG*, *SIZ*, *SC* and *DBT* were also significantly higher in companies that used the BNDES. With respect to *CF*, *TANG* and *SIZ*, the analysis of the difference in means suggests that the reduction of the financial constraint promoted by the use of BNDES loans promoted increases in cash flow, tangibility and size, as expected. With respect to the variables *SC* and *DBT*, which represent the variation in share capital and the variation in long-term debt, respectively, it is important to note that the reduction of financial constraint is associated with the increase in other sources of funds, leading to a complementarity effect between the BNDES and other financing alternatives related to equity and third-party capital.

4.2 Multivariate analysis of the determinants of investment

Although Table 1 shows evidence that helps corroborate *H1*, the results are from univariate analysis and do not consider the joint effect of the determinants of investment. To confirm the univariate results – and, in particular, to determine the conditional mean of the investment-cash flow, which, in turn, indicates the level of

Table 1.
Basic statistics of the study variables relative to the general sample

Var.	General sample (I)			Without BNDES (II)			With BNDES (III)			Diff. II and III <i>p</i> -value
	<i>n</i>	Mean	SD	<i>n</i>	Mean	SD	<i>n</i>	Mean	SD	
<i>INV</i>	2903	0.0768	0.0792	2098	0.0718	0.0806	805	0.0899	0.0739	0.000
Q_{t-1}	3139	1.3523	0.6347	2277	1.3476	0.6474	862	1.3648	0.6003	0.484
<i>CF</i>	2926	0.1381	0.0925	2117	0.1346	0.0948	809	0.1472	0.0853	0.001
<i>TANG</i>	3031	0.3235	0.2438	2195	0.3040	0.2458	836	0.3747	0.2309	0.000
<i>SIZ</i>	3059	7.1551	1.6653	2198	6.9823	1.7112	861	7.5963	1.4523	0.000
<i>SC</i>	3138	6.2952	1.5220	2276	6.2266	1.5247	862	6.4765	1.5008	0.000
<i>DBT</i>	2746	5.7468	2.2287	1889	5.6615	2.2313	857	5.9346	2.2128	0.003

Table 2.
Multiple regression with unbalanced panel data from the investment-cash flow sensitivity model in observations of company-years that contracted and did not contract BNDES loans

Independent variables	General sample (Fixed effects)	Without BNDES (Fixed effects)	With BNDES (Fixed effects)
	<i>INV</i>	<i>INV</i>	<i>INV</i>
Q_{t-1}	0.0149*** (0.003)	0.0151*** (0.003)	0.0202*** (0.006)
<i>CF</i>	0.1902*** (0.017)	0.1790*** (0.019)	0.2143*** (0.039)
<i>TANG</i>	0.1434*** (0.008)	0.1481*** (0.009)	0.1268*** (0.016)
Fixed effects of firm and time	Yes	Yes	Yes
<i>N</i>	2885	2081	804
<i>R</i> ²	0.2864	0.2898	0.3189
<i>F</i>	66.13	45.92	18.82

Notes: The *t* statistics are in parentheses. The asterisks *, ** and *** represent statistical significance at the 5, 1 and 0.1% levels, respectively

financial constraint of the companies – Tables 2 and 3 present the results of the multivariate regression analyses for companies that took and did not take BNDES loans. In addition to the results of the panel analysis with fixed effects (reported in the tables), analyses with pooled data and with random effects were also performed (not reported due to space limitations). Both the Breusch–Pagan and Hausman tests showed that the results with fixed effects were more appropriate, which is why we chose to report only the latter. In addition, the standard errors are corrected by the White–Huber estimator as a function of heteroscedasticity.

Table 2 shows the results of the base model [equation (1)] without the effect of the interaction of the BNDES with cash flow. The cash flow coefficient (*CF*) for companies with BNDES loans (coefficient = 0.2143, *p*-value < 0.001) is higher than that of companies without BNDES loans (coefficient = 0.170, *p*-value < 0.001). This difference is an indication that companies that have borrowed from the BNDES are more financially restricted. It is important to remember that, according to the investment-cash flow sensitivity model, the greater the effect of cash flow on investment expenditure is, the greater the financial constraint faced by the company. This effect would represent more difficulty for the company in raising external resources (whether debt or new shares).

Table 3 shows the results of the regressions with the inclusion of three new control variables: *SIZ*, variation in *SC* and *DBT*. The financial constraint remains in the samples and is greater in company-years with BNDES loans. This result reinforces the presence of financial constraint in the sample, especially in the sample with BNDES loans.

Among the control variables included in the analysis, there was no significance for *SC* in the three samples (Table 3). For the *DBT* variable, there was significance with a positive relationship in the general sample and with BNDES loans. This result means that companies that borrowed from the BNDES also managed to raise third-party capital that was channeled into new investments. For the variable company size (*SIZ*), there was a negative significance in the three samples. That is, larger companies invested less, perhaps due to the lack of good projects with positive NPV.

Independent variables	General sample (Fixed effects)	Without BNDES (Fixed effects)	With BNDES (Fixed effects)
	<i>INV</i>	<i>INV</i>	<i>INV</i>
Q_{t-1}	0.0182*** (0.003)	0.0197*** (0.004)	0.0210*** (0.006)
<i>CF</i>	0.2024*** (0.019)	0.1867*** (0.023)	0.2488*** (0.042)
<i>TANG</i>	0.1299*** (0.009)	0.1342*** (0.011)	0.1195*** (0.016)
<i>SIZ</i>	-0.0138*** (0.004)	-0.0135** (0.004)	-0.0248* (0.011)
<i>SC</i>	-0.0055 (0.004)	-0.0043 (0.004)	0.0012 (0.007)
<i>DBT</i>	0.0034* (0.002)	0.0012 (0.002)	0.0085* (0.004)
Fixed effects of firm and time	Yes	Yes	Yes
<i>N</i>	2530	1729	801
R^2	0.2860	0.2886	0.3291
<i>F</i>	47.63	30.77	16.30

Notes: The *t* statistics are in parentheses. The asterisks *, ** and *** represent statistical significance at the 5, 1 and 0.1% levels, respectively

Table 3. Multiple regression, with the inclusion of control variables in an unbalanced data panel, from the investment-cash flow sensitivity model, in observations of company-years that contracted and did not contract BNDES loans

4.3 Analysis of the credit multiplier

In a progressive comparison of the effects of the variables related to the BNDES on the variable *INV*, Table 4 is an extension of Table 3. An interaction variable *CF * BNDES* is then inserted. The dummy variable *BNDES* takes a value of 1 when the company-year observation contains BNDES loans and zero otherwise. This interaction variable aims to show the effect of the credit multiplier effect produced by BNDES loans. The interaction variable showed strong significance, with a positive relationship, indicating that the multiplier effect is strong in companies that borrowed from the BNDES. In other words, companies that have borrowed funds from the BNDES can amplify the effect of cash flow on investments. Despite the differences in objectives, our result is similar to that of Almeida and Campello (2007), who

Table 4.

Multiple regression, comparing the base investment-cash flow sensitivity model with the inclusion of interaction variables, in an unbalanced data panel, in the observations of company-years that contracted and did not contract BNDES loans

Independent variables	General sample (Fixed effects)	General sample (Fixed effects)
	<i>INV</i>	<i>INV</i>
<i>Q_{t-1}</i>	0.0182*** (0.003)	0.0176*** (0.003)
<i>CF</i>	0.2024*** (0.019)	0.1880*** (0.020)
<i>TANG</i>	0.1299*** (0.009)	0.1285*** (0.009)
<i>SIZ</i>	-0.0138*** (0.004)	-0.0147*** (0.004)
<i>SC</i>	-0.0055 (0.004)	-0.0045 (0.004)
<i>DBT</i>	0.0034* (0.002)	0.0034* (0.002)
<i>CF * BNDES</i>		0.0818*** (0.023)
Fixed effects of firm and time	Yes	Yes
<i>N</i>	2530	2530
<i>R²</i>	0.2860	0.2902
<i>F</i>	47.63	46.06

Notes: The *t* statistics are in parentheses. The asterisks *, ** and *** represent statistical significance at the 5, 1 and 0.1% levels, respectively

Table 5.

Multiple regression, comparing the base investment-cash flow sensitivity model with the inclusion of variables of loan form and modality, in an unbalanced data panel, in the observations of company-years that contracted BNDES loans

Independent variables	Direct form (Fixed effects)	Indirect form (Fixed effects)	Automatic modality (Fixed effects)	Nonautomatic Modality (Fixed effects)
	<i>INV</i>	<i>INV</i>	<i>INV</i>	<i>INV</i>
<i>Q_{t-1}</i>	0.0195 (0.011)	0.0193* (0.008)	0.0185* (0.007)	0.0272* (0.013)
<i>CF</i>	0.3476*** (0.077)	0.1544** (0.056)	0.1894*** (0.049)	0.3632*** (0.097)
<i>TANG</i>	0.0394 (0.024)	0.2100*** (0.027)	0.2208*** (0.026)	0.0298 (0.028)
<i>SIZ</i>	-0.0495** (0.016)	0.0003 (0.017)	-0.0095 (0.015)	-0.0537** (0.019)
<i>SC</i>	0.0242* (0.011)	-0.0079 (0.012)	-0.0031 (0.010)	0.0183 (0.015)
<i>DBT</i>	0.0136 (0.008)	0.0082 (0.004)	0.0095* (0.004)	0.0084 (0.011)
Fixed effects of firm and time	Yes	Yes	Yes	Yes
<i>N</i>	316	485	540	261
<i>R²</i>	0.3356	0.3504	0.3797	0.3472
<i>F</i>	5.22	9.74	13.02	4.17

Notes: The *t* statistics are in parentheses. The asterisks *, ** and *** represent statistical significance at the 5, 1 and 0.1% levels, respectively

showed that tangibility exerts a credit multiplier effect. In our case, however, the multiplier effect analyzed is that of the BNDES.

4.4 Forms and modalities of Brazilian National Bank for Economic and Social Development support and financial constraint

After comparing subsamples with and without BNDES loans, the study narrows its analysis of financial constraint to only company-years with BNDES loans. In this phase, the focus is on the form and modality of financial support.

The variable that indicates the level of financial constraint (*CF*) stands out in [Table 5](#), as it was significant in the four subsamples. The greatest indications of financial constraint are in the samples of company-years that had loans approved through direct form and nonautomatic modality (Columns 2 and 5 of [Table 5](#)), corroborating *H3*. It is important to remember that direct operations and nonautomatic operations are related to more complex and higher-value projects. Therefore, the internal generation of cash flow would not be sufficient to finance the totality of these projects. Thus, companies would need to resort to external resources, thereby increasing their level of financial constraint. As a result, it is expected that the cash flow coefficient – which represents the level of financial constraint – will be statistically and economically higher when credit operations are direct or nonautomatic. In fact, the cash flow coefficient in direct operations (coefficient = 0.3476, *p*-value < 0.001) is twice as high as that of indirect operations (coefficient = 0.1544, *p*-value < 0.01). Likewise, the coefficient of nonautomatic operations (coefficient = 0.3632, *p*-value < 0.001) is almost twice as high as that of automatic operations (coefficient = 0.1894, *p*-value < 0.001).

A secondary result that may be associated with the nature of the investments concerns tangibility. As we can see, tangibility showed a positive and statistically significant relationship in indirect or automatic operations. This result may be associated with the fact that such transactions are strongly associated with collateral. After all, a large part of these operations is intended to finance specific assets that, in turn, are given as guarantees in case of default, i.e. nonpayment. The same result was not found in direct or nonautomatic operations, which suggests that collateral is not important in such operations.

5. Final considerations

The main objective of this article was to analyze whether companies that contracted BNDES loans between 2002 and 2014 were able to invest more than companies that did not. Our study presents important results on the role of the BNDES in reducing financial constraints and increasing the ability of companies to invest. That is, companies that borrowed from the BNDES invested more than companies that did not. More importantly, however, our study showed that BNDES loans create a type of credit multiplier that significantly increases the investment capacity of each monetary unit of cash flow.

However, an important side effect may emerge from the relaxation of this financial constraint. Access to subsidized loans from the BNDES can eventually exacerbate problems of overinvestment and cause companies to invest in projects with negative NPV that would not be carried out with market resources (such as debentures and shares). Although it is a relevant issue, the analysis of this problem is not part of the

main objective of this article, and we suggest that it be properly addressed in future studies.

The BNDES is a development bank founded in the 1950s that remains active in the Brazilian economy to this day, as has occurred with other banks around the world (Hermann, 2011; Luna-Martínez & Vicente, 2012). Such banks, however, are gaining new contours and transnational configurations, as is the case of continental banks in Europe and Asia. Nevertheless, the presence of state management persists, which sometimes focuses on the needs of the economy and sometimes focuses on interests foreign to the role of development banks. As the studies on development banks are less numerous than the studies on private institutions, this topic certainly has substantial room for the exploration and investigation of the paths that these banks have traveled and will travel, with those institutions gaining increasingly more support and incentive from global organizations such as the World Bank and the United Nations.

The role of the BNDES is controversial, but our study showed that it played an important role in offering credit to financially constrained companies. However, the need for it not to compete with private banks is an important aspect, which may distort its original role in the development of the country. Studies that can analyze the performance of the BNDES in different political periods (e.g. different presidents of the republic) may bring another facet of its role in terms of political influence and the effective protection of the economy. These and other research problems can also be analyzed in future studies.

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582

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