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Abstract[1]

This paper shows that exchange rate depreciation has a negative effect on the balance sheet of Brazilian companies with foreign indebtedness; this effect stems mainly from the negative correlation between the exchange rate and international commodity prices. While the face value of liabilities increased in proportion to the exchange rate during the period studied, revenues from exporting companies did not increase in the same proportion, since most exporting companies in Brazil are commodity producers. Therefore, the hedge expected by exporting companies' receivables is less effective than expected. The paper also finds a negative relationship between debt by BNDES and the foreign currency debt; moreover, only total assets and total liabilities have significant effects on accessing BNDES debt. Brazil's high dependence on the production and export of commodities affects domestic companies' growth of domestic companies, suggesting that the correlation effect between exchange rate and international commodity prices must be considered when investigating companies' competitiveness.

JEL classifications: F34, G10, G15
Keywords: Exchange rate, Commodity prices, Brazilian companies, Hedge, Profits and losses

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1. Introduction

Jurisdictional uncertainty, fiscal deficit and macroeconomic instability largely tend to explain the high costs and short maturities observed in the Brazilian credit market. BNDES is the main long-term funding source in Brazil, providing subsidized interest rates. International credit markets are an alternative for credit at lower interest rates. However, companies that opt for foreign financing are more exposed to currency risk.

Exporting companies have greater access to the external debt market, and in the absence of hedging through derivatives, the natural hedging of exporters seems to help these companies to manage exchange rate risks. In the meantime, there is a negative correlation between exchange rate and commodity prices, increasing assets and liabilities, but not in the same proportion. Therefore, it seems that the natural hedge is not as efficient as expected, leading companies with foreign currency debt to incur more losses than others.

Financing conditions in the Brazilian economy have always been considered one of the major obstacles to firms' growth and development. The cost of borrowing, currency risk, and access to capital are among the top 10 concerns for Brazilian businesses, as noted by Duke University's Fuqua School of Business[2] in its September 2015 Business Outlook.

The availability of credit to non-financial corporations in Brazil oscillated under 30 percent of GDP until 2007, according to the Bank for International Settlements.[3] Even though credit to non-financial corporations in Brazil grew by 62 percent between 2008 and 2015, this percentage was 50.1 percent of the GDP at the end of 2015, which is relatively low compared to international standards. The respective figure for other countries in 2015 was 100.7 percent in emerging economies, 85.7 percent in advanced economies and 70.9 percent in the United States.

Another important characteristic of the Brazilian credit market is that prevailing interest rates tend to be quite high. According to the World Bank,[4] the domestic lending rate was equal to 32 percent per year in 2014. As a comparison basis to other Latin America countries, the same figure was 24 percent in Argentina, almost 11 percent in Colombia, and 8 percent in Chile. In the United States, the lending rate was 3.25 percent in 2014.

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[2] CFO Magazine Business Outlook, September 2014.
[3] "Credit to the Non-Financial Sector," Bank for International Settlements. Available at: http://www.bis.org/statistics/totcredit.htm. Accessed on April 11, 2016.
[4] "World Development Indicators," World Bank. Available at: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators. Accessed on April 11, 2016.

Given scant resources and high interest rates, long-term financing is restricted to official banks, particularly BNDES (National Bank for Economic and Social Development) and a few bond issuers (debentures), the latter not accessible to most companies (Cicogna et al., 2006).

The lower interest rates charged in international debt markets have turned this source of financing into an important factor in Brazilian firms' capital structure (Valle and Albanez, 2012). From 1996 to 2004, the ratio of foreign currency debt to total debt reached the maximum percentage of 54.6 percent in 2001 and a minimum of 45.6 percent in 2004 (Rossi Jr., 2007). According to the Brazilian Central Bank, the gross foreign debt of Brazilian non-financial companies went up from $51.534 million in 2007 to $112.084 million in 2014. The short-term foreign debt of these companies grew by almost 237 percent in this period, while long-term foreign debt rose 446 percent.

The exchange rate represents a huge market risk for companies. The exchange rate was 2.18 Real per Dollar in 2007 and 2.35 in 2014, with an average decrease around 4.8 percent from 2006 to 2011, an average increase of 12.1 percent from 2011 to 2014, and a standard deviation of 10.9 percentage points during the whole period.

Beginning in 2002, a high and rapid appreciation of the real exchange rate was observed, accompanied by a sharp deterioration of the current account balance. After 2008, there was a reversal of the trade balance surplus due to strong growth in imports and lower export growth caused by the downturn of the world economy and the fall in commodity prices. This, combined with greater domestic economic instability, has caused a severe depreciation of the exchange rate since then, especially after 2014.

Within this context, this study aims at determining the impact of exchange rate exposure on Brazilian companies' balance sheets and its potential impact on investment. Moreover, this study also aims to identify the characteristics of the companies exposed to foreign currency debt, as well as the role of BNDES in companies' indebtedness.

A priori, a common argument is that exchange rate depreciation should benefit exporting companies due to increased competitiveness. At the same time, an increase in exchange rate could damage companies indebted in foreign currency. Thus, this work seeks to assess what effect is predominant among Brazilian companies, given their characteristics, especially dependence on commodities exporting.

The paper is organized as follows. Section 2 contains some important results from other studies. Section 3 presents the database, including some important remarks from the descriptive statistics. Section 4 shows the econometric models and discusses their results, and Section 5 concludes.

2. Literature Review

Negative consequences from high foreign currency indebtedness could happen as a result of local currency depreciation or the increase in interest rates in developed economies, raising the price of payments in foreign currency and the cost of debt, or causing difficulty in renegotiating the debt. Krugman (1999) states that high foreign currency indebtedness may cause a negative effect on the balance sheet of the firms in case there is a depreciation of domestic currency. As a result, investment by these firms could be reduced because debt becomes more expensive, reducing investment capacity.

Kamil (2004) argues that non-financial companies in emerging markets could be exposed to exchange rate and interest rate, because such companies tend to show currency and maturity mismatches in their balance sheets. These companies tend to issue foreign currency-denominated debt with short maturity, but revenues used for paying these debts occur mainly in local currency, from their operating assets. As a result, currency mismatch causes exposure to exchange rate variation and maturity mismatch causes exposure to interest rates changes and risk of debt rollover. In this context, currency depreciation and/or an increase in interest rates could lead to a deterioration of the assets of these companies compared to their liabilities and, ultimately, to the contraction of their investments.

Exchange rate fluctuations can be problematic for firms financed by foreign currency liabilities, especially if firms have mismatches in their balance sheet, that is, if there is not some form of hedge, e.g., from exports and foreign currency assets, or financial hedge through derivatives. Therefore, depreciation could lead to negative balance sheet effects on the investment of these firms. On the other hand, currency depreciation can lead to competitiveness effects, by which there is a rise in revenue in local currency of exporting companies, ceteris paribus, increasing their investment capacity. Exchange rate depreciation may also be beneficial for domestic companies that sell tradable goods, since imported competing products become more expensive (Pratap, Lobato and Somuano, 2003).

Benavente, Johnson and Morandé (2003) and Carranza, Cayo and Galdón-Sánchez (2003) identified a predominance of balance sheet effects for Chilean and Peruvian companies, respectively, with evidence in favor of competitiveness effects in the first case. Endrész and Harsztosi (2014) pointed out the balance sheet effects for Hungarian private companies after the 2008 crisis, with less impact for larger, foreign, trading and foreign-owned firms.

For Mexican firms, Pratap, Lobato and Somuano (2003) found evidence of balance sheet effects on investment in times of currency depreciation, but also noted the competitiveness effect for exporting firms. These results contrast with Aguiar (2005), which also looked at Mexican companies and found no impact on investment, arguing that the negative balance sheet effect offset the benefits of exchange rate depreciation.

Echeverry et al. (2003) and Galiani, Levy Yeyati and Schargrodsky (2003) did not identify any negative effects of currency depreciation on investment for Colombian and Argentinean companies, respectively, although the first author found a negative effect on the profitability of firms.

Regarding Brazilian companies, Bonomo, Martins and Pinto (2003) did not find a significant balance sheet effect on the investment of companies. The authors argue that this result could be explained by the companies' hedge policies, implying that for companies that do not hedge against exchange rate variation, the balance sheet effect on investment could be relevant. They found that firms in industries with a high level of imported inputs invest less due to exchange rate depreciation.

Bleakley and Cowan (2008), examining a sample of companies from Argentina, Brazil, Chile, Colombia and Mexico in the years 1990-1999, concluded that the competitiveness effect predominated in the analyzed sample. The authors note that the result is motivated by matching the currencies of assets and liabilities.

In general, Brazilian companies' debt and its maturity are determined by the debt sources, such as capital markets, subsidized interest rates (especially by the BNDES), and bank loans (Tarantin Jr., 2013). In Brazil, international credit markets and subsidized interest rates are generally restricted to large Brazilian companies that are publicly traded and have a high volume of foreign sales (Rossi Jr., 2007; Rossi Jr., 2012).

The positive effect of firm size on foreign currency debt was also identified in other countries. International resources are absorbed firstly by large firms that have broad access to

international markets (Gelos, 2003; Echeverry et al., 2003). Moreover, the size of the firms can be considered an important collateral to the international debt markets (Benavente, Johnson and Morandé, 2003; Pratap, Lobato and Somuano, 2003; Bonomo, Martins and Pinto, 2003).

The presence of foreign investors in companies can also increase foreign currency debt, as concluded by Echeverry et al. (2003) regarding Colombian firms. Galiani, Levy Yeyati and Schargrodsky (2003) point out that, for Argentinean companies, borrowing in foreign currency is positively related to the leverage of the companies, indicating that access to the international debt market is facilitated by total debt. Another result found by the authors indicates that operating revenues positively affect foreign currency debt, and they argue that operations generate a greater number of liquid resources to support such debts.

The costs of borrowing in foreign currency and the market risk associated with the exchange rate and the foreign interest rate determine the currency composition of debt and the level of hedging (Berrospide, 2008). Hence, exports can be considered a natural hedge to reduce exchange rate market risk. Therefore, exporting firms have a greater propensity for debt in foreign currency (Gelos, 2003; Carranza, Cayo and Galdón-Sánchez, 2003; Pratap, Lobato and Somuano, 2003; Echeverry et al., 2003; Rossi Jr., 2012).

The definition of the financial policy of a company, including the use of derivatives to hedge the exchange rate, is a determining factor of the access to the international debt market (Rossi Jr, 2012). The use of derivatives plays a role in insulating a firm's level of investment from exchange rate shocks (Cowan, Hansen and Herrera, 2005; Saito and Schiozer, 2007; Bartram, 2008; Rossi Jr., 2007; Jongen, Muller and Verschoor, 2012; Boehe, 2014).

Even though the Brazilian derivative market is restricted to large companies and that hedging strategies are costly to firms, there are many derivative strategies that can be applied to reduce the mismatch between assets and liabilities (Figueiredo and Cicogna, 2008). Also, Coutinho, Sheng and Lora (2012) concluded that in Brazil there is a positive relationship between the use of derivatives and the reduction of the cost of capital, which indicates that hedging strategies go beyond risk reduction in the balance sheet.

Macroeconomic environment and country-specific factors additionally play an important role in determining companies' risk management practices. The exchange rate regime is an important determinant of firm-level exchange rate exposure for emerging market firms (Ihrig and

Prior, 2005; Ye, Hutson and Muckley, 2014). However, the effect of exchange rate changes for companies with debt in foreign currency is unclear.

Therefore, as the exchange rate fluctuations may impact the firms' investment both due to the balance sheet effect, as well as to the competitiveness effect, this issue is worth exploring in the Brazilian context, since there has been a sharp depreciation of the Real against the Dollar in recent years.

3. Macroeconomic Environment and the Commodity Effect on the Natural Exchange Rate Hedge

The inefficiencies of the Brazilian Financial System (called National Financial System, or SFN) stem from a number of factors, including i) historical economic instability and high inflation rates, ii) the recurrent funding crisis of the public sector regarding its debt and high public deficits, and iii) the currency crisis due to the instability in commodity prices and imbalances in the current account.

In addition to the macroeconomic aspects, there are microeconomic factors that deserve attention, such as i) institutional inadequacies in a number of strategic public definitions, such as taxation rules, lack of transparency, guarantee facilities, etc.; ii) legal uncertainty; and iii) the "Risk of Prince," in which the Prince is the representative figure of the political leader in power, whose interests lead to changes in public policies, such as debt renegotiations, financing incentives, default definitions, and contracts rules, among others.

Macroeconomic instability, uncertainty and institutional inadequacies may explain, to a large extent, the fragility of the financial system, its high costs and short maturities, as well as the lack of credit to the private sector.

As argued by Arida, Bacha and Resende (2005), the absence of a domestic long-term credit market and high interest rates in Brazil are attributed to a policy-related distortion, namely Jurisdictional Uncertainty, which prevents the convergence of Brazilian interest rates to international levels. Jurisdictional Uncertainty also accounts for the nonexistence of a long-term domestic credit market.

The effect of institutional and legal inadequacies on economic and financial markets development was first introduced by North (1981), and extensively studied by many other authors, such as La Porta et al. (1996 and 1997), Beck at al. (2004), and López-de-Silanes

(2003). Cicogna et al. (2006) showed that companies that adhere to good practices of corporate governance exceeding the accountability requirements of Brazilian law requirements, have reduction in credit restrictions, and achieved prorogations of debt maturity.

The fiscal problem is also highlighted by Franco (2011), whose central thesis for the high interest rates is the elevated costs of maintaining a captive market for domestic public debt, without the adequate level of domestic savings.

The question that remains is: why does capital mobility not allow foreign savings to balance the market for goods and services with lower interest rates? Nakane and Pessoa (2011) offer two answers. First, the continuous accumulation of international reserves partly counteracts the convergence process of domestic interest rates to international levels. Second, the lack of deep and liquid international markets in Brazilian Reals increases the risk of capital mobility, in the sense that it may not allow international investors to move their resources at the appropriate time or do so without major financial losses.

Institutional risk and high interest rates in Brazil distort capital formation in different manner to firms. Small and medium firms finance their investment with their own profits, since these firms face high costs of credit verification to access foreign credit markets and do not have access to long-term finance. Large firms have access to foreign credit market, but have to deal with the risk of currency mismatch. Finally, cash-rich firms tend to overinvest in their own business (Arida, Bacha and Resende, 2005).

In the last decade, there was a strong credit expansion in Brazil due to greater economic stability and a set of microeconomic reforms introduced as of 2003, such as bankruptcy law, payroll loans, and the creation of the Real Estate Financing System and the Credit Risk Center, respectively, among other measures.

With the return of greater economic instability from the international crisis in 2008, but especially in recent years with the fiscal deficit and economic crisis in Brazil, there has been a sharp drop in the expansion of the supply of credit, especially by private financial institutions.

Since 2008, BNDES increased its supply of credit, acting as a counter-cyclical agent in the supply of credit in order to stimulate the economy, and doing so at subsidized interest rates. Between 2011 and 2014, the volume of BNDES loans increased 32 percent, while the volume of unsubsidized credit increased just 7.8 percent, according to data from the Brazilian Central Bank.

By way of comparison, the average interest rate of BNDES loans in 2014 was 7.4 percent per year for working capital debt, while the same figure for commercial banks was 20.4 percent.

BNDES is the main long-term funding source in the country. In general, BNDES financing lines interest rates are significantly lower than market interest rates. BNDES action and directed credit in Brazil are a source of several controversies. On the one hand, there are arguments that BNDES is correcting SFN failures that proved inadequate to finance; on the other hand, this solution deepened the SFN's difficulties.

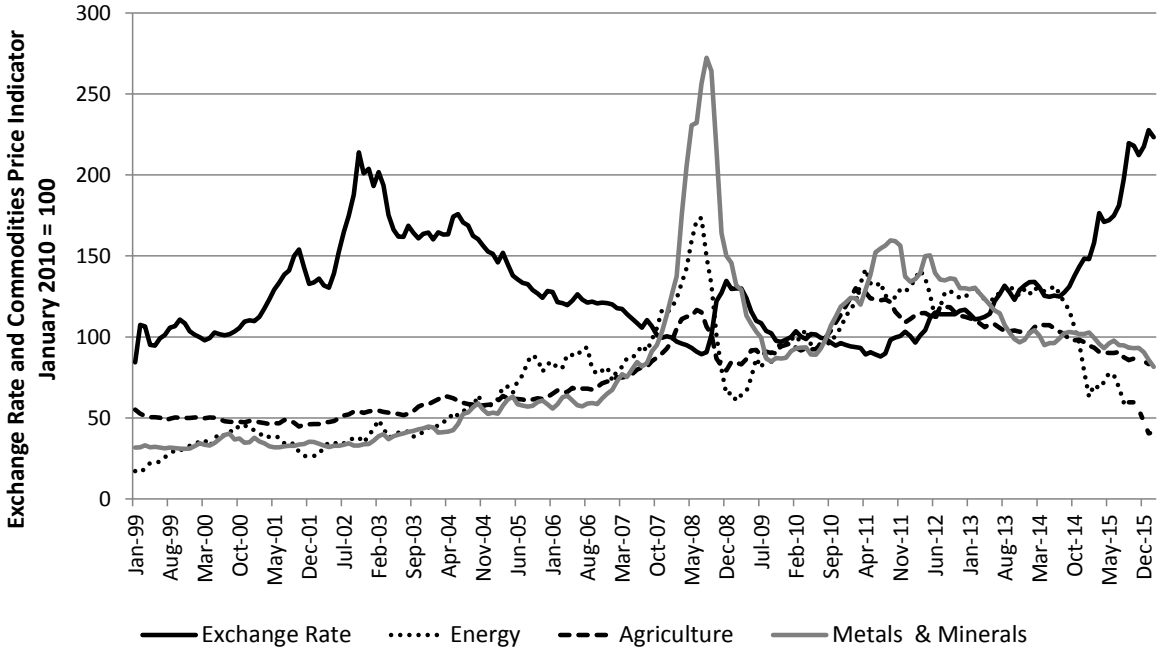
The major concerns regarding BNDES refer to its credit tending to focus on large companies that could raise funds from other sources. In addition, the rules for accessing subsidized lines are not clear, and the presence of reduced-cost conditions in targeted resources tends to be one of the explanations for the high interest rates charged in the free market segment.

In general, foreign funding tends to occur at lower interest rates and longer terms when compared to domestic credit conditions. However, foreign credit access tends to be restricted to a specific group of companies: those with greater insertion in the international market, large companies, and companies with foreign capital (Rossi Jr., 2007; Rossi Jr., 2012).

Companies that opt for foreign financing are more exposed to currency risk. As extensively argued in the previous section, when the exchange rate depreciates, it can generate a negative balance sheet effect, or a positive competitive effect. The effect of the exchange rate on companies depends on assets versus liabilities in foreign currency.

Exporting companies have greater access to the external debt market, and exporters are expected to have a natural hedge against the volatility of the exchange rate. However, as can be seen in Figure 1, there is a negative correlation between exchange rate and commodity indexes.

Figure 1. Exchange Rate and Commodity Indexes



Source: Brazilian Central Bank and World Bank (nominal prices).

In terms of real rates, the negative correlation between exchange rate and prices is -0.28 for Energy, -0.52 for Agriculture and -0.47 for Metals & Minerals.

Therefore, the negative correlation between commodities and exchange rate brings an additional point of uncertainty for companies. Many exchange rate depreciation competitive gains are offset by the falling price of commodities.

In the absence of hedging through derivatives, the natural hedging of exporters does not seem to be as efficient as expected, since commodity prices are quoted in international markets, leading to falling revenues in dollars. At the same time, foreign currency liability remains the same. That is, revenue in domestic currency does not vary in proportion to the exchange rate, so that foreign currency liabilities grow faster than assets.

In 2015 some 67 percent of Brazil's exports were based on commodities, in many of which Brazil is a leading producer; these include meat, iron ore, sugar, coffee and soybeans, among others. The dependence on commodity exports grew 8 percentage points since 1997, according to the Ministry of Development, Industry and Foreign Trade (MDIC).

This increase in commodity dependence, however, runs in the opposite direction from that which is conducive to long-term economic development, as commodity prices have fallen relative to manufactures and services and are likely to continue to do so (Page and Hewitt, 2001).

Commodity price volatility leads to macroeconomic instability, which is detrimental to economic development. Export earnings fluctuations lead to uncertainty in domestic income, savings and government revenues (Asfaha, 2008). Thus, dependence on commodity exports exacerbates the problem of long-term savings and the creation of a long-term credit market.

During the world economic crisis in 1999 and 2008, or domestic crises such as 2002 and 2015, the exchange rate BRL / USD depreciated considerably. In these periods, the firms suffered heavy financial impacts, reducing profits, incurring high debt costs and, in extreme cases, bankruptcies.

4. Data

The companies included in the sample were selected based on 2014 data. Publicly held with shares traded in the BM&FBOVESPA and with active registration and headquartered in Brazil were considered. Based on NAICS industry classifications, companies from sectors related to financial activities were excluded.[5]

After such exclusions, the top 100 companies were selected by their total assets at the end of 2014. Annual financial data were collected based on the Explanatory Notes to the Financial Statements, Economatica and S&P Capital IQ software for years between 2003 and 2014.

The database is composed by the largest 100 companies selected according to their total assets in 2014; they were kept in the sample and data going back to 2003 were collected. Many of these firms were publicly traded over the years considered in the sample. Hence, in 2003, there were 57 firms.

4.1 Main Variables Description

To create the debt variables, the explanatory notes of financial statements notes were accessed, specifically the financial debt note. Based on the debt instruments reported by the companies, each debt was divided into domestic currency debt and foreign currency debt. After that, in order

[5] The sectors excluded were those concerning business management and entrepreneurship, activities related to credit intermediation, banks, stock exchange and commodities, insurance brokerage, credit intermediation institutions, and other activities related to financial investments, other funds and insurance companies.

to classify each debt by its source (bank, capital market, subsidized or leasing), the debt characteristics were analyzed. First, if the firm reported a BNDES loan, it was classified as a subsidized debt. Second, if the firm reported a debenture or a bond, it was classified as capital market debt. Third, if the firm reported a bank loan, it was considered bank debt. Generally, leasing debts are called lease.

Other information sources were also considered, such as the debt interest rate. For example, bank loans are frequently based on CDI (Brazilian market interest rate), and the subsidized debt is usually based on TJLP (BNDES interest rate). The interest rate information, combined with the debt instrument, provides a more reliable classification of debt source. Additionally, there are some firms with broad disclosure of their financial policy, facilitating debt classification.

When there was insufficient information to classify the debt, or in cases the firms classified their debt as other, then it was classified as "other.". After the debt classification, the sum of each category by currency and by source is equal to the total debt in the balance sheet for a given firm.

The ownership variables included in the database are classified as Domestic investors (OwnNational), foreign investors (OwnForeign), shares in Treasury (OwnTreasury), and others (OwnOthers). This information was collected from firms' reports to CVM, called the "Reference Form." The sum of OwnNational, OwnForeign, OwnOthers and OwnTreasury is 100 percent for each firm in each year, representing the total of common shares of the firm. CVM requires that firms identify the shareholder or group of controlling shareholders, providing their information, such as name and nationality. CVM also requires that firms provide information such as name and nationality of the shareholders or group of shareholders acting together or representing the same interest, with interest equal to or greater than 5 percent of the same class or type of shares. These requirements are in the CVM Instruction 480. This information about firms was not found for the year 2009 (the reference forms for this year were unavailable), so we repeated the information of the year 2010 for 2009, considering that the ownership position did not change radically from one year to another.

OwnOthers represents the percentage of the common shares held by other investors, because firms classify some percentage of the common shares as held by "others" investors. Thus, "others" are investors not identified by the companies. Considering what is discussed in

the CVM instructions, OwnOther could be considered to represent the shares not held by “large enough shareholders” to be disclosed and could be considered free float shares.

For the econometric models, a dummy variable equal to one was built, if the percentage of common shares held by foreign investors exceeded 30 percent. As “Others” is a non-identified group of investors, the percentage of foreign investors was calculated as 1-(OwnNational-OwnTreasury).

To access the values of exports and imports of the companies, two data sources from the Ministry of Development, Industry and Foreign Trade of Brazil (MDIC) were used. Every year, the Ministry releases two lists containing the 250 largest exporting firms and the 250 largest importing firms for that year. These reports present the value exported and imported for each firm. Thus, the first step was to match the sample of this study with the companies that were in the Ministry lists. Based on these two lists, for export data, the largest number of companies matched was 26; for import data, the largest number was 18, both in more recent years of the sample.

In order to assure that any company out of the MDIC lists, but present in the sample, would not be misclassified, a second report, also from MDIC, was consulted, which is more comprehensive but less precise. This report provides the values of exports and imports for a larger number of companies, but in the following ranges: up to USD 1 million; between USD 1 and 5 million; between USD 5 and 10 million; between USD 10 and 50 million; between USD 50 and 100 million; and more than USD 100 million. This second source was used to build binary exports and imports variables.

If a particular company was not found in these reports, it was assumed not to be an exporter, or an importer. Thus, considering the binary variables, all the observations of the sample were classified in relation to their exports and imports. To generate the binary variables, we employed the six ranges from MDIC reports mentioned above. Besides those ranges, the non-exporter and non-importer dummies were generated for the firms that were not found in the reports. Finally, seeking greater detail, the range “more than USD 100 million” was divided into two new ranges (not offered by the MDIC reports): between USD 100 million and USD 1 billion; more than USD 1 billion. To perform the division, we used the information from the reports of the 250 largest exporter and importer firms.

Besides NAICS sectors, companies were also divided by Aggregated Sectors, which are: Manufacturing Industry, Extractive Industry, Public Services,[6] Commerce, and Services.

The companies were been classified according to their type of product, whether or not a commodity. This information is derived from the companies' websites regarding their products and business. In this classification, companies are defined as non-producers of commodities, energy commodities (oil, gas, among others), agricultural commodities and metal and mineral commodities.

Please refer to Attachment A for the detailed description of all the variables included in the database.

4.2 General Descriptive Statistics

The 100 companies of the sample are distributed among 41 activity sectors, including industry, commerce and services. The sector named "Generation, Transmission and Distribution of Electric Power" is the most representative, with 23 companies. In second place is the sector "Construction of Residential Buildings," which contains nine companies. Other activity sectors have a maximum of four companies each.

Table 1 shows descriptive statistics for the entire sample period. Reflecting the criteria for sample selection, the average size (in terms of total assets) of the companies is BRL 19.4 billion, i.e., companies included in the sample are large firms. Let us emphasize that, during the sample period, several companies went public, especially in 2007. Therefore, in 2003, the sample contains 57 companies (see Table 2).

On average, the total debt to total assets ratio is 33.0 percent; the short-term debt to total assets ratio is 8.8 percent; the foreign currency debt to total assets ratio is 12.9 percent and the BNDES debt to total assets ratio is 9.3 percent. Average annual sales growth is 22.3 percent, the average ratio of EBIT (CF) to total assets is 9.8 percent and the ratio of total profits to total assets is 5.3 percent, while gains or losses due to exchange rate changes are 0.13 percent of total assets. The average ratio of exports to total sales is 19.56 percent.

Table 2 shows that the firms' capital structure profile did not change significantly during the sample period. However, both total debt and short-term debt ratios show a decreasing trend

[6] Public Services in the sense that the services must be available to all, regardless of income, and subject to regulation beyond that in most economic sectors. Public services include: electricity, education, public transport, and telecommunications.

from 2003 to 2007, when it begins to grow again, especially in 2010. The foreign currency debt ratio fell from 19.2 percent in 2003 to 9.5 percent in 2010 but rose again as of 2011, reaching 14.3 percent in 2014. The BNDES debt ratio is quite stable, reaching a peak of 11.25 percent in 2011.

Table 3 shows that, on average, almost half of the observations of the sample have less than 10 percent of total assets financed by foreign currency debt; 26.2 percent of the observations have between 10 percent and 20 percent; 15.1 percent have between 20 percent and 30 percent; and 9.34 percent have more than 30 percent of their total assets financed by foreign currency debt. It seems that firms with higher ratios of exports to total assets (or exports to total sales) have higher proportions of foreign currency debt.

Regarding the ownership of the firms, in 2003, 63 percent of companies had more than 30 foreign investors. This percentage dropped to 58 percent in 2014. The percentage of foreign control of the firms in the sample also decreased: from 21.2 percent in 2003 to 17.5 percent in 2014.

Table 2 also shows the macroeconomic scenario for the twelve years of the sample. There were consecutive reductions in the Brazilian interest rate until 2009. In 2010 and 2011, the interest rate increased, but fell again in 2012. However, after 2013, the interest rate rose considerably, reaching 11.46 percent per year at the end of 2014. On average, the interest rate was 13.18 percent per year (see Table 1). During these years, Brazil experienced a significant credit expansion, since credit as a percentage of GDP rose from 23.8 percent in 2003 to 49.6 percent in 2014.

The exchange rate followed the same trend in interest rates. However, after 2012, the exchange rate went up 40 percent, reaching 2.35 BRL/USD in 2014. It is worth mentioning that the movements of the exchange rate did not significantly alter the percentage of exports in relation to total assets, or the percentage of exports as compared to total sales.

Please refer to Attachment B to see some descriptive statistics of all the variables included in the database.

4.3 Evidence from Data

Seeking to identify relevant patterns in the data and to extract information from statistics, financial indicators of debt, profit, cash flow, revenue and investments were thoroughly

analyzed. The composition of corporate debt was also detailed, in order to understand how the funding sources have changed over the period.

Data were analyzed according to different groups of companies: i) exporting and non-exporting, ii) aggregated sectors, and iii) producers of commodities and non-commodities.

4.3.1 Exporting and Non-Exporting Companies

In 2014, there were 35 exporting companies in the sample and 65 non-exporting companies.

Total debt and short-term debt of exporting and non-exporting firms are quite similar. However, the foreign currency debt of exporting companies is, on average, 11 percentage points higher than that of non-exporting companies. At the same time, the BNDES debt of non-exporting companies is, on average, almost 3 percentage points higher than for exporting companies. It is worth mentioning that the foreign currency debt of exporting firms is higher in each year of the sample, as well as the BNDES debt of non-exporting firms.

Total profit and cash flow are higher for exporting companies, but these companies faced average losses due to exchange rate changes in the years of 2008, 2011, 2012, 2013 and 2014. The data from Table 2 allow us to observe that in these same years the Real depreciated against the Dollar. This thus evidences that foreign currency indebtedness harms the results of the companies when exchange rate depreciates.

In line with the argument concerning the effect of commodities, the revenues of exporting companies were not affected by exchange rate variations. Although exporting firms presented higher revenues during the whole period when compared to non-exporting companies, this difference began to fall in 2011. In 2003, the revenues of exporting companies were 43 percentage points higher, but in 2014 the difference was 14 percentage points.

Regarding investment, until 2008, exporting companies invested more than non-exporting companies. On average, the variation of investment over the total assets of the previous year was 13.2 percent for exporting companies the fall of non-exporting firms investments fell to 10.3 percent, while for exporting companies, the figure was 8.2 percent.

4.3.2 Aggregated Sectors

In 2014, 50 companies were classified as Manufacturing Industry, 8 companies were considered Extractive Industry, 16 companies were in Public Services, 6 companies were inside the Commerce sector, and 20 companies were considered Service sector.

Their financial indicators show that the total leverage is almost the same amongst all the sectors. The short-term leverage is almost the same for all sectors, except for Commerce, the short-term debt of which is higher compared to the others. The BNDES debt is lower for companies from Commerce and Extractive Industry. At the same time, Extractive Industry companies presented the highest foreign currency indebtedness, and it rose considerably after 2010.

Extractive Industry showed the highest losses due to exchange rate variations after 2010, and its total profit had a sharp fall from 2006 to 2008, and also from 2011, with some recuperation in between. Interestingly, seven of the eight companies classified as Extractive Industry are exporters, and when these data are compared to the ones mentioned in Section 4.3.1, the tendencies can be observed to be clearer for the Extractive Industry than for exporters in general.

The revenues are well defined among sectors. In the first place, with the largest revenues over total assets, is the Commerce sector, followed by Extractive Industry, Manufacturing Industry, Public Services, and Services. Again, revenues did not change over the years according to exchange rate fluctuations for any sector.

4.3.3 Commodities

The majority of the sample is formed by non-producing commodity companies (75 companies in 2014). Amongst commodity producer companies, four companies produce energy commodities (Energy), 11 companies produce agricultural commodities (Agriculture), and 10 are Metal & Mineral commodity producers.

In the division of financial indicators by commodities, there is a more well-defined segregation than in the other groups.

The total leverage is higher for the Agriculture sector, followed by Energy, Metals & Minerals, and, finally, non-commodity companies. Short-term debt follows the same standard as total leverage.

BNDES debt is higher for Energy, followed by the non-commodity companies, Agriculture and Metals & Minerals. The inverse relationship is observed for the foreign currency debt. Agriculture presented the highest level of foreign currency debt; in second place, there was

Metals & Minerals; Energy was in third place, and finally there were the non-commodity companies. Note that this pattern remains constant over all the years in the sample.

Agriculture has negative highlights for cash flow, total profits and losses due to exchange rate variations, featuring total losses in 2008 and the strong negative tendency from 2010 in total profits. Moreover, from 2011, these companies showed recurring losses due to exchange rate variations.

Regarding revenues, Energy deserves special attention, since these companies stood out strongly against the others. Revenues remained almost the same for all commodity and non-commodity companies, but Energy presented a great rise in revenues from 2006 to 2013, which can be a distortion caused by Petrobras, included in this group.

From non-commodity companies, only 13 companies are exporters (or 17.3 percent). Among the energy-producing companies, two are exporters (50 percent). All the agricultural commodity companies are exporters (100 percent). Lastly, nine out of 10 Metal & Mineral companies are exporters. These percentages explain the results observed for the commodity sectors, which are in line with the previous analysis and discussions from Section 3.

Several trends emerge from these data. First, most exporters in Brazil are commodity producers, and their revenues have not changed in the same proportion as the exchange rate. This derives from the negative correlation between the exchange rate and commodity prices.

Second, exporters are more indebted in foreign currency than the non-exporting companies, and the debt in foreign currency increased as from 2011. This indebtedness profile is particularly observed for commodity producers and for Extractive Industry firms. Note that indebtedness in foreign currency has derived mainly from international capital markets and not from banking credit.

Concurrently, exporters presented less debt to BNDES in the same period. There seems to be a negative relation between debt to BNDES and debt in foreign currency; these debt sources seem to be substituting each other. However, there is neither evidence from causality, nor is there is a BNDES preference among sectors or restrictions at the moment of concession.

Finally, as of 2009, the total banking credit decreased, both in Brazil and in international markets. Domestic and international capital markets have occupied part of this space. In Brazil, debt to BNDES has gained great importance in the companies funding, especially for the Manufacturing Industry, Commerce and Services sectors.

5. Econometric Models and Results of Firm's Exchange Rate Exposure to Debt

In order to verify what factors influence the search for external borrowings and the effects of foreign currency debt for companies, six econometric tests were carried out. Each econometric test was run twice: once considering the export dummy (1 if the company is an exporter, and 0 otherwise), and a second time considering the interaction between exporter and commodity producer dummy (1 if the company is a commodity exporter, and 0 otherwise).

The first two tests seek to identify which companies have foreign currency debt and what factors affect the level of debt in foreign currency, both micro-economically and macro-economically. The other four tests aimed at assessing the effects of foreign currency debt on profits and investments, given exposure to exchange rates.

In the following sections, the models are presented, together with their results and the descriptive statistics of the variables used in each model. For econometric tests, outliers above 99 percent were dropped. The coefficients were truncated in the fourth decimal place.

5.1 Determinants of Participating in Foreign Currency Debt Markets

The study of companies' foreign indebtedness began with the analysis of what the determining factors for companies are to be able to access foreign currency resources.

Given this goal, a panel model was estimated for a binary response dependent on a variable for each firm *i*, at period *t*. The binary dependent variable is equal to 1 if the firm has foreign currency debt at time t, and 0 otherwise. A LOGIT model was carried out for panel data.

The model specification is:

$$\begin{aligned} d_{FC_{i,t}} = a_i + \theta_t + X_{i,t-1}B + s_{t-1}\left[\alpha_1 A_{i,t-1} + \alpha_3 d_{FO30}\%_{i,t-1}\right] \\ + f_{t-1}\left[\beta_1 A_{i,t-1} + \beta_3 d_{FO30}\%_{i,t-1}\right] \\ + c_{t-1}\left[\delta_1 A_{i,t-1} + \delta_3 d_FO30\%_{i,t-1}\right] + \varepsilon_{i,t} \end{aligned} \qquad (1)$$

where:

$d_{FC_{i,t}}$ = equal to 1, if the firm has foreign currency debt at time t, and 0 otherwise;

X = set of firm-specific control variables: dummy equal to 1 if the firm is an exporter (D_exp) or equal to 1 if the firm is a commodity exporter (D_ComExp); natural logarithm of total assets (A); a dummy equal to 1 if more than 30 percent of the firm's share are foreign owned (d_FO30%);

share of short-term debt to total assets (S); share of total debt over total assets (L); indebtedness to BNDES; and Revenues (Rev).

s = difference between Brazilian and Federal U.S. Treasury securities at 1-year interest rate;

f = exchange rate forward premium for 3 months future exchange rate contract (BRL/USD);

c = domestic credit to private sector / GDP.

Model (1) was tested for different specifications and the results are reported in Table 5.

Columns (1) to (3) refer to the tests carried out with the exporting dummy. Columns (4) to (6) show the results for the specifications considering the commodity exporting companies dummy. The coefficients signal and their significance were very similar across the results.

In all the specifications, the exporting dummy and the commodity exporting dummy were positive and highly significant, as well as total leverage. Predicted probabilities of the significant variables are presented in Table 6.

It is worth noting that the probabilities associated with the commodity exporting dummy are higher than the probabilities associated to the exporting dummy. These results corroborate the aforementioned descriptive statistics. As most companies have foreign currency debt, however small, the predicted probabilities of foreign currency debt are high in relation to all variables.

The positive leverage sign corroborates the findings of Galiani, Levy Yeyati and Schargrodsky (2003), who argue that a possible explanation for the positive correlation between foreign currency debt and leverage can be that companies need to achieve a certain scale to gain access to the international capital markets. Such scale could also be due to the high costs of raising funding in international markets; therefore, these costs could be diluted in the high debt amount.

In column (3), total assets presented a positive relation to the access to the foreign debt markets. This indicates that the size of the company benefits foreign currency indebtedness. However, the interaction between assets and credit/GDP ratio is negative, indicating that large companies have decreased their foreign indebtedness in moments of less domestic credit.

A possible interpretation for the last result is that large companies with access to the international debt market have access to a larger pool of available funding sources, especially domestic credit, allowing such companies to manage greater leverage as compared to firms that do not have foreign currency debt market access.

Larger firms tend to have greater access to foreign currency resources (Benavente, Johnson and Morandé, 2003) and the size of the firms can be taken as a collateral for foreign currency debt (Benavente, Johnson and Morandé, 2003; Pratap, Lobato and Somuano, 2003), such that larger firms tend to be less risky.

The ownership dummy showed negative and significant impact in columns (3) and (6). At the same time, the interaction between this variable and credit/GDP ratio, as well as the exchange rate forward premium, indicate that foreign-owned firms increased their foreign indebtedness when the exchange rate forward premium was high, and at moments when the domestic credit increased.

Bonomo, Martins and Pinto (2003) did not find significant result for the relationship between foreign ownership and foreign currency debt for Brazilian companies; they did find, however, that companies with ADR trade are more foreign currency indebted.

5.2 Foreign Currency Indebtedness

Similarly to that described in the previous section, a fixed effects panel data (OLS FE) was made in order to investigate which factors influence the foreign currency indebtedness.

Thus, considering firm *i* at time *t*, the model specification is:

$$\begin{aligned} FC_{i,t} = a_i + \theta_t + X_{i,t-1}B + s_{t-1}\left[\alpha_1 A_{i,t-1} + \alpha_3 d_{FO30}\%_{i,t-1}\right] \\ + f_{t-1}\left[\beta_1 A_{i,t-1} + \beta_3 d_{FO30}\%_{i,t-1}\right] \\ + c_{t-1}\left[\delta_1 A_{i,t-1} + \delta_3 d_FO30\%_{i,t-1}\right] + \varepsilon_{i,t} \end{aligned} \qquad (2)$$

where:

$FC_{i,t}$ = share of foreign currency debt;

X = set of firm-specific control variables: dummy equal to 1 if the firm is an exporter (D_exp) or equal to 1 if the firm is a commodity exporter (D_ComExp); natural logarithm of total assets (A); a dummy equal to 1 if more than 30 percent of the firm's share are foreign owned (d_FO30%); share of short-term debt to total assets (S); share of total debt over total assets (L); sales growth (G); and indebtedness to BNDES.

s = difference between Brazilian and Federal U.S. Treasury securities at 1-year interest rate;

f = exchange rate forward premium for 3 months future exchange rate contract (BRL/USD);

c = domestic credit to private sector / GDP.

The results of Model (2) are in Table 7. Columns (1) to (3) refer to the tests carried out with the exporting dummy. Commodity exporting dummy was tested in Model (2) as well, but the results were so similar to the exporting dummy that we opted for not reporting it.

The exporting dummy showed a positive and significant coefficient when companies' finance variables were included, and also when macroeconomic variables were added to the model, columns (2) and (3), respectively.

The results shown in column (2) consider financial firms' characteristics. Leverage (L) was strongly significant, and positive, which reinforces the results discussed in Section 4.1 regarding total debt.

Moreover, total revenues were negative and significant to foreign currency debt. This result can be a result of the decrease in commodity prices since 2007, which affects most Brazilian exporting companies.

The debt to BNDES was considered, and showed a negative sign, but not significant.

In column (3), macroeconomic variables were included; however, none of them was significant.

It can thus be inferred that leverage and the size of exports matter for foreign currency debt.

5.3 BNDES Subsidized Debt

Debt to BNDES is an alternative to long-term credit lines, as well as to lowest interest rates. However, as BNDES is a public bank, the rules for credit concession are not clear, nor are the credit concession parameters. Moreover, BNDES credit concessions follow political directions, leading to what was previously mentioned as "The Risk of Prince."

As an important debt source, an OLS Fixed Effect panel data used to investigate the determinants of BNDES indebtedness. Considering firm *i* at time *t*, the model specification is:

$$\begin{aligned} BNDES_{i,t} = a_i + \theta_t + X_{i,t-1}B + i_{t-1}\left[\alpha_1 A_{i,t-1} + \alpha_3 d_{FO30}\%_{i,t-1}\right] \\ + f_{t-1}\left[\beta_1 A_{i,t-1} + \beta_3 d_{FO30}\%_{i,t-1}\right] \\ + c_{t-1}\left[\delta_1 A_{i,t-1} + \delta_3 d_FO30\%_{i,t-1}\right] + \varepsilon_{i,t} \end{aligned} \qquad (3)$$

where:

$BNDES_{i,t}$ = debt to BNDES over total assets;

X = set of firm-specific control variables: a dummy equal to 1 if the firm is an exporter (D_exp); natural logarithm of total assets (A); cash flow over total assets (CF); a dummy equal to 1 if more than 30 percent of the firm's share are foreign owned (d_FO30%); share of short-term debt to total assets (S); share of total debt over total assets (L); share of foreign currency debt (FC).
i = Brazilian Treasury securities at 1-year interest rate;
f = exchange rate forward premium for 3 months future exchange rate contract (BRL/USD);
c = domestic credit to private sector / GDP.

The results from model (3) are reported in Table 8.

In column (1) only the export dummy was considered. The coefficients associated with this variable were negative and significant at the 1 percent level for all specifications. This result indicates that exporters have less access to BNDES debt, but, on the other hand, their foreign currency indebtedness is consistently higher than that of non-exporters, as shown above.

The negative relationship between exporters and BNDES debt may be a result of BNDES counter-cyclical policies, which prioritizes companies that raise funds in the domestic market at higher costs. Conversely, this may also result from exporting companies preferring to raise funds in foreign markets.

In column (2), companies' financial characteristics were added. In the same way as foreign currency debt, total leverage is positively related to BNDES debt, albeit less significant than in the previous case.

Macroeconomic variables related to Brazilian economic conditions were added in column (3). They were not significant, but the positive sign of Brazilian interest rate (i) was expected and reinforces the counter-cyclical component of BNDES credit.

Note that, in column (3), size was significant and negative. At the same time, the signal of the interaction between total assets and Brazilian interest rate is positive, but not significant. When going back to the data, large companies are observed to have greater access to credit sources.

BNDES debt is also an option for large companies, and because of their size and economic relevance, it is easier for them to access BNDES credit lines. Thus, this result suggests that at moments of higher interest rates, large companies resort to BNDES to finance their activities.

The same tendency can be observed by the positive sign of the interaction between size and credit/GDP. In other words, large companies have broad access to BNDES debt at moments of high interest rates or increase in credit concession. However, the results point out that these companies may prefer other credit sources.

5.4 Effect of Debt Composition on Profits and Losses Due to Exchange Rate Changes

The effect of foreign debt over firm profit or loss due to exchange rate changes aims at identifying the significance of foreign currency debt to explain the variations in profits and losses arising from exchange rate fluctuations.

For this, the dependent variable (PE) is calculated as currency exchange gain or loss over total assets. The specification of the fixed effects panel data was built using the share of foreign currency debt to total assets (FC), and the effect of exchange rate variations from one year to another over the FC value as regressors. Characteristics of the firms were also included as control variables.

The panel model for firm *i* at time *t* is defined as:

$$PE_{i,t} = a_i + \theta_t + FC_{i,t-1}(\alpha + \beta\Delta e_t) + \delta X_{i,t-1} + \varepsilon_{i,t} \qquad (4)$$

where:

$PE_{i,t}$ = profit or loss due to exchange rate changes;

FC = share of foreign currency debt over total assets;

Δe_t = annual change in real exchange rate (ReR);

X = set of firm-specific control variables: dummies for different export levels, equal to 1 if the firm is an exporter at that level; natural logarithm of total assets (A); cash flow over total assets (CF); a dummy equal to 1 if more than 30 percent of the firm's share are foreign owned (d_FO30%); share of short-term debt to total assets (S); share of total debt over total assets (L); difference between Brazilian and Federal U.S. Treasury securities at 1-year interest rate (s); and exchange rate forward premium for 3 months future exchange rate (BRL/USD) contract (f); c = domestic credit to private sector / GDP.

The OLS FE model was estimated considering robust standard errors. The results for model (4) are in Table 9.

In column (1), foreign currency debt and its interaction with real exchange rate were considered, together with the exporting dummy. Foreign currency debt has a positive and significant effect over the PE value, which shows that foreign currency debt increases profit, or reduces losses, due to the exchange rate.

However, the negative sign of the interaction between foreign currency debt and exchange rate indicates that foreign currency indebtedness contribution to profit and losses due to exchange rate is negatively impacted by the exchange rate. Moreover, exporting dummies tend to have losses due to exchange rates, or the worst results.

The greatest losses related to exchange rate and export companies reinforce points mentioned in the descriptive statistics.

Financial and macroeconomic variables were included in columns (2) and (3), respectively.

5.5 Effect of Debt Composition on Total Profits

To check the impact of foreign currency debt on total profits, a model was built similar to the one in the previous section, but with other financial variables among the regressors.

Accordingly, the fixed effects panel data to check for the effects over total profits/losses is defined as:

$$PR_{i,t} = a_i + \mu_{in,t} + FC_{i,t-1}(\alpha + \beta\Delta e_t) + \delta X_{i,t-1} + \varepsilon_{i,t} \qquad (5)$$

where:

$PR_{i,t}$ = total profits or losses;

FC = share of foreign currency debt over total assets;

Δe_t = annual change in real exchange rate;

X = set of firm-specific control variables: a dummy equal to 1 if more than 30 percent of the firm's share are foreign owned (d_FO30%); share of short-term debt to total assets (S); share of total debt over total assets (L); i = Brazilian Treasury securities at 1-year interest rate; exchange rate forward premium for 3-month future exchange rate (BRL/USD) contract (f); c = domestic credit to private sector / GDP.

The results are presented in Table 10.

First of all, in column (1), the foreign currency debt and its interaction with real exchange rate were included. Both variables have negative coefficients. Considering descriptive statistics, firms with higher foreign currency debt ratio are observed to have had losses in total profits/losses, on average for the whole period. Additionally, the real exchange rate worsens the total profits of companies with foreign currency debt.

Size and other financial variables are added to the specifications in column (3). Size had a negative and significant coefficient over the total profits, as well as total leverage and debt to BNDES.

In column (3), interactions of macroeconomic variables were included in the model. Note that the interest rates positively impact total profits. This can be a consequence of total financial assets from large companies and foreign owned companies, which are remunerated by domestic interest rates.

5.6 Effect of Debt Composition on Investment Due to Exchange Rate Changes

In order to verify the effect of debt composition due to fluctuations on the exchange rates, the model by Bleakley and Cowan (2008) was tested. This aims to identify which of the effects of exchange rate changes prevails over investments: the balance sheet effect or the competitiveness effect.

To this end, the model analyses the response of investments in relation to total assets in a period, explained by the foreign currency debt, the influence of the real exchange rate on the debt in foreign currency, plus the inertial component of investments in the previous period. The heterogeneous effects panel data for firm *i* in period *t* is:

$$\frac{I_{i,t}}{TA_{i,t-1}} = a_i + \tau_t + \gamma_i \left(\frac{FC_{i,t-1}}{TA_{i,t-1}} \Delta e_t\right) + \delta \frac{FC_{i,t-1}}{TA_{i,t-1}} + \alpha \frac{I_{i,t-1}}{TA_{i,t-2}} + \delta X_{i,t-1} + \varepsilon_{i,t} \quad (6)$$

where:

I = firm's investment measured by the CAPEX;

TA = total assets;

FC = foreign currency debt;

Δe_t = annual change in real exchange rate;

X = set of firm-specific control variables: dummy for exporting company, equal to 1 if the firm is an exporter; a dummy equal to 1 if more than 30 percent of the firm's share are foreign owned (d_FO30%); share of short-term debt to total assets (S); share of total debt over total assets (L).

The effect of debt composition on investment was analyzed considering total assets in the denominator, not in the capital stock. When model (6) was tested with capital stock, there were too many outliers, and the inferences were not good enough. Results are in Table 11.

Initially, in the specification model, among the regressors, only foreign currency debt was considered, its interaction with real exchange rate, and the dependent variable lagged in one period. The lagged value of the investments was not significant, although positively correlated to the current value of the variable in the first two specifications, and negatively correlated in the last one.

Foreign currency debt seems not to have significant impact on investments; however, the exchange rate variations negatively affect investment through the foreign currency debt. The negative effect of ReR variations on investments is significant at 1 percent and consistent over all the specifications. In other words, when exchange rate depreciates, investment is reduced. This is strong evidence in favor of the balance sheet effect.

As mentioned before, Bonomo, Martins and Pinto (2003) did not find a significant balance sheet effect in the investment of companies, and the authors argue that this result could be explained by companies' hedge policies. However, according to the database used in the present research, the total derivatives were extremely low in 2014 when compared to the total financial liabilities of companies. These data were taken from the explanatory notes to the balance sheet and include both interest rates and exchange rates derivatives.

In column (2), the exporting dummy was considered. Although there is a negative effect, the coefficients were not significant.

Finally, the variables associated with the capital structure (L and S) presented negative coefficients, and they were not significant. The size is significant and negatively correlated to investment. A possible explanation for the negative coefficient for size is that larger firms have, by definition, larger total assets, and then the new investments can be less representative in the amount of total assets of these firms than it is for smaller firms.

The dummy for foreign ownership is significant at the 1 percent level and positively correlated to investment. Lastly, the BNDES debt is positively correlated to investment, but not significant, as can be observed in column (3).

5.7 Effect of Debt Composition on Sensitivity of Investment to Cash Flow

This model is proposed in order to verify the existence of financial constraints, as proposed by Fazzari, Hubbard and Petersen (1988). The authors state that firms' investment is limited to internally generated funds when the access to external funds is difficult due to information asymmetry and agency costs. Owing to the high cost of external financing, firms prefer internal financing from their operating cash flow (Wan and Zhu, 2011). In this situation, a positive relationship between investment and cash flow is expected (Pellón and Ferrer, 1989).

To test the debt composition on financial constraint, firms' investment was regressed against cash flow, and the effect of foreign currency debt on cash flow. As foreign currency debt and investment are endogenous variables, a random effects panel data was employed, considering instrument variable and robust errors.

The instrument was defined by the lagged value of foreign currency debt (in two periods) adjusted to the next period by the real exchange rate variation. So: $FC_{i,t-1}$ was instrumented by $FC_{i,t-2}\Delta e_{t-1}$ in the following specification:

$$\frac{I_{i,t}}{TA_{i,t-1}} = a_i + \tau_t + \frac{CF_{i,t-1}}{TA_{i,t-1}}\left(\emptyset + \varphi FC_{i,t-1}\right) + \alpha\frac{I_{i,t-1}}{TA_{i,t-2}} + \delta X_{i,t-1} + \delta FC_{i,t-1} + \varepsilon_{i,t} \qquad (7)$$

where:

I = firms' investment measured by the CAPEX;

TA = total assets;

CF = cash flow;

FC = foreign currency debt;

Δe_t = annual change in real exchange rate;

X = set of firm-specific control variables: dummies for different export levels, equal to 1 if the firm is an exporter at that level; d a dummy equal to 1 if more than 30 percent of the firm's share are foreign owned (d_FO30%); share of short-term debt to total assets (S); share of total debt over total assets (L).

The results can be seen in Table 12.

First of all, the behavior of the variables cash flow, foreign currency debt, and interaction of cash flow and foreign currency debt remain constant in all the specifications. Cash flow is negatively correlated to investment, and is significant at a 10 percent level when the firms' characteristics are included in columns (3) and (4).

Foreign currency debt is also negatively correlated to investment, and not significant at any specification. Thus, if foreign currency debt rises in one year, a decrease in investment could be expected.

However, the interaction between cash flow and foreign currency debt presented positive signs, strongly correlated to investments, in all the specifications. This result suggests that firms with a high ratio of foreign currency debt present credit constraints, indicating preference for internal financing resources for investing.

In column (2), the exporting dummy was added to the model, but this variable did not show relevant impact over investments. In column (3), capital structure variables (S and L), size and the dummy for foreign investors were considered as control variables. Note that size is negatively correlated to investment, and significant at the 1 percent level. Foreign investors show a positive impact on investments, which is also deeply significant.

In column (4), debt to BNDES was considered, but with no significance in spite of being positively related to investments. However, a positive sign is expected, since BNDES has many credit lines to finance investments.

6 Conclusions

Given the high interest rates and credit restrictions in the Brazilian financial market, firms seek funds in the international market to finance their activities. The international credit market has lower interest rates and longer-term credit lines. Another alternative for business financing in Brazil are the loans from BNDES, which has subsidized interest rates and long-term maturities.

However, the access to foreign currency debt brings exchange risk to the firms, which can have major impacts on financial planning, especially in times of exchange rate depreciation.

Export companies and companies with higher leverage levels were here observed to have more debt in foreign currency than the others. Adding to that, among the 35 exporting companies

considered in the present research, 22 are commodity producers, many of which are leaders in their markets.

The descriptive statistics and the econometric tests showed that the depreciation of the exchange rate had a negative impact on the balance sheet of companies that presented foreign indebtedness.

Although foreign currency debt has shown a positive effect on profit / loss due to changes in the exchange rate, this effect was negative and very significant when analyzing the interaction of this variable with the exchange rate. The negative impact of exchange rate on the foreign currency debt was also observed in total profits, despite the fact that the foreign currency debt variable has shown a positive effect on total profits/losses, albeit not significant.

To understand the source of the largest losses associated with companies with foreign currency debt, the fall in commodity prices in recent years was observed to have reduced a significant portion of earnings for exporters. In fact, historically, there has been a negative correlation between commodity prices and exchange rate.

Thus, while the face value of liabilities increased in proportion to the exchange rate, revenues from exporting companies did not increase likewise. As the derivatives market in Brazil is still little explored and developed, the natural hedge expected by the exporting companies receivables does not seem to be as effective as expected, leading to losses in the balance sheets of these companies.

This hypothesis was supported by the higher balance sheet effect over the competitiveness effect seen in the companies' data, and also in econometric tests. Moreover, the positive sign and highly significant interaction between the exchange rate and the cash flow suggests that exporting companies, affected by the exchange rate, have increased credit restrictions more than other firms.

Finally, another important finding is the negative relationship between debt to BNDES and the foreign currency debt. Two possible reasons for this result are the following: i) BNDES countercyclical action when selecting borrowers who do not have access to the international market and ii) borrowers' preference for international credit, which is less bureaucratic than that of BNDES and with clearer concession rules. However, this point was not thoroughly investigated in this work and may be a subject for further investigation.

Thus, the high dependence of Brazil on the production and export of commodities affects the growth of domestic enterprises and goes against the tide of international guidelines to improve the level of development of countries. The correlation effect between exchange rate and international commodity prices must be considered when investigating companies' competitiveness.

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ATTACHMENT A
Variables Description

Panel Reference	Source	Description
IndNumber	Economática	We assigned numbers for industry classification. Industry information is from economática, based on NAICS. See "NAICS Code" in database for definition
TotalAssetsR$	Economática	Total assets
TotalAssetsMKT	-	Total assets (converted by market exchange rate PTAX)
TotalAssetsPPP	-	Total assets (converted by PPP exchange rate)
K_PPE	Economática	Property, plant and equipment (net of depreciation)
TradeAssets	Economática	Accounts receivable from customers + inventory
CurrentAssets	Economática	Total current assets
LiqAssetBanks	Economática	Cash and equivalents + short term investments
TotalLiab	Economática	Total liabilities (equity is not included)
TotalDebt	Economática	Short term + long term debt
STDebt	Economática	Short term debt
TradeDebt	Economática	Accounts payable to suppliers in short term
TotalSales	Economática	Total net revenue
EBIT	Economática	Earnings before interest and taxes
Depreciation	Economática	Depreciation, amortization and depletion
TotalProfit	Economática	Net income (including minority interest)
AccEquity	Economática	Accounting equity (including minority interest)
I_CAPEX	Economática	Capital expenditure
FixedAssets	Economática	Investments + PPE + Intangibles
InterestExp	Capital IQ	Interest expense
ExchVar_1	Capital IQ	Currency exchange gain or (loss) collected from Capital IQ
ExchVar_2	Explanatory notes	Currency exchange gain or (loss) collected from explanatory notes. In most cases, the information was collected from financial results note. Values in accounts with "exchange variation" as part of the name (or the full name) were collected. There are cases where the exchange rate variation gain or loss is reported along with monetary variation gain or loss

OwnNational	Comissão de Valores Mobiliários (CVM)	The following ownership information was collected from firms reports to CVM (called "Reference Form"). The sum of OwnNational, OwnForeign, OwnOthers and OwnTreasury is 100% for each firm in each year, representing the total of common shares of the firm. CVM requires that firms identify the shareholder or group of controlling shareholders, providing their information like name and nationality. CVM also require that firms provide information (like name and nationality) about the shareholders or group of shareholders acting together or representing the same interest, with interest equal to or greater than 5% of the same class or type of shares. These requeriments are in the Instruction CVM 480. It was not found these information about firms for the year 2009 (the reports for this year were unavailable), so we repeated the information of the year 2010. OwnNational represents the percentage of the common shares held by domestic investors (the shareholders identified by name and nationality, according to reference form)
OwnForeign	CVM	Percentage of the common shares held by foreign investors
OwnOthers	CVM	Percentage of the common shares held by other investors. Firms classify some percentage of the common shares as held by "others" investors. Considering what is diposed in the instruction from CVM, it could be considered that OwnOther represents the shares that are not held by "large shareholders". It could be considered free float shares
OwnTreasury	CVM	Percentage of the common shares in firms' treasury
ADR	NYSE	1 if the firm has ADR; 0 otherwise
ForeignControl	CVM	1 if the firm has foreign controlling shareholder; 0 otherwise. Information collected from Reference Form
MKTCapit	Economática	Market value equity

BRLCurDt_Bank	Explanatory notes	To create the following debt variables, we accessed the explanatory notes to financial statements, specifically the financial debt note. Based on the debt instruments reported by the companies, we first divided each debt instrument in national or foreign currency. In most cases, firms offer this classification. In order to classify each debt instruments between bank debt, capital markets debt, subsidized or lease debt instrument we analyzed the instrument characteristics. As examples of instruments, if the firm reported a BNDES loan, we classified it as a subsidized one. If the firm reported a debenture or a bond, we classified them as a capital market instrument. If the firm reported a bank debt instrument we classified as a bank debt. Generally, lease instruments are called lease. We used other information too, besides the kind of instrument. We used the interest rate assigned to the instrument. For example, a loan that has it interest rate based on CDI (Brazilian market interest rate) is a common bank loan. A loan that has it interest rate based on TJLP (BNDES interest rate) is a subsidized loan. This information, allied with the kind of debt instrument, provides a more reliable classification. Additionally, firms that have a good disclosure policy comment their debt instruments, providing more information about them. This is another support to the classification. When there aren't sufficient information to classify the debt instrument, it is classified as "other". It happens when firm classify as "other" too. So, after the classification, we sum each category and the sum of all categories is equal to total debt in that year. BRLCurDt_Bank represents national currency bank debt
BRLCurDt_CapMkt	Explanatory notes	National currency bonds debt
BRLCurDt_BNDES	Explanatory notes	National currency subsidized debt
BRLCurDt_Leas	Explanatory notes	National currency financial lease
BRLCurDt_Other	Explanatory notes	National currency other debt (unclassified)
ForCurDt_Bank	Explanatory notes	Foreign currency bank debt

ForCurDt_CapMkt	Explanatory notes	Foreign currency bond debt
ForCurDt_Subs	Explanatory notes	Foreign currency subsidized debt (Most foreign currency BNDES)
ForCurDt_Leas	Explanatory notes	Foreign currency financial lease
ForCurDt_Others	Explanatory notes	Foreign currency other debt (unclassified)
TotalDebtNotes	Explanatory notes	Short term + long term debt (from explanatory notes)
TotalDebtPPP	-	Short term + long term debt (from explanatory notes) (PPP exchange rate)
STDebtNotes	Explanatory notes	Short term debt (from explanatory notes)
ExpUSD	Ministry of Development, Industry and Foreign Trade of Brazil	The firm has exports value if it is among the 250 largest Brazilian exporters in the year, otherwise the exports value will be missing. ExpUSD and ImpUSD are collected from reports of the Ministry of Development, Industry and Foreign Trade of Brazil that presents only the values of exports and imports of the 250 largest exporters and 250 largest importers of the year. Because of this restricted form, some sample companies are missing.
ImpUSD	Ministry of Development, Industry and Foreign Trade of Brazil	The firm has imports value if it is among the 250 largest Brazilian importers in the year, otherwise the imports value will be missing
ExpBRL	-	Exports in BRL (based on ExpUSD). It was used the year average market exchange rate (based on all exchange rates available for the year)
ImpBRL	-	Imports in BRL (based on ImpUSD). It was used the year average market exchange rate (based on all exchange rates available for the year)

D_NonExp	Ministry of Development, Industry and Foreign Trade of Brazil	The following exports and imports dummies are based on reports from Ministry of Development, Industry and Foreign Trade of Brazil. These reports are different from those used to generate ExpUSD and ImpUSD. The reports used to generate the dummies offer value ranges from exports and imports and they are more comprehensive, covering more firms. We classified each company in each year based on these value ranges from reports. The dummy D_NonExp is 1 if the company is not in the "exporter report" for the year; 0 otherwise
(E)_Less1m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm exported less than 1 million dollars during the year; 0 otherwise
(E)_Betw1-5m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm exported between 1 and 5 million dollars during the year; 0 otherwise
(E)_Betw5-10m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm exported between 5 and 10 million dollars during the year; 0 otherwise
(E)_Betw10-50m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm exported between 10 and 50 million dollars during the year; 0 otherwise
(E)_Betw50-100m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm exported between 50 and 100 million dollars during the year; 0 otherwise
(E)_More100m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm exported more than 100 million dollars during the year; 0 otherwise

(E)_Bet100m-1bi	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm exported between 100 million and 1 billion dollars during the year; 0 otherwise. This dummy is based on ExpUSD.
(E)_More1bi	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm exported more than 1 billion dollars during the year; 0 otherwise. This dummy is based on ExpUSD.
Exp_rangeUSD	-	Value of exports according to the average of the value range dummies for exports
Exp_ValueRangeBRL	-	Value of exports using the effective value of exports by the company, if any; for companies that did not have absolute value, it was used the average value of exports ranges defined in Exp_range, converted to BRL
(I)_NonImporter	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the company is not in the "importer report" for the year; 0 otherwise
(I)_Less1m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm imported less than 1 million dollars during the year; 0 otherwise
(I)_Betw1-5m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm imported between 1 and 5 million dollars during the year; 0 otherwise
(I)_Betw5-10m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm imported between 5 and 10 million dollars during the year; 0 otherwise
(I)_Betw10-50m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm imported between 10 and 50 million dollars during the year; 0 otherwise

(I)_Betw50-100m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm imported between 50 and 100 million dollars during the year; 0 otherwise
(I)_More100m	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm imported more than 100 million dollars during the year; 0 otherwise
(I)_Bet100m-1bi	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm imported between 100 million and 1 billion dollars during the year; 0 otherwise. This dummy is based on ImpUSD.
(I)_More1bi	Ministry of Development, Industry and Foreign Trade of Brazil	1 if the firm imported more than 1 billion dollars during the year; 0 otherwise. This dummy is based on ImpUSD.
Imp_rangeUSD	-	Value of imports according to the average of the value range dummies for imports
Imp_ValueRangeBRL	-	Value of imports using the effective value of imports of the company, if any; for companies that did not have absolute value, it was used the average value of imports ranges defined in Imp_range, converted to BRL
FinAssets_BRL	Explanatory notes	Financial assets in BRL
FinAssets_For	Explanatory notes	Financial assets in foreign currency (BRL value)
LiqPosAsLiab_BRL	Explanatory notes	Financial assets less financial liabilities (derivatives not included) in BRL
LiqPosAsLiab_For	Explanatory notes	Financial assets less financial liabilities (derivatives not included) in foreign currency (BRL value)
DerivLiqPos_BRL	Explanatory notes	Liquid position of derivatives in BRL (Derivatives registered in assets less derivatives registered in liabilities)
DerivaLiqPos_For	Explanatory notes	Liquid position of derivatives in foreign currecy (Derivatives registered in assets less derivatives registered in liabilities) (BRL value)
LiqPosAsLiabDeriv_BRL	Explanatory notes	Financial assets less financial liabilities in BRL, including derivatives
LiqPosAsLiabDeriv_For	Explanatory notes	Financial assets less financial liabilities in foreign currency, including derivatives (BRL value)

FinLiab_BRL	Explanatory notes	Financial liabilities in BRL
FinLiab_For	Explanatory notes	Financial liabilities in foreign currency (BRL value)
ForeignCurSens	Explanatory notes	Sensibility of the liquid position of financial assets and liabilities, including derivatives, for a rise of 25% in foreign currency interest rate and currencies
Dum_FinInfoQual	-	Dummy for the quality of information about financial assets and liabilities collected from explanatory notes (1 for good information)
TotalFinAssets	-	FinAssets_BRL + FinAssets_For
FCFA_TLA	-	Foreign Currency Financial Assets = FinAssets_For / TotalFinAssets
UnknownEff	-	The following dummies were created intending to classify the sample years in characteristics periods along with characteristics of the firms. The two variables of the firms used to predict some possible effect due to exchange rate variation are foreign currency debt and exports. The dummy unknown effect (UnknownEff) is 1 for the firm that is an exporter and has foreign currency debt.
BSheetEff	-	BSheetEff is a dummy that takes 1 if the firm has foreign currency debt and does not export. For this kind of firm we expect balance sheet effect due BRL devaluation
CompetEff	-	CompetEff is a dummy that takes 1 if the firm is an exporter and does not have foreign currency debt. For this kind of firm we expect competitiveness effect due BRL devaluation
NoEff	-	NoEff is a dummy that takes 1 if the firm is not an exporter and does not have foreign currency debt. For this kind of firm we do not expect an effect due BRL devaluation
Dperiod1	-	Dperiod1 is a dummy that takes 1 for the years 2003, 2004, 2005, 2006, 2007 and 2008. These years are characterized by the boom in commodities and exchange rate appreciation
DCrisis	-	DCrisis is a dummy that takes 1 for the years 2008 and 2009. Represents the years of the financial crisis
Dperiod2	-	Dperiod2 is a dummy that takes 1 for the years 2010, 2011, 2012, 2013 and 2014. These years (after crisis) are characterized by the exchange rate devaluation and low international interest rates
CompEff*Dperiod1	-	Dummy interacting previous dummies.

BSheetEff*Dperiod2	-	Dummy interacting previous dummies.
CommodityExp	-	CommodityExp is a dummy that takes 1 if the firm is an exporter and is from a commodity industry.
G	-	(Total Sales t - Total Sales t-1)/Total Sales t-1
VarExchRt_Real	Central Bank of Brazil	Change in the real exchange rate
c	Central Bank of Brazil	Loans to the private sector to GDP
s_1yIntRate	BM&FBovespa and Federal Reserve	Difference between Brazilian and American interest rates within 1 year. US interest rate considered: "Market yield on US Treasury securities at 1-year constant maturity, quoted on investment basis" - Source: Federal Reserve; Brazilian interest rate considered: reference rate pre-fixed DI swaps (BM&F) - Period of 360 days (period average)
f	BM&FBovespa and Central Bank of Brazil	Exchange rate forward premium, calculated for the 3 month dollar exchange future contracts
Dol_spot	Central Bank of Brazil	Exchange rate (BRL/ USD)
Dol_PPP	BID	Exchange Rate (BRL/USD) Purchase Power Parity
VarExchRt_Spot	-	Change in the exchange rate BRL/USD
RZ	RZ (1998)	External financial requirements of the firm's industry from Rajan and Zingales (1998)
A	-	LN (TotalAssetsR$)
S	-	STDebtNotes/TotalAssets
L	-	TotalDebtNotes/TotalAssets
ForCurDebt	-	Total foreign currency debt. (ForCurDt_Bank + ForCurDt_CapMkt + ForCurDt_Subs + ForCurDt_Leas + ForCurDt_Others)
Z_1	-	Exports/TotalSales. Based on ExpBRL
Z_2	-	Exports/TotalSales. Based on ExpBRL + ExpValueRange
PR	-	TotalProfit/TotalAssets
PE_1	-	ExchVar_1/TotalAssets
PE_2	-	ExchVar_2/TotalAssets
CF	-	EBIT/TotalAssets
i	Central Bank of Brazil	Interest rate with a term of one year in Brazil. Brazilian interest rate considered: reference rate pre-fixed DI swaps (BM&F) - Period of 360 days (period average)
FO15_1	-	1 if the firm has more than 15% of foreign investors, based only in OwnForeign information; 0 otherwise

FO15_2	-	1 if the firm has more than 15% of foreign investors, % foreign investors = (1 – OwnNational- OwnTreasury); 0 otherwise.
D_FO30	-	1 if the firm has more than 30% of foreign investors, % foreign investors = (1 – OwnNational- OwnTreasury); 0 otherwise.
FC	-	ForCurDebt/TotalAssets
BNDES_Debt	-	BRLCurDt_BNDES + ForCurDt_Subs
Dum_FC	-	1 if company has foreign currency debt; 0 otherwise
K_TotalAssets	-	K_PPE/TotalAssets
BNDES_TA	-	BNDES_debt/TotalAssets
Exp_TotAss	-	Exports/TotalAssets
CurrAsset_TotA	-	CurrentAssets/TotalAssets
Bond_TotDebt	-	(BRLCurDt_CapMkt + ForCurDt_CapMkt)/TotalDebtNotes
ForCurrBond_Bonds	-	ForCurDt_CapMkt / (BRLCurDt_CapMkt + ForCurDt_CapMkt)
Interest_TotDebt	-	InterestExp/TotalDebtNotes

ATTACHMENT B
DESCRIPTIVE STATISTICS

Table 1. General Descriptive Statistics

Variable	Nº Obs.	Mean	Std. Deviation	Min.	Max.
General Numbers (R$ Million)					
Total Assets (TA)	1027	R$ 19,400,000	R$ 56,300,000	R$ 88,877	R$ 793,000,000
Exports (BRL)	264	R$ 4,579,322	R$ 9,112,076	R$ 140,106	R$ 58,000,000
Foreign Currency Debt (BRL)	782	R$ 3,860,147	R$ 14,500,000	R$ 31	R$ 265,000,000
Financial Indicators Statistics					
Sales Growth (G)	989	0.2227	0.3753	-1	2.9643
Exports / Total Assets (E)	364	0.1462	0.2071	0.0001	1.9879
BNDES Debt / TA	944	0.0931	0.0944	0.0000	0.6337
Foreign Currency Debt / TA (FC)	782	0.1292	0.1129	0.0000	0.5963
Short Term Debt /TA (S)	1021	0.0877	0.0795	0.0000	0.9388
Total Debt / TA (L)	1021	0.3301	0.1521	0.0000	0.9943
Exports / Total Sales (Z)	360	0.1956	0.2049	0.0001	0.9381
Cash Flow (CF)	1027	0.0981	0.0897	-0.6489	0.7086
Total Profits (PR)	1027	0.0531	0.0762	-0.7004	0.5168
Profits and Losses due to exchange rate changes (PE)	670	0.0013	0.0499	-0.1207	1.1666
Macroeconomic Variables					
Exchange Rate (BRL/ USD)	1200	2.1910	0.4218	1.6746	3.0715
Exchange Rate Variation	1200	-0.0128	0.1029	-0.1680	0.1671
Real Exchange Rate (ReR) Variation	1200	-0.0502	0.0918	-0.1951	0.1297
Brazilian Interest Rate (i)	1200	0.1318	0.0394	0.0805	0.2213
Brazilian Interest Rate – Dollar Interest Rate (s)	1200	0.1138	0.0359	0.0667	0.2064
Exchange Rate 3 Months Forward Premium (f)	1200	0.0811	0.0290	0.0451	0.1437
Domestic Credit to Private Sector / GDP (c)	1200	0.3722	0.0973	0.2388	0.5014

Table 2. Variables Average per Year

Variable	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Nº. Firms	57	59	65	69	90	94	96	98	99	100	100	100
Financial Indicators												
Sales Growth (G)	0.2324	0.3058	0.1946	0.1607	0.2282	0.3916	0.1941	0.3690	0.1597	0.2272	0.1092	0.1273
Exports / Total Assets (E)	0.1848	0.2203	0.2135	0.1730	0.1571	0.1404	0.1067	0.1259	0.1394	0.1199	0.1306	0.1098
BNDES Debt / TA	0.0992	0.0990	0.0913	0.087	0.0849	0.0939	0.1072	0.1106	0.1125	0.1085	0.1047	0.0974
Foreign Currency Debt / TA (FC)	0.1922	0.1402	0.1385	0.125	0.1245	0.1505	0.1097	0.0953	0.1022	0.1227	0.1316	0.1435
Short Term Debt / TA (S)	0.1354	0.0973	0.0766	0.0750	0.0738	0.0846	0.0921	0.0745	0.0863	0.0871	0.0815	0.1035
Total Debt / TA (L)	0.3404	0.3037	0.2889	0.2991	0.2793	0.3267	0.3222	0.3184	0.3427	0.3630	0.3641	0.3749
Exports / Total Sales (Z)	0.1937	0.1413	0.2064	0.2436	0.2062	0.1941	0.1643	0.1920	0.2065	0.1949	0.2080	0.1965
Cash Flow (CF)	0.1112	0.1418	0.1306	0.1181	0.1039	0.1050	0.0917	0.1080	0.0957	0.0740	0.0744	0.0646
Total Profits (PR)	0.0558	0.0724	0.0758	0.0701	0.0642	0.0511	0.0593	0.0697	0.0542	0.0328	0.0343	0.0216
Profits and Losses due to exchange rate changes (PE)	0.0570	0.0003	0.0053	0.0019	0.0077	-0.0144	0.0125	0.0023	-0.0053	-0.0056	-0.0083	-0.0068
Macroeconomic Variables												
Exchange Rate (BRL/ USD)	3.0715	2.9257	2.4341	2.1771	1.9483	1.8375	1.9946	1.7593	1.6746	1.9545	2.1605	2.3547
Exchange Rate Variation	.04798	-.0475	-.1680	-.1056	-.1051	-.0569	.0855	-.1179	-.0481	.1671	.1054	.0898
Real Exchange Rate (ReR) Variation	-.05607	-.0851	-.1951	-.1147	-.1117	-.0768	.0374	-.1474	-.0803	.1297	.0553	.0425
Brazilian Interest Rate (i)	.2213	.1693	.1818	.1439	.1149	.1363	.0991	.1123	.1168	.0804	.0907	.1146
Brazilian Interest Rate – Dollar Interest Rate (s)	.2064	.1476	.1405	.0901	.0666	.1159	.09412	.1088	.1148	.0786	.0892	.1133
Exchange Rate 3 Months Forward Premium (f)	.1437	.1195	.1203	.0743	.0450	.0548	.0606	.0648	.0677	.0691	.0704	.0824
Domestic Credit to Private Sector / GDP (c)	.2387	.2399	.2572	.2851	.3164	.3710	.4054	.4206	.4475	.4868	.5014	.4963

Table 3. Variables Average per FC level

FC Level	Nº. Obs	Sales Growth (G)	Exports / Total Assets (E)	BNDES Debt / TA	Short Term Debt / TA (S)	Total Debt / TA (L)	Exports / Total Sales (Z)	Cash Flow (CF)	Total Profits (PR)	Profits and Losses due to exchange rate changes (PE)
FC <= 0.1	386	0.2105	0.0883	0.1079	0.0738	0.3062	0.0965	0.1167	0.0672	-0.0015
0.1 < FC <= 0.2	205	0.1426	0.1789	0.0896	0.0892	0.3167	0.2532	0.1060	0.0560	-0.0016
0.2 < FC <= 0.3	118	0.2144	0.1457	0.0792	0.1004	0.3990	0.2141	0.0914	0.0476	0.0065
0.3 < FC <= 0.4	58	0.3089	0.1757	0.0752	0.1291	0.4746	0.2281	0.0696	0.0223	0.0027
0.4 < FC <= 0.5	10	0.1718	0.1578	0.0319	0.1477	0.5258	0.1711	0.0463	-0.0543	-0.0489
0.5 < FC <= 0.6	5	0.2162	0.4289	0.0158	0.2196	0.7317	0.4107	-0.0715	-0.1930	-0.0362
0.6 < FC <= 0.7	-	-	-	-	-	-	-	-	-	-
0.7 < FC <= 0.8	-	-	-	-	-	-	-	-	-	-
0.8 < FC <= 0.9	-	-	-	-	-	-	-	-	-	-
0.9 < FC <= 1.0	-	-	-	-	-	-	-	-	-	-

Table 4. Variables Average per BNDES Debt level

FC Level	Nº. Obs	Total Assets (R$ Million)	Cash Flow (CF)	Exports / Total Assets (E)	Total Debt / TA (L)	Short Term Debt / TA (S)	Total Profits (PR)	Profits and Losses due to exchange rate changes (PE)
BNDES Debt <= 0.1	579	24,800	0.0962	0.1377	0.3028	0.0774	0.0502	0.0004
0.1 < BNDES Debt <= 0.2	249	12,000	0.1018	0.1573	0.3595	0.0891	0.0558	0.0012
0.2 < BNDES Debt <= 0.3	73	5,202	0.0919	0.1726	0.4187	0.1241	0.0554	0.0054
0.3 < BNDES Debt <= 0.4	27	4,962	0.0797	0.1005	0.4679	0.1319	0.0359	0.0056
0.4 < BNDES Debt <= 0.5	13	3,391	0.0460	0.0000	0.6078	0.1072	-0.0045	0.0207
0.5 < BNDES Debt <= 0.6	2	991	0.0085	0.0000	0.8852	0.0427	-0.0929	0.0000
0.6 < BNDES Debt <= 0.7	1	1,770	0.0096	0.0000	0.9943	0.0792	-0.1311	0.0000
0.7 < BNDES Debt <= 0.8	-	-	-	-	-	-	-	-
0.8 < BNDES Debt <= 0.9	-	-	-	-	-	-	-	-
0.9 < BNDES Debt <= 1.0	-	-	-	-	-	-	-	-

ATTACHMENT C
ECONOMETRIC MODELS RESULTS

Table 5. Determinants of Participating in Foreign Currency Debt Markets

Dummy	Exporting Dummy			Commodity Exporting Dummy		
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
D_exp	2.8907*** (0.7926)	3.8588*** (1.0333)	3.8628*** (1.0526)	-	-	-
D_ComExp	-	-	-	4.7681*** (1.4837)	5.2356*** (1.6415)	5.5319*** (1.9169)
$A_{i,t-1}$		-0.2798 (0.2260)	1.1224*** (0.3706)		-0.2185 (0.2252)	1.1934*** (0.3745)
$d_FO30\%_{i,t-1}$		0.7628 (0.5849)	-7.5362** (3.1024)		0.6481 (0.5838)	-7.5249** (3.1126)
$S_{i,t-1}$		0.7773 (3.5587)	-2.9236 (3.8831)		1.6272 (3.5425)	-1.9744 (3.7885)
$L_{i,t-1}$		4.7410** (2.2558)	8.8951*** (2.6296)		3.2125 (2.2222)	7.0861*** (2.5684)
$Rev_{i,t-1}$		-0.8815 (0.7283)	-0.0564 (0.8062)		-0.2019 (0.7315)	0.7748 (0.8357)
$BNDES_{i,t-1}$		0.7456 (2.8570)	-2.7108 (3.2019)		1.2612 (2.8143)	-1.7002 (3.1713)
$s_{t-1} \times A_{i,t-1}$			0.2995 (0.9804)			0.3211 (.9774)
$s_{t-1} \times d_FO30\%_{i,t-1}$			-7.1048 (20.3791)			-7.4335 (20.2695)
$f_{t-1} \times A_{i,t-1}$			-0.5514 (1.3051)			-0.5140 (1.2956)
$f_{t-1} \times d_FO30\%_{i,t-1}$			68.9639** (28.1606)			66.9187** (27.9336)
$c_{t-1} \times A_{i,t-1}$			-1.0893*** (0.28711)			-1.0841*** (0.2867)
$c_{t-1} \times d_FO30\%_{i,t-1}$			11.0290** (5.3003)			11.0791** (5.2834)
Observations	782	711	711	782	711	711
Method	Logit	Logit	Logit	Logit	Logit	Logit

Note: The table shows estimates of Model (1) in the text. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.1.

Table 6. Predicted Probabilities of Significant Variables, Model (1)

Dummy	Exporting Dummy			Commodity Exporting Dummy		
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
D_exp	0.9957	0.9967	0.9948	-	-	-
D_ComExp	-	-	-	0.9994	0.9995	0.9994
$A_{i,t-1}$			0.9177			0.9161
$d_FO30\%_{i,t-1}$			0.6635			0.6710
$L_{i,t-1}$		0.9434	0.9228			0.9308
$f_{t-1} \times d_FO30\%_{i,t-1}$			0.9432			0.9389
$c_{t-1} \times A_{i,t-1}$			0.9223			0.9147
$c_{t-1} \times d_FO30\%_{i,t-1}$			0.8805			0.8659
Observations	694	694	694	694	694	694
Method	Logit	Logit	Logit	Logit	Logit	Logit

Note: Predicted Probabilities at means. For binary variables, predicted probabilities at 1.

Table 7. Determinants of Foreign Currency Indebtedness

Variable	(1)	(2)	(3)
D_exp	0.0032 (0.0077)	0.0642** (0.0264)	0.0521* (0.0294)
$A_{i,t-1}$		0.0056 (0.0076)	0.0207 (0.0270)
$d_FO30\%_{i,t-1}$		0.0098 (0.0125)	-0.0307 (0.0467)
$S_{i,t-1}$		0.0075 (0.0665)	0.0069 (0.0650)
$L_{i,t-1}$		0.1586** (0.0622)	0.1513** (0.0603)
$G_{i,t-1}$		-0.0059 (0.0096)	-0.0053 (0.0096)
$BNDES_{i,t-1}$		-0.0257 (0.0757)	-0.0234 (0.0738)
$s_{t-1} \times A_{i,t-1}$			-0.0202 (0.0841)
$s_{t-1} \times d_FO30\%_{i,t-1}$			0.0285 (0.1871)
$f_{t-1} \times A_{i,t-1}$			-0.0144 (0.1442)
$f_{t-1} \times d_FO30\%_{i,t-1}$			0.2845 (0.2567)
$c_{t-1} \times A_{i,t-1}$			-0.0344 (0.0586)
$c_{t-1} \times d_FO30\%_{i,t-1}$			0.0335 (.0915)
R-square within	0.1985	0.1625	0.1697
R-square between	0.0024	0.4948	0.5076
R-square overall	0.0517	0.4177	0.4108
Firm Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Method	Panel FE	Panel FE	Panel FE
Observations	782	694	694

Note: The table shows estimates of Model (2) in the text. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.1.

Table 8. Determinants of BNDES Subsidized Indebtedness

Variable	(1)	(2)	(3)
D_exp	-0.1524***	-0.0956***	-0.0963***
	(0.0063)	(0.0153)	(0.0192)
$FC_{i,t-1}$		-0.1457	-0.1329
		(0.1004)	(0.0992)
$A_{i,t-1}$		-0.0089	-0.0515**
		(0.0080)	(0.0237)
$d_FO30\%_{i,t-1}$		0.0006	0.0724
		(0.0139)	(0.0598)
$S_{i,t-1}$		-0.0212	-0.0285
		(0.0769)	(0.0683)
$L_{i,t-1}$		0.1749*	0.1751*
		(0.0887)	(0.0948)
$G_{i,t-1}$		0.0115	0.0103
		(0.0144)	(0.0143)
$Rev_{i,t-1}$		-0.0320	-0.0310
		(0.0201)	(0.0201)
$i_{t-1} \times A_{i,t-1}$			0.0726
			(0.0927)
$i_{t-1} \times d_FO30\%_{i,t-1}$			0.0139
			(0.2494)
$c_{t-1} \times A_{i,t-1}$			0.0694
			(0.0548)
$c_{t-1} \times d_FO30\%_{i,t-1}$			-0.1299
			(0.1042)
$f_{t-1} \times A_{i,t-1}$			0.1234
			(0.1096)
$f_{t-1} \times d_FO30\%_{i,t-1}$			-0.3379
			(0.2975)
Observations	944	652	652
R-square within	0.0234	0.1232	0.1396
R-square between	0.0297	0.1026	0.1000
R-square overall	0.0200	0.0958	0.0958
Firm Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Method	Panel FE	Panel FE	Panel FE

Note: The table shows estimates of Model (3) in the text. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.1.

Table 9. Consequences of Debt Composition for Profit and Loss Due to Exchange Rate Changes

Variable	(1)	(2)	(3)
$FC_{i,t-1}$	0.0773**	0.0649***	0.0612***
	(0.0330)	(0.0182)	(0.0180)
$FC_{i,t-1} \times \Delta e_t$	-0.0358	-0.1754**	-0.1754*
	(0.1750)	(0.1031)	(0.1037)
D_exp	-0.0148***	-0.0060	-0.0061
	(0.0039)	(0.0055)	(0.0053)
$A_{i,t-1}$		-0.0035	-0.0008
		(0.0028)	(0.0037)
$CF_{i,t-1}$		0.0230	0.0217
		(0.0224)	(0.0221)
$d_FO30\%_{i,t-1}$		-0.0080*	-0.0116
		(0.0047)	(0.0080)
$s_{t-1} \times A_{i,t-1}$			-0.0287
			(0.0420)
$s_{t-1} \times d_FO30\%_{i,t-1}$			-0.1174
			(0.1066)
$f_{t-1} \times A_{i,t-1}$			0.0121
			(0.0428)
$f_{t-1} \times d_FO30\%_{i,t-1}$			0.2187*
			(0.1109)
Observations	570	542	542
R-square within	0.1046	0.2271	0.2335
R-square between	0.0232	0.1423	0.1426
R-square overall	0.0753	0.0906	0.1000
Firm Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Method	Panel FE	Panel FE	Panel FE

Note: The table shows estimates of Model (4) in the text. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.1.

Table 10. Effect of Foreign Currency Debt on Total Profits

Variable	(1)	(2)	(3)
$FC_{i,t-1}$	-0.1375***	-0.0262	-0.0145
	(0.0427)	(0.0534)	(0.0568)
$FC_{i,t-1} \times \Delta e_t$	-0.4249*	-0.4220*	-0.3728*
	(0.2354)	(0.2202)	(0.2072)
$A_{i,t-1}$		-0.0270***	-0.0323
		(0.0095)	(0.0293)
$S_{i,t-1}$		-0.1408	-0.1431
		(0.1159)	(0.1182)
$L_{i,t-1}$		-0.0884*	-0.0983*
		(0.0456)	(0.0500)
$d_FO_{30\%}$		-0.0067	-0.0235
		(0.0100)	(0.0635)
$BNDES_{i,t-1}$		-0.1032**	-0.0969*
		(0.0483)	(0.0489)
$i_{t-1} \times A_{i,t-1}$			0.0233
			(0.0968)
$i_{t-1} \times d_FO_{30\%}$			0.0266
			(0.2395)
$f_{t-1} \times A_{i,t-1}$			0.0655
			(0.0777)
$f_{t-1} \times d_FO_{30\%}$			-0.1333
			(0.2204)
$c_{t-1} \times A_{i,t-1}$			-0.0199
			(0.0458)
$c_{t-1} \times d_FO_{30\%}$			0.0568
			(0.1058)
Observations	753	708	708
R-square within	0.1171	0.2412	0.2446
R-square between	0.1774	0.0204	0.0507
R-square overall	0.1271	0.0454	0.1077
Firm Effect	Yes	Yes	Yes
Year Effect	Yes	Yes	Yes
Method	Panel FE	Panel FE	Panel FE

Note: The table shows estimates of Model (5) in the text. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.1.

Table 11. Effect of Debt Composition on Investment Due to Exchange Rate Changes

Variable	(1)	(2)	(3)
$FC_{i,t-1} \times \Delta e_t$	-0.9321*** (0.3258)	-0.9379*** (0.3274)	-1.099*** (0.3290)
$FC_{i,t-1}$	-0.0060 (0.0336)	0.0071 (0.0436)	0.0854 (0.0706)
$I_{i,t-1}/A_{i,t-2}$	0.0051 (0.0112)	0.0047 (0.0111)	-0.0015 (0.0101)
D_exp		-0.0082 (0.0132)	-0.0190 (0.0160)
$A_{i,t-1}$			-0.0139* (0.0079)
$L_{i,t-1}$			-0.0407 (0.0592)
$S_{i,t-1}$			-0.0529 (0.1190)
$d_FO30\%_{i,t-1}$			0.0323*** (0.0098)
BNDESDetb			0.1194 (.0739)
Observations	613	613	613
R-square within	0.1044	0.1026	0.1225
R-square between	0.0038	0.0088	0.1092
R-square overall	0.0696	0.0717	0.1181
Year Effect	Yes	Yes	Yes
Method	Panel GLS RE	Panel GLS RE	Panel GLS RE

Note: The table shows estimates of Model (6) in the text. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.1.

Table 12. Effect of Debt Composition on Sensitivity of Investment to Cash Flow

Variable	(1)	(2)	(3)	(4)
$CF_{i,t-1}$	-0.0892 (0.0820)	-0.0845 (0.0825)	-0.1533* (0.0841)	-0.1376* (0.0835)
$CF_{i,t-1} \times FC_{i,t-1}$	1.2329*** (0.4756)	1.2427*** (0.4758)	1.4415*** (0.4779)	1.3549*** (0.4780)
$I_{i,t-1}/A_{i,t-2}$	0.0058 (0.0067)	0.0054 (0.0068)	0.0022 (0.0067)	-0.0001 (0.0069)
$FC_{i,t-1}$	-0.0970 (0.0067)	-0.0834 (0.0676)	-0.0699 (0.0732)	-0.0255 (0.0756)
D_exp		-0.0088 (0.0129)	-0.0129 (0.0138)	-0.0174 (0.0136)
$A_{i,t-1}$			-0.0172*** (0.0053)	-0.0152*** (0.0051)
$L_{i,t-1}$			-0.0137 (0.0449)	-0.0444 (0.0497)
$S_{i,t-1}$			-0.0356 (0.0759)	-0.0222 (0.0761)
$d_FO30\%_{i,t-1}$			0.0290*** (0.0101)	0.0303*** (0.0099)
BNDESDetb				0.0998 (0.0629)
Observations	612	612	612	612
R-square within	0.1184	0.1166	0.1422	0.1365
R-square between	0.0071	0.0035	0.0185	0.0428
R-square overall	0.0686	0.0711	0.0978	0.1096
Year Effect	Yes	Yes	Yes	Yes
Method	Panel GLS IV	Panel GLS IV	Panel GLS IV	Panel GLS IV

Note: The table shows estimates of Model (7) in the text. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.1