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# Do Government Guarantees Really Matter in Fixed Exchange Rate Regimes?

Marcio Janot
Marcio Garcia

DEPARTAMENTO DE ECONOMIA
www.econ.puc-rio.br

# Do Government Guarantees Really Matter in Fixed Exchange Rate Regimes?

**Marcio M. Janot [*], Márcio G. P. Garcia[**]**

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**Abstract.** Since the mid 1990s, theories of speculative attacks have argued that fixed exchange rate regimes induce excessive borrowing in foreign currency as an optimal response to implicit guarantees that the government will not devalue the domestic currency. Using data on Brazilian firms before and after the end of the fixed exchange rate regime in 1999, we estimate the relevance of the government guarantees by comparing the changes in foreign debt of two groups of firms: those that hedged their foreign currency debt prior to the exchange rate float and those that did not. Using the difference-in-differences approach, in which firm-specific characteristics are introduced as control variables, we exclude the macroeconomic effects of the change in the exchange rate regime and the possible differences in foreign debt trends of the two groups of firms, thus obtaining an estimate of the impact of the government guarantees on borrowing in foreign currency. The results suggest that the guarantees do not induce excessive borrowing in foreign currency.

*Keywords*: Foreign Exchange Risk, Government Guarantees, Exchange rate regime, Hedging

*JEL classification*: F31, F34, G15, G18

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## 1. Introduction

Beginning in the mid 1990s, many emerging countries underwent speculative attacks that put in check their fixed exchange rate regimes. Since that time, new theoretical models have sought to explain speculative attacks based on the impact of government guarantees on firms' financial decisions. A large number of firms with unhedged foreign currency debt would result in a speculative attack with negative consequences for the real sector. Corsetti et al. (1999), for example, develop a model with the goal of providing an interpretive scheme of the 1997 Southeast Asia crisis. In the model, private agents act under the presumption that there exists public guarantees on corporate and financial investment, so that the return on domestic assets is perceived as implicitly insured against adverse circumstances. To the extent that foreign creditors are willing to lend against future bailout revenue, unprofitable projects and cash shortfalls are refinanced through external borrowing. Another kind of model was developed by Burnside et al. (2004), in which the presence of government guarantees induce banks to borrow

[*] Banco Central do Brasil and Pontifical Catholic University of Rio de Janeiro. Av. Pres. Vargas, 730/14º - 20071-900 - Rio de Janeiro/RJ, Brazil. Phone: (5521) 2189-5760. This article should not be reported as representing the views of the Banco Central do Brasil. The views expressed in the papers are those of the author(s) and do not necessarily reflect those of the Banco Central do Brasil.
E-mail address: : marcio.janot@bcb.gov.br
[**] Pontifical Catholic University of Rio de Janeiro. Economic Department. Rua Marquês de São Vicente, 225 – 22451-900 – Rio de Janeiro/RJ, Brazil. Phone: (5521) 3527-1078. Fax: (5521) 3527-1084
E-mail address: mgarcia@econ.puc-rio.br

foreign currency, lend domestic currency and do not hedge the resulting exchange rate risk.With guarantees, banks will also renege on their foreign debts and declare bankruptcy when a devaluation occurs.

Some authors as Calvo and Miskhin (2003) describe a view that emerged in the aftermath of the Asian crisis that the fixed exchange rate regime was in part responsible for the depth of the macroeconomic crisis. Although there was no explicit institutional guarantee that the exchange rate would remain fixed, the stability of the exchange rate for long period induce local financial insitutions to borrow dollars abroad and then loan for domestic borrowers in dollars, without adequate protection against exchange rate risk. However, when a surge of foreign investment stops, the existing exchange rate becomes unsustainable and the borrowers were unable to repay their dollar-denominated loans. Eichengreen and Hausmann (1999), in its turn, emphasizes moral hazard and in the distorting consequences of implicit guarantees. These guarantees stem from the disposition of governments to provide bailouts to domestic financial market participants and from the willingness of the international community to rescue countries in trouble. They imply that investors do not face the full risks of their investments, which in turn creates an incentive to take on excessive risk. It is this excessive risk taking that is at the root of financial fragility. In their view, the implicit government guarantee of a fixed exchange rate regime is fundamentally linked to firms' decisions to protect themselves or not against exchange rate risk, and not to the choice of currency composition of debt. They argue that foreign currency loans could be the only option for long-term loans.

Few articles empirically test at firm level whether there is a relationship between exchange rate regimes and firms' decisions to borrow in foreign currency without protect themselves against exchange rate risk. Using a sample of Mexican firms, Martinez and Werner (2002) showed that exports are the main determinant of foreign currency debt in a floating exchange rate regime, but not in a fixed exchange rate regime. In turn, Rossi (2009) and Cowan et al. (2005) show that Brazilian and Chilean firms, respectively, reduced their foreign currency debt and increased their hedge positions following the adoption of a floating exchange rate regime. In general, the evidence is consistent with the hypothesis that there is excessive borrowing in foreign currency in fixed exchange rate regimes.

The evidence, however, does not link directly the unhedged foreign debt to an implicit government guarantee of the pegged exchange rates. The documented correlation between fixed exchange rate regimes and foreign debt could be driven by the same economic conditions that led the government to opt for a fixed-exchange rate regime. The main contribution of this article is to test empirically the impact of these government guarantees on foreign currency debt. Do they really matter and induce excessive borrowing in foreign currency?

To answer this question, we use data surrounding the Brazilian currency crisis of January 1999, which culminated in the fixed exchange rate regime changing to a floating regime. In the context of this regime change, we argue herein that the impact of the government guarantees can be estimated through the change (before and after the adoption of floating exchange rate regime) of the foreign currency debt of two groups of firms: those that believed in the guarantees and those that did not.

For the firms that believed in the government guarantees, the change in foreign debt captures the removal of the implicit guarantees, as well as other macroeconomic effects related to the regime change. In contrast, the change in foreign debt of firms that did not believe in the guarantees captures only the macroeconomic effects. By comparing the foreign debt changes

of these two groups, we exclude the macroeconomic effects and obtain the impact on foreign debt of losing the fixed regime's implicit insurance. Our task, then, is to identify a treatment group of firms that believed in government guarantees, and a control group with firms that did not.

Obviously, confidence in the implicit government guarantees of the fixed exchange rate regime is not of the zero or one type, as the preceding paragraph suggests. In light of this, the criterion for selecting the firms had to be such that the treatment group consisted of firms whose decision-makers had considerable confidence in the guarantees of the fixed exchange rate regimes, while the control group consisted of firms whose controllers had serious doubts about the credibility of the guarantees.

There is a natural candidate for the treatment group: the group of firms with debt in foreign currency who did not hedge their currency risk during the fixed exchange rate regime. Undoubtedly, this group contains firms that firmly trusted the government's commitment to not devalue the currency, because it would be unreasonable for them to pay hedge costs if they perceived no threat of devaluation.[1] In turn, firms that hedged their debt are natural candidates for our control group of firms that were skeptical about the implicit guarantees of the fixed exchange rate regime. However, what is the level of hedge that indicates that a firm was skeptical enough to be included in the control group?

To understand the trade-offs involved in determining the hedge cutoff point, consider the case of public health insurance. Even if a citizen considers the free medical and hospital service to be inadequate, he does not necessarily purchase the most comprehensive private health insurance available. The extent of coverage acquired will be based on the best cost-benefit ratio according to the individual's profile. Likewise, the decision-makers of firms with foreign debt do not necessarily hedge 100%, even if they seriously question the credibility of the implicit guarantees of the fixed exchange rate regime. So if we adopted a cutoff point of 100% foreign exchange coverage, several firms would be unduly excluded from the control group.

If a very high cutoff point is likely to exclude many firms that questioned the government guarantees, a very low cutoff point leads to the opposite problem: the control group would have many firms that, despite their hedge positions, had a reasonable degree of confidence in the fixed regime guarantees. Thus, the cutoff point must be neither too high nor too low.

Data detailed in the text shows that, three years after Brazil's fixed exchange rate regime ended, the firms with debt in foreign currency covered an average of 30% of their exchange rate risk. Conceivably, three years is long enough for the firms to adjust to the floating exchange rate regime, erasing any type of implicit guarantee that could have existed in the fixed exchange rate regime. Accordingly, we use 30% as a cutoff point for determining which firms were skeptical about the government guarantees at the time of the fixed exchange rate regime. This means the firms that did not trust in the guarantees are those that, in the fixed exchange rate regime, had coverage exceeding the 30% average that prevailed in a period when the guarantees unquestionably did not exist.

We have, then, the selection criterion for the group of firms that did not trust the guarantees of the fixed exchange rate regime (control group): firms with high foreign currency debt that hedged at least 30% of their debt. For the group of firms that trusted the guarantees (treatment group), we selected those that had debt in foreign currency during the fixed exchange rate regime, but still did not hedge this debt. Data on these two groups provides evidence that the

guarantees are relevant to foreign debt if, after the change in the exchange rate regime, the treatment group reduced their indebtedness in foreign currency significantly more than the control group. In theory, this difference is explained by the removal of the implicit guarantee.

We use a difference-in-differences approach, in which firm-specific characteristics are included as control variables to deal with possible selection bias if the two groups had different foreign currency debt trends immediately prior to the regime change. The results did not confirm the hypothesis that the implicit guarantees of fixed exchange rate regimes encourage borrowing in foreign currency. Between 1998 and 2000 (the years before and after the change in exchange rate regime), the group of firms that did not hedge raised their ratio of foreign currency debt over total debt an average of 1.3 percentage points more than the group of firms that hedged. However, this difference was not statistically significant, contradicting the hypothesis about the relevance of the government guarantees as an incentive for unhedged foreign-corrency debt.

The irrelevance of the government guarantees is robust to different measures of debt in foreign currency and to different criteria to determine the groups of firms that did and did not believe on the implicit guarantees.

The remainder of the article is organized as follows: Section 2 describes the database and presents the sample's descriptive statistics; Section 3 describes the econometric model; Section 4 presents the article's main results and the robustness tests; and lastly, Section 5 concludes.

## 2. Description of Data

### 2.1 Sample Period

The 1999 Brazilian currency crisis, which culminated in a change from a fixed to a floating exchange rate regime, is the basis of our study. As Figure 1 shows, the crisis, which took place in January of 1999, caused a sharp currency devaluation: 47.1%. This study's point of departure is comparing firms' foreign currency debt before and after this crisis.

The two years prior to the crisis of 1999 were characterized by a large difference in domestic and international interest rates: 16.5% in 1997 and 20.2% in 1998.[2] The high cost of hedge, however, neutralized much of the relative gains of borrowing abroad, despite the low volatility of the real exchange rate in 1997 (2.6%) and 1998 (3.1%).[3] This combination of low exchange rate volatility, large interest rates differential and high hedging costs could in theory encourage borrowing in foreign currency, without adequate protection from exchange rate risk.

While the volatility of the real exchange rate was quite low in 1997 and 1998, it rose significantly after the floating of the exchange rate: 7.2% in 2000 and 23.3% in 2001. Along with the increased volatility of the real exchange rate, the interest rate differential fell to 11% in 2000 and 16.1% in 2001.[4] Comparing the post-crisis and pre-crisis years, in addition to the regime change, we see significant movements in key macroeconomic factors that are important determinants of decisions on borrowing in foreign currency. This combination of factors makes it difficult to estimate the impact of the implicit insurance of the fixed exchange rate regime on foreign debt-related decisions. Nevertheless, careful selection of the treatment and control groups allowed us to isolate the effects of the implicit guarantees from the macroeconomic effects.

## 2.2 Sample Selection and Data Sources

Having established the sample period, we now describe the firms in the sample. Our starting point consists of all 477 Brazilian publicly held firms as of December 2004. We excluded firms in the financial and insurance sectors (43 firms); those that were not trading publicly between December of 1998 and December of 2001 (75); diversified holding firms with stakes in financial firms, or that did not report operating revenue (27); those that did not close their fiscal year in the month of December (2); and those that did not have financial statements available for the sample period (14). Three firms were also excluded because their balance sheets were practically identical to other sample firms in the same economic group.[5] After these exclusions, we ended up with an unbalanced panel of 313 firms.

The next step was to obtain information on the financial variables we would use in our analysis: total assets, total revenue, operating profitability and bank debt, the latter being the sum of debt in foreign currency and debt in domestic currency, including debentures. All these financial variables are from consolidated financial statements of the 313 firms in our sample. While total assets, total revenue, operating profit and debentures were obtained from the Economática database, the currency composition of bank debts and assets was collected from the explanatory notes of consolidated balance sheets.

We used the firms' consolidated financial statements because many publicly held Brazilian firms are holding firms, without operating income or foreign currency debt in the period analyzed. Additionally, many of the firms analyzed, even those that were not holding firms, borrowed abroad or owned foreign currency assets through their subsidiaries. By consolidating the data, we also analyzed unlisted firms that are controlled directly or indirectly by firms in our sample.

In addition to the financial variables, we collected import and export data on the firms in our sample from the Foreign Trade Secretariat (SECEX). These data are important to our study for two reasons. First, import and export data allow us to analyze the competitiveness effect of currency depreciation, and second, they can influence currency mismatches and investment decisions and are thus important variables in our econometric analysis. Both the export and import values were converted into domestic currency using the year's average exchange rate, and like the other variables described in this section, subsequently deflated by the Consumer Price Index (IPCA).[6]

The financial data we gathered let us identify the 183 of our 313 sample firms that, on December 31, 1998 (just 13 days before the floating exchange rate regime was adopted), had debt in foreign currency exceeding 5% of their total assets. Focusing on firms with foreign debt over 5% of assets excludes firms for which managing exchange rate risk was a minor issue. Our final sample consists of these 183 firms with significant exposure to currency risk.

Lastly, we identified which of the 183 firms in our sample belong in the treatment group and which in the control group. As we explained in the introduction, the percentage of foreign currency debt with hedge coverage during the fixed exchange rate regime was the dividing line between the two groups. Establishing the treatment and control groups, then, required calculating each sample firm's amount of currency mismatch.

We defined currency mismatch as foreign currency debt net of foreign currency assets and positions in foreign exchange derivatives. Foreign currency debt is the sum of banking loans

and trade credit denominated in foreign currency. Foreign currency assets are the sum of financial investments denominated in foreign currencies and foreign currency derivatives. Firms without currency mismatches thus hedged 100% of its foreign currency debt.

Data on foreign currency debt and assets were collected from the explanatory notes of the firms' consolidated annual balance sheets, obtained from the Securities and Exchange Commission of Brazil (CVM). Positions in foreign currency derivatives reported in balance sheet notes include currency swaps contracted domestically or overseas as well as other currency derivatives like dollar options, futures and forwards.[7] However, many of the firms that report positions in foreign currency derivatives do not specify the amounts, but rather report only their spending and revenues on these contracts. Other firms report positions in foreign currency derivatives together with positions in interest rate derivatives; in these cases we did not use this balance sheet information. To minimize such gaps, we complemented the data with information on foreign currency swaps between financial institutions and non-financial firms registered with the Clearing House for the Custody and Financial Settlement of Securities (CETIP), from 1999 and 2002.

### 2.3 Sample Statistics

Table 1 presents the descriptive statistics of the 183 firms in our sample. The first two lines of the table show that foreign currency debt changed little in the 1997-2001 period. On average, foreign debt amounted to 22.2% of total assets (65.2% of total debt). Total debt as a percentage of assets was also stable after 1998, with an average of 36.1% between 1997 and 2001.

The table also shows that while the firms on average hedged only 7% of their foreign currency debt in 1997, this percentage raised to 30.1% in 2001. This increase in hedge positions reflects a reduction in currency mismatches. While in the year prior to the exchange rate float in 1999, average currency mismatches were 18.4% of assets, in 2000 they were 16% and in 2001, 13.3%. In summary, the change in exchange rate regime led to a reduction in firms' unhedged foreign currency debt, and this reduction occurred largely by increasing hedge positions.

On the operational side, Table 1 shows that exports changed little, contributing to 11.3% of total revenue. Imports (as a percentage of total revenue) tended downward in the sample period, with an average decrease of 44% between 1997 and 2001. Parallel to the downward trend of imports, average total assets measured in dollars fell significantly in the period. However, this drop was largely due to the accounting impact of the currency devaluations on values converted into dollars. Lastly, operational profit rose continuously in the sample period, increasing from 3.3% of assets in 1997 to 8.5% in 2001.

## 3. The Model

In this section, we use the difference-in-differences approach to investigate the impact of the implicit guarantees of fixed exchange rate regimes on borrowing in foreign currency. To this end, we divide our sample into a treatment group and a control group. We include in the treatment group firms that trusted the implicit guarantees, and in the control group firms that were skeptical about the implicit guarantees. In the treatment group, the change in foreign currency debt after the adoption of the floating exchange rate regime should reflect the removal of the fixed rate regime's implicit guarantees as well as the macroeconomic effects of the regime change. In contrast, the debt change of the control group should reflect only the

macroeconomic effects. After all, the removal of implicit guarantees could not imply losses for those who did not take them seriously. The difference in the changes in foreign currency debt between these two groups therefore gives us the impact of the implicit guarantees on the foreign currency debt.

There are two obvious difficulties with implementing the difference-in-differences approach in this context: How should we select the firms for the treatment and control groups? How should we control for potential biases in selecting the two groups? The next two sections address these two difficulties.

### 3.1 Treatment and Control Groups

As we argued in the introduction, the firms with unhedged foreign currency debt prior to the exchange rate float are natural candidates for the group of firms that trusted in the implicit guarantees of the fixed exchange rate regime. The logic is that a firm that trusts the government's promise to not devalue the currency has no reason to embrace hedging costs. Therefore, the treatment group is composed of the 90 sample firms that did not have hedge positions in December of 1998, despite their foreign debt exceeding 5% of their assets.

Let us now look at the control group, the firms that were skeptical about the government's guarantees to not devalue the currency. Analogous to the criterion for selecting the treatment group, the firms with fully hedged foreign currency debt are natural candidates for the control group. However, hedging costs make it highly unlikely that a firm would cover 100% of its exposure, even if its decision makers were extremely skeptical about the implicit guarantees of the fixed exchange rate regime. If our selection criterion for the control group required 100% forex hedge, we could unduly exclude from the control group many firms skeptical about the implicit guarantees.

Table 2 shows that, in fact, only 5% of the 93 firms with hedge positions fully covered their foreign currency debt just prior to the rate regime change. The table also shows that 25% of these firms hedged a maximum 8.6% of their debt, while another 25% had hedge positions exceeding 53.2% of their foreign currency debt. This distribution shows that there is a trade off in choosing the hedge cutoff point. On the one hand, a very high cutoff point would probably exclude from the control group a considerable number of firms that did not trust the implicit guarantees, thus diminishing the power of our tests; on the other hand, a low cutoff point would probably include many firms with relatively strong confidence in the implicit guarantees.

In the baseline tests, we use 30% as the cutoff value for inclusion in our control group. This cutoff corresponds, approximately, to the average hedge position of the firms analyzed in December of 2001, three years after the floating of the exchange rate, when, conceivably, implicit guarantees no longer play a role in the firms' capital structure decision. Thus, the firms that did not trust the implicit guarantees were those that, under the fixed exchange rate regime, had hedge positions exceeding the prevailing 30% average of the period when implicit guarantees unquestionably did not exist. With this cutoff value, the control group consists of 40 firms, meaning we eliminated from the sample 53 firms that hedge less than 30% of their foreign currency debt.

Table 3 shows tests of equality of means of characteristics of the firms in the treatment and control groups. On average, 60.6% of the treated firms' debt was denominated in or indexed to foreign currency, and their total debt was 37.5% of assets. For the control group (firms that did

not trust the guarantees), the percentage of debt in foreign currency was greater, 73.6%, but total debt was slightly lower, 32.4% of assets. While the difference between the percentage of foreign currency debt between the two groups is statistically significant (*p*-value of 0.001), the same did not occur with the difference in total debt over assets.

Table 3 also shows that firms that firms that did not trust the guarantees (the control group) hedged an average of 64.9% of their foreign currency debt (median of 54%). The average currency mismatch of these firms amounted to 8.7% of their assets. By design, the treated firms did not hedge, represing an average currency mismatch of 30.4% of assets. Both average differences in hedge positions and currency mismatchs are statistiscally significant with a *p*-value of 0.000.

One could argue that the higher currency mismatch of the treated firms could partly reflect the higher percentage of export revenue, and that therefore the differences between the two groups was spurious with regards to the estimated costs of changing the exchange rate regime. Contrary to this argument, however, the unhedged firms exported significantly less than the hedged firms did in 1998. The difference in exports (as a percentage of total revenue) between the two groups was 9.4%, with *p*-value of 0.012, and average imports did not differ significantly between the groups.

The table also shows that the firms that hedged their debt were significantly larger than the treatment group firms. Lastly, there were no significant differences between the two groups in terms of operating profitability.

### 3.2 Difference-in-Differences Estimator and Selection Bias

Supposing that decisions regarding currency composition of debt made by the firms in our control group did not depend on the implicit guarantees of the fixed exchange rate regime, a difference-in-differences estimation of the impact of the implicit guarantees on borrowing in foreign currency is given by:

$$\left( \frac{\sum_{i \in treatment} Y(i,t)}{M} - \frac{\sum_{i \in treatment} Y(i,t-1)}{M} \right) - \left( \frac{\sum_{i \in control} Y(i,t)}{N} - \frac{\sum_{i \in control} Y(i,t-1)}{N} \right). \qquad (1)$$

In equation (1), Y(i,t) is the foreign debt of firm i in the year t, M is the number of firms in the treatment group (firms that did not hedge) and N is the number of firms in the control group. The first difference gives us the change in the treatment group's foreign currency debt after the exchange rate floated, and the second gives us the same change for the control group. When determining the difference of these two differences, we exclude the macroeconomic effects of the change in exchange rate regime, thus obtaining an estimate of the impact of the implicit guarantees on borrowing in foreign currency.

Despite exclusion of the macroeconomic effects, equation (1) may not accurately reflect the impact of the implicit guarantees. The estimator would be biased, for example, if the two groups had different foreign currency debt trends immediately prior to the regime change. In this case, the difference-in-differences estimator would not disentangle the removal of the implicit guarantees from differences in pre-existing trends.

The standard way of accounting to pre-existing trends is to obtain the difference-in-differences estimator using a regression model, in which firm-specific characteristics are introduced as control variables. Following Abadie (2005), we consider the following econometric specification:

$$Y(i,t) = \mu + X(i) \cdot \pi(t) + \tau \cdot D(i,1) + \delta \cdot t + \alpha \cdot D(i,t) + \varepsilon(i,t), \qquad (2)$$

where Y(i,t) is the percentage of foreign currency debt in total debt for firm i in period t.
In equation (2), the firms are observed in a pre-treatment period (t = 0) and in a post-treatment period (t=1). D(i,t) is an indicator variable that takes the value one if firm i is in the treatment group (those that were not hedged in December of 1998) and if the exchange rate regime is floating. Since the firms are only exposed to the floating exchange rate regime in period t=1, we have D(i,0) =0 for all of i and D(i,1) =1 for the treated firms and D(i,1)=0 for those not treated. While the indicator variable D(i,1) takes into consideration differences between the treatment and control groups of foreign currency debt prior to the exchange regime change, D(i,t) captures the impact of the implicit guarantees on this difference. The coefficient $\alpha$, therefore, is our difference-in-differences estimator conditional to the vector of characteristics X(i).

Equation (2) contains a trend component common to all the firms, t, the error term $\varepsilon(i,t)$, and a vector X(i) of the firms' characteristics, which controls differences in foreign debt trends of the treatment and control groups. So that vector X(i) does not capture part of the effects of the exchange rate regime change, the firms' characteristics are fixed in the year 1998. The characteristics of the controlled firms are: import and export levels (normalized by total revenue), the logarithm of total assets and operating profit over assets. The idea here is that export firms should be less likely to reduce foreign debt, since exporting is positively correlated with the exchange rate, at least partially offsetting exchange rate risk. Likewise, importers should be more likely to reduce their exposure to foreign currency in periods of exchange rate uncertainty. Larger firms have more access to international credit lines, as do firms that are more lucrative. Moreover, low profitability can lead to financial distress problems that constrain the firms' ability to buy the instruments that hedge their currency risk. Lastly, note that the vector of the coefficients of X(i), $\pi_t$, varies over time. For example, a firm's profitability may be an important determinant of its foreign currency debt trend in one exchange rate regime and irrelevant in another regime.

Differentiate equation (2) with respect to the time t yields:

$$Y(i,1) - Y(i,0) = \delta + X(i)' \cdot \pi + \alpha \cdot D(i,1) + \eta_{it}, \qquad (3)$$

where $\pi = \pi(1) - \pi(0)$ and $\eta_{it} = \varepsilon(i,1) - \varepsilon(i,0)$.

One of the nice features of specification (3) is that it makes it clear that the difference-in-differences method rules out estimation biases due to constant ommited variables. These omitted variables are eliminated by the first differences. Based on equation (3), we adopt the following econometric specification to estimate the impact of the implicit guarantees of fixed exchange rate regime on the currency composition of debt:

$$\begin{aligned}&(\text{Foreign Debt/Total Debt})(i,2000) - (\text{Foreign Debt/Total Debt})(i,1998) = \\ &\delta + \Pi_1 \text{Exports/Revenue}(i) + \Pi_2 \text{Imports/Revenue}(i) + \Pi_3 \text{LogAssets}(i) \\ &+ \Pi_4 \text{Operacional Profit/Ativo} + \alpha I(\text{Mismatched}) + \eta_{it}\end{aligned} \quad (4)$$

In equation (4), the dependent variable captures the change in the ratio of foreign currency debt to total debt before and after the exchange rate regime change. The year 1998 is the base period (pre-floating) while 2000 is the post-floating period. We exclude the year 1999 from the analysis to give some time for the firms adjust their capital structure to the new exchange rate regime. The variable I (Mismatched) is a binary variable that takes the value one for firms in the group with large currency mismatches in 1998, and zero otherwise.

If the implicit guarantees of a fixed exchange rate regime are relevant to borrowing in foreign currency, firms with unhedged foreign currency debt should reduce their debt in foreign currency more than firms that hedged their forex exposure. In this case, the estimated coefficient $\alpha$ should be negative. On the contrary, $\alpha$ should be statistically equal to zero. In these tests, we use firm level clusters to estimate standard errors robust to serial correlation and heteroscedasticity.[8]

## 4. Empirical Results

Column (A) of Table 4 reports the results of OLS estimates of equation (4) that includes the difference-in-difference coefficient of the variable I (Mismatched). In this specification, the foreign debt of the group of firms with mismatches increased 1.3 percentage points more than the others, but the difference is insignificant (*p*-value of 0.813). This result suggest that the government guarantees of the fixed exchange rate regimes are not relevant to decisions about borrowing in foreign currency. In other words, increases in foreign debt under fixed-exchange regimes are not due to implicit guarantees that the government will not devalue the exchange rate.

It is always possible, however, that the lack of statistical significance in the difference in the two groups' debt change reflects specification rather the irrelevance of the implicit guarantees to foreign debt decisions. For example, the difference in the changes may be statistically null if the firms that reported losses from the exchange rate float took more than two years to adjust their capital structures. To address this possibility, we re-estimated equation (4) substituting the year 2000 with 2001 as the post-crisis year. The results, described in Column (B), were basically the same. The firms with mismatches raised the percentage of foreign currency debt in the 1998-2001 period by 7.5 percentage points more than the firms that hedged, but the increase was not statistically significant (*p*-value of 0.202). Once again, the results indicated that the implicit guarantees are irrelevant to foreign debt decisions.

In all regressions, the variables that control for selection bias were not statistically significant. In fact, only the constant was statistically significant in the regression with 2001 as the post-crisis year). Its negative sign suggests an average reduction in foreign currency debt following the exchange rate regime float, which confirms the results obtained by Martínez and Werner (2002), Rossi (2009) and Cowan et al. (2005).

### 4.1 Robustness tests

The difference-in-differences approach assumes that the variable of interest (i.e., foreign currency debt over total debt) follows the same temporal trend in the treatment and control groups. However, the groups' distinct characteristics (possibly not observable) may invalidate this identification assumption and thus contaminate the results.

In order to investigate this possibility, we estimated equation (4) between the years 1997 and 1998, when there were no significant changes in the exchange rate or exchange rate regime. If the previous results were contaminated by a trend, we should see distinct and significant changes in the foreign currency debt of the treatment and control groups in this window of time that did not include a regime change.

The results described in Table 5 did not confirm the different trends assumption. Although the treated firms had reduced their borrowing in foreign currency more than the control group firms, these reductions were not statistically significant.

As an additional test, we substitute the variable foreign currency debt over total debt by foreign currency debt over total assets as our dependent variable in the regressions. Table 6 shows that using this alternative normalization of foreign debt does not alter our principal result: the implicit guarantees of the fixed exchange rate regime were not relevant to firms' decisions regarding their foreign debt. The table's Columns (A) and (B) show that the firms with mismatches reduced relatively more their foreign debt over assets between 1998 and 2000 by 0.2 percentage point (without selection controls) and 1.5 p.p. (with selection controls). Between 1998 and 2001, the reduction was 0.5 p.p. more (Column C). These reductions were not statistically significant in any of these cases.

As a final robustness test, we changed the minimum percentage of hedge that determines whether a firm belongs to the control group of firms that do not trust the implicit guarantess of a fixed exchange-rate regime. In the baseline regressions, the minimum level of hedge – 30% of the foreign currency debt – is the average hedge in December of 2001, almost three years after the change in exchange rate regime. On this date, the firms should have had enough time to establish the optimal level of hedge, which is no longer influenced by the implicit guarantees. One could argue, however, that the firms with hedge positions just over 30% could be influenced by the implicit guarantees. In order to test this possibility, we estimated equation (4) using a stricter cutoff value for establishing the control group, 50%. This new value reduced the control group from 40 to 26 firms. Table 7 shows that the results did not change qualitatively in relation to those obtained with the 30% cutoff point: the foreign debt variation of the two groups remained statistically insignificant.

A second concern regarding the control groups is the date for defining which firms had hedged foreign currency debt.When forming the control group using data on December 1998, we may have included firms that had abruptly changed both their currency mismatches and their foreign currency debt in anticipation of the January 1999 regime change. To address this concern, we used December 1997 as the base date for selecting the control group. We thus estimated our model for the new treatment and control groups, with the initial period for the change in foreign debt as of December 1997. Table 8 shows that the difference in the two groups' changes remained statistically insignificant, contrary to the assumption that the implicit guarantees are relevant.

## 5. Conclusions

Following the speculative attacks that provoked the collapse of many fixed exchange rate regimes in the 1990s, some authors argue that these regimes involve an implicit guarantee from the government against currency devaluation, and that these guarantees induce firms to borrow in foreign currency without adequate exchange rate risk protection.

In this article, we test the impact of this government guarantees on firms' borrowing in foreign currency using data on Brazilian firms before and after January of 1999, when Brazil's fixed exchange rate regime ended. To separate the effects of this regime change from the macroeconomic effects, we identified two groups of firms. The treatment group consisted of firms with sufficient confidence in the fixed regime's implicit guarantees to leave their foreign debt unhedged. The control group consisted of firms sufficiently skeptical about this guarantees that they hedged a significant portion of their foreign currency debt. While the change in foreign debt (before and after the exchange rate was floated) of the treatment group should reflect both the loss of the implicit insurance and the macroeconomic effects of the regime change, the change in foreign debt of the control group should reflect only the macroeconomic effects. If we take the difference in the two groups' changes, then we obtain an estimate of the impact on firms' foreign currency debt of removing the implicit insurance.

Compared with firms who hedged their foreign currency debt, firms with unhedged foreign currency debt didn´t reduce their foreign currency debt in the period surrounding the regime change (1998-2000). The difference in these two groups' debt changes was not statistically significant. This result is robust to different foreign currency debt measures, different temporal trends and different control groups, suggesting that the implicit guarantees of the fixed exchange rate regime do not exercise considerable influence on borrowing in foreign currency.

Of course, the results of this work do not suggest that the implicit guarantees of fixed exchange rate regimes are irrelevant to the firms. The implicit guarantees must affect the cost of hedging, which is unquestionably an important consideration in hedging decisions. One subject we intend to explore in future works is how the implicit guarantees of a fixed exchange rate regime influence the costs of hedging foreign exchange.

## Endnotes

1. However, there is a potential bias in this selection criterion: financial or liquidity issues can keep companies with foreign currency debt from hedging, even if they do not trust the implicit guarantees of the fixed exchange rate regime. In the econometric analysis, we use the companies' profitability to control this selection bias.

2. To measure the cost of borrowing in domestic currency, we used the average annual interest rate built into swaps contracts with fixed interest rates (ID) versus 360-day floating interest rates. To measure the cost of borrowing in foreign currency, we used the average annual interest rate of one-year US Treasury issues.

3. For example, the premium built into exchange rate futures contracts, calculated by the interest rate on one-year dollar futures contracts versus the spot rate, was 11.4% in 1997 and 13.2% in 1998. The volatility of the real exchange rate was calculated by the annual

standard deviation of the monthly nominal interest rates normalized by inflation rates using the Amplified Consumer Price Index (IPCA).

4. The premium built into one-year dollar futures contracts fell to 8.2% in 2000 and to 12.7% in 2001.

5. From each pair of firms with very similar balance sheets, we included the one with higher total assets.

6. To reconcile SECEX data and financial data, we identified the firms by their Corporate Taxpayer Identification Numbers (CNPJ). This allowed us to consider firms with different CNPJs separately, even if they are in the same group. Since we used consolidated data, we also obtained import and export figures for 334 firms that are subsidiaries or associate firms of controlling firms in our sample. Our export measure was either the consolidated export figures reported in balance sheet explanatory notes or the sum of the exports of the controlling and controlled firms obtained from the SECEX (sum weighted by the respective stock holdings), whichever was greater. For imports we used only the SECEX database, since most financial statements do not report import spending.

7. To accurately assess positions in currency options, we must know each option's strike price. As this detailed information was unavailable for most of the firms, we considered the consolidated financial positions in options reported in balance sheet notes.

8. Bertrand et al. (2004) discuss the gains of using robust standard errors in the difference-in-differences approach.

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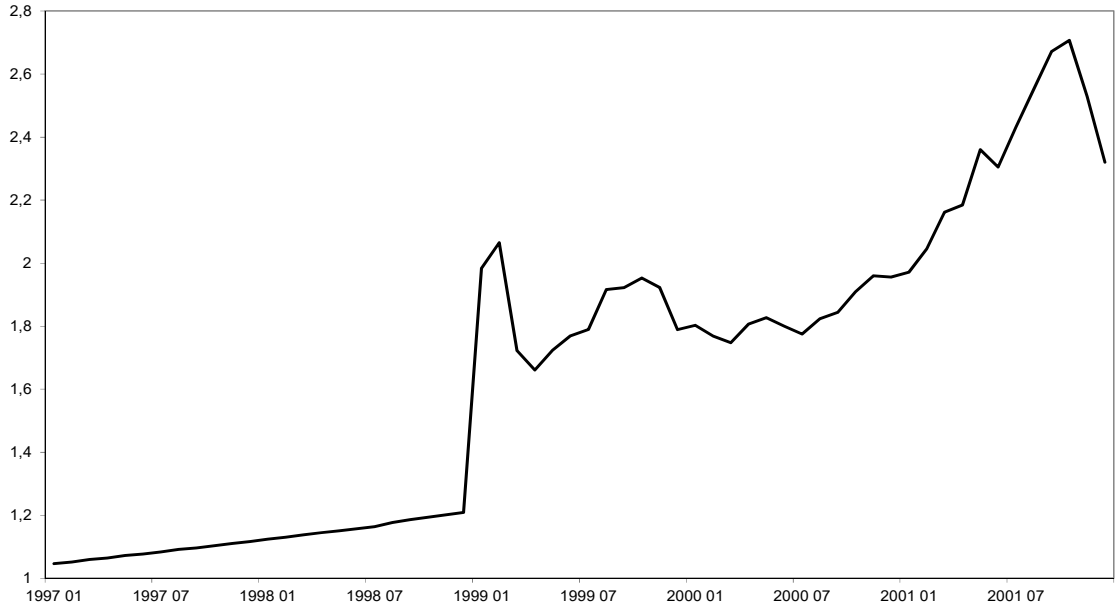
**Figure 1. Nominal exchange rate (Real/US$)**




Source: Banco Central do Brasil.

**Table 1: Descriptive Statistics**

| Variable / Year | 1997 | 1998 | 1999 | 2000 | 2001 | Mean |
|---|---|---|---|---|---|---|
| Foreign currency debt / Total debt | 64,9% | 66,4% | 64,9% | 65,6% | 64,9% | 65,3% |
| Foreign currency debt / Total asset | 20,5% | 22,6% | 23,4% | 22,1% | 23,2% | 22,4% |
| Total debt / Total asset | 33,2% | 36,6% | 38,5% | 35,1% | 37,1% | 36,1% |
| Hedge / Foreign currency debt | 7,0% | 13,4% | 14,8% | 19,0% | 30,1% | 16,9% |
| Currency mismatch / Total asset | 18,6% | 18,4% | 18,7% | 16,0% | 13,3% | 17,0% |
| Exports / Total revenue | 11,5% | 11,3% | 10,9% | 11,3% | 11,7% | 11,3% |
| Imports / Total revenue | 6,6% | 5,0% | 4,6% | 3,8% | 3,7% | 4,7% |
| Total asset (US$ million) | 4.063 | 3.608 | 2.582 | 2.491 | 2.245 | 2.998 |
| Operational profit / Total asset | 3,3% | 4,4% | 7,0% | 7,4% | 8,5% | 6,1% |

Notes: This table presents the average annual values of characteristics of the 183 firms that comprise our sample: firms with foreign debt exceeding 5% of assets in December of 1998. Foreign currency debt is calculated as the sum of all debt indexed to or denominated in foreign currency, borrowed internationally or domestically. Total debt is the sum of all liabilities. Hedge is the sum of the value of financial assets denominated in foreign currency and of foreign currency derivatives. Foreign currency derivatives include holdings in currency swaps contracted domestically or overseas and in other currency derivatives like dollar options, futures and forwards. Currency mismatch is foreign currency debt net of hedge positions. Exports are sales to foreign countries reported by either the notes in the consolidated financial statements by SECEX (Brazilian Office of Foreign Trade), whichever is greater. Imports are purchases from foreign countries by the sample firms or any of its affiliates, as reported by SECEX. Both exports and imports were converted into domestic currency using the average exchange rate of each year. Total assets were converted into dollars using the exchange rates at the end of each year. Operating profit is profit before tax and interest.

**Table 2: Hedge Distribution of the Firms in December of 1998**

| Percentile | Hedge / Foreign Currency Debt |
|---|---|
| P5 | 2,3% |
| P10 | 4,0% |
| P25 | 8,6% |
| P50 | 25,7% |
| P75 | 53,2% |
| P90 | 84,2% |
| P95 | 100,0% |

Notes: This table presents the distribution of hedge among the 93 firms that hedged and had foreign currency debt exceeding 5% of their assets in December of 1998, just before the exchange rate regime changed. Hedge positions are the sum of the value of financial assets denominated in foreign currency and of foreign currency derivatives. Foreign currency derivatives include holdings in currency swaps contracted domestically or overseas and in other currency derivatives like dollar options, futures and forwards. Foreign currency debt is the sum of all debt indexed to or denominated in foreign currency, borrowed internationally or domestically.

**Table 3: Summary Statistics for Treatment Group (firms that believed in the implicit guarantees) and Control Group (firms that did not believe in the implicit guarantees)**

| Groups of Firms | Treatment Group (N=90) | | Control Group (N=40) | | Mean Difference (*p*-value of t-test) |
|---|---|---|---|---|---|
| Variables | Mean | Median | Mean | Median | |
| Foreign currency debt / Total debt | 60.6% | 63.3% | 73,6% | 74,1% | -13.1%*** (.001) |
| Foreign currency debt / Total asset | 20,4% | 16,3% | 23,4% | 20,4% | -3% (.225) |
| Total debt / Total asset | 37,5% | 31,0% | 32,4% | 32,8% | 5.1% (.197) |
| Hedge / Foreign currency debt | 0,0% | 0,0% | 64,9% | 54,0% | -64.9%*** (.000) |
| Currency mismatch / Total asset | 20,4% | 16,3% | 8,7% | 8,3% | 10.3%*** (.000) |
| Exports / Total revenue | 6,4% | 0,6% | 15,9% | 8,0% | -9.4%** (.012) |
| Imports / Total revenue | 5,3% | 1,4% | 4,7% | 1,5% | 0.6% (.746) |
| Log total assets | 13,60 | 13,62 | 14,27 | 14,31 | -0.67** (.015) |
| Operational profit / Total asset | 4,6% | 4,0% | 5,5% | 5,3% | -1% (.519) |

Notes: All the firms had foreign currency debt exceeding 5% of their assets. The treatment group consists of 90 firms that did not have hedge positions in 1998. The control group consists of 40 firms that hedged at least 30% of their foreign currency debt. Foreign currency debt is total debt indexed to or denominated in foreign currency, whether borrowed domestically or overseas. Total debt is the sum of all liabilities foreign currency or in domestic currency. Hedge is the sum of financial assets in foreign currency and foreign currency derivatives. Foreign currency derivatives include currency swaps contracted domestically or overseas as well as other currency derivatives like dollar options, futures and forwards. Currency mismatches are defined as foreign currency debt net of hedge positions. Exports are sales to foreign countries reported by either the notes in the consolidated financial statements by SECEX (Brazilian Office of Foreign Trade), whichever is greater. Imports are purchases from foreign countries by the sample firms or any of its affiliates, as reported by SECEX. Both exports and imports were converted into domestic currency using the average exchange rate of each year. The log of total assets is the logarithm of total assets. Operating profit is profit before tax and interest. The far right column shows the differences in means and the p-values for tests of equality of means with different variances between the treatment and control group for each variable. The coefficients that are significant at 10, 5 and 1% levels are indicated by *, ** and ***, respectively.

**Table 4. Do Implicit Guarantees of Fixed Exchange Rate Regimes Encourage Foreign Debt?**

| | $\Delta$ (Foreign Currency Debt/Total Debt)$_t$ | |
|---|---|---|
| | (A) | (B) |
| I(Mismatched) | 0.013 | 0.075 |
| | (0.813) | (0.202) |
| Exports / Total Revenue | 0.143 | 0.104 |
| | (0.240) | (0.453) |
| Imports / Total Revenue | -0.068 | -0.040 |
| | (0.782) | (0.899) |
| Log Total Assets | 0.016 | 0.029 |
| | (0.359) | (0.118) |
| Operational Profit / Total Asset | -0.078 | 0.004 |
| | (0.859) | (0.994) |
| Constant | -0.278 | -0.506* |
| | (0.257) | (0.056) |
| Obs. | 130 | 125 |
| $R^2$ | 0.02 | 0.04 |

Notes: This table contains the results of OLS estimates of equation (4) in the text. The sample comprises 183 firms with foreign currency debt exceeding 5% of their assets. The dependent variable is the change in foreign currency debt over total debt. In Columns (A), this change is between 1998 and 2000, in Column (B), between 1998 and 2001. Foreign currency debt is the sum of all liabilities indexed to or denominated in foreign currency, whether borrowed domestically or overseas. Total debt includes all liabilities whether it is denominated in foreign currency or not. The indicator variable I (Mismatched) assumes the value one for firms that did not have hedge positions in 1998 and zero for firms that hedged a minimum of 30% of their foreign currency debt. Hedge is the sum of financial assets in foreign currency and foreign currency derivatives. Foreign currency derivatives include currency swaps contracted domestically or overseas as well as other currency derivatives like dollar options, futures and forwards. Exports are sales to foreign countries reported by either the notes in the consolidated financial statements by SECEX (Brazilian Office of Foreign Trade), whichever is greater. Imports are purchases from foreign countries by the sample firms or any of its affiliates, as reported by SECEX. Both exports and imports were converted into domestic currency using the average exchange rate of each year. The log of total assets is the logarithm of total assets. Operating profit is profit before tax and interest. The coefficients significant to 10, 5 and 1% are indicated by *, ** and ***, respectively. We use clusters at the firm level to estimate standard deviations and to correct possible errors of serial correlation and heteroscedasticity. Robust *p*-values are reported in parentheses.

**Table 5: Different Temporal Trends in the Treatment and Control Groups**

| | $\Delta$ (Foreign Currency Debt/Total Debt)$_t$ | |
|---|---|---|
| | (A) | (B) |
| I(Mismatched) | -0.035 | -0.038 |
| | (0.360) | (0.361) |
| Exports / Total Revenue | | -0.057 |
| | | (0.597) |
| Imports / Total Revenue | | 0.214 |
| | | (0.497) |
| Log Total Assets | | 0.007 |
| | | (0.559) |
| Operational Profit / Total Asset | | 0.192 |
| | | (0.515) |
| Constant | 0.035 | -0.085 |
| | (0.239) | (0.666) |
| Obs. | 111 | 108 |
| $R^2$ | 0.01 | 0.03 |

Notes: This table contains the results of OLS estimates of equation (4) in the text. The sample comprises 183 firms with foreign currency debt exceeding 5% of their assets The difference in this table and Table 4 is that there was no exchange rate regime change in the testing period: the year 1997 was used for pre-crisis data and the year 1998 for post-crisis. The dependent variable is the change in foreign currency debt over total debt between 1998 and 2000. Foreign currency debt is the sum of all liabilities indexed to or denominated in foreign currency, whether borrowed domestically or overseas. Total debt includes all liabilities whether it is denominated in foreign currency or not. The indicator variable I (Mismatched) assumes the value one for firms that did not have hedge positions in 1998 and zero for firms that hedged a minimum of 30% of their foreign currency debt. Hedge is the sum of financial assets in foreign currency and foreign currency derivatives. Foreign currency derivatives include currency swaps contracted domestically or overseas as well as other currency derivatives like dollar options, futures and forwards. Exports are sales to foreign countries reported by either the notes in the consolidated financial statements by SECEX (Brazilian Office of Foreign Trade), whichever is greater. Imports are purchases from foreign countries by the sample firms or any of its affiliates, as reported by SECEX. Both exports and imports were converted into domestic currency using the average exchange rate of each year. The log of total assets is the logarithm of total assets. Operating profit is profit before tax and interest. The coefficients significant to 10, 5 and 1% are indicated by *, ** and ***, respectively. We use clusters at the firm level to estimate standard deviations and to correct possible errors of serial correlation and heteroscedasticity. Robust *p*-values are reported in parentheses.

**Table 6: Another Measure of Foreign Debt**

| | $\Delta$ (Foreign Currency Debt/Total Debt)$_t$ | | |
|---|---|---|---|
| | (A) | (B) | (C) |
| I(Mismatched) | -0.002 | 0.013 | 0.075 |
| | (0.945) | (0.813) | (0.202) |
| Exports / Total Revenue | | 0.143 | 0.104 |
| | | (0.240) | (0.453) |
| Imports / Total Revenue | | -0.068 | -0.040 |
| | | (0.782) | (0.899) |
| Log Total Assets | | 0.016 | 0.029 |
| | | (0.359) | (0.118) |
| Operational Profit / Total Asset | | -0.078 | 0.004 |
| | | (0.859) | (0.926) |
| Constant | -0.015 | -0.278 | -0.233* |
| | (0.357) | (0.257) | (0.072) |
| Obs. | 130 | 130 | 125 |
| $R^2$ | 0.00 | 0.06 | 0.08 |

Notes: This table contains the results of OLS estimates of equation (4) in the text. The sample comprises 183 firms with foreign currency debt exceeding 5% of their assets. The only difference between this and Table 4 is the dependent variable, which is now the change in foreign currency debt over total assets. In Columns (A) and (B), this change is between 1998 and 2000, in Column (C), between 1998 and 2001. Foreign currency debt is the sum of all liabilities indexed to or denominated in foreign currency, whether borrowed domestically or overseas. Total debt includes all liabilities whether it is denominated in foreign currency or not. The indicator variable I (Mismatched) assumes the value one for firms that did not have hedge positions in 1998 and zero for firms that hedged a minimum of 30% of their foreign currency debt. Hedge is the sum of financial assets in foreign currency and foreign currency derivatives. Foreign currency derivatives include currency swaps contracted domestically or overseas as well as other currency derivatives like dollar options, futures and forwards. Exports are sales to foreign countries reported by either the notes in the consolidated financial statements by SECEX (Brazilian Office of Foreign Trade), whichever is greater. Imports are purchases from foreign countries by the sample firms or any of its affiliates, as reported by SECEX. Both exports and imports were converted into domestic currency using the average exchange rate of each year. The log of total assets is the logarithm of total assets. Operating profit is profit before tax and interest. The coefficients significant to 10, 5 and 1% are indicated by *, ** and ***, respectively. We use clusters at the firm level to estimate standard deviations and to correct possible errors of serial correlation and heteroscedasticity. Robust *p*-values are reported in parentheses.

**Table 7: Different Control Group**

| | $\Delta$ (Foreign Currency Debt/Total Debt)$_t$ | |
|---|---|---|
| | (A) | (B) |
| I(Mismatched) | -0.015 | 0.007 |
| | (0.782) | (0.361) |
| Exports / Total Revenue | | 0.185 |
| | | (0.221) |
| Imports / Total Revenue | | 0.144 |
| | | (0.665) |
| Log Total Assets | | 0.013 |
| | | (0.429) |
| Operational Profit / Total Asset | | 0.188 |
| | | (0.656) |
| Constant | -0.038 | -0.271 |
| | (0.410) | (0.266) |
| Obs. | 116 | 116 |
| $R^2$ | 0.00 | 0.03 |

Notes: This table contains the results of OLS estimates of equation (4) in the text. The sample comprises 183 firms with foreign currency debt exceeding 5% of their assets. The difference between this and Table 4 is the control group, which here contains firms that have a minimum of 50% foreign debt hedging. The dependent variable is the change in foreign debt over total assets between 1998 and 2000. Foreign currency debt is the sum of all liabilities indexed to or denominated in foreign currency, whether borrowed domestically or overseas. Total debt includes all liabilities whether it is denominated in foreign currency or not. The indicator variable I (Mismatched) assumes the value one for firms that did not have hedge positions in 1998 and zero for firms that hedged a minimum of 30% of their foreign currency debt. Hedge is the sum of financial assets in foreign currency and foreign currency derivatives. Foreign currency derivatives include currency swaps contracted domestically or overseas as well as other currency derivatives like dollar options, futures and forwards. Exports are sales to foreign countries reported by either the notes in the consolidated financial statements by SECEX (Brazilian Office of Foreign Trade), whichever is greater. Imports are purchases from foreign countries by the sample firms or any of its affiliates, as reported by SECEX. Both exports and imports were converted into domestic currency using the average exchange rate of each year. The log of total assets is the logarithm of total assets. Operating profit is profit before tax and interest. The coefficients significant to 10, 5 and 1% are indicated by *, ** and ***, respectively. We use clusters at the firm level to estimate standard deviations and to correct possible errors of serial correlation and heteroscedasticity. Robust *p*-values are reported in parentheses.

**Table 8: Different Database to Form the Treatment and Control Groups**

| | $\Delta$ (Foreign Currency Debt/Total Debt)$_t$ | |
|---|---|---|
| | (A) | (B) |
| I(Mismatched) | 0.013 | 0.025 |
| | (0.842) | (0.717) |
| Exports / Total Revenue | | 0.137 |
| | | (0.399) |
| Imports / Total Revenue | | -0.032 |
| | | (0.907) |
| Log Total Assets | | 0.009 |
| | | (0.569) |
| Operational Profit / Total Asset | | 0.199 |
| | | (0.678) |
| Constant | -0.048 | -0.197 |
| | (0.437) | (0.359) |
| Obs. | 118 | 118 |
| $R^2$ | 0.00 | 0.02 |

Notes: This table contains the results of OLS estimates of equation (4) in the text. The sample comprises 183 firms with foreign currency debt exceeding 5% of their assets. The difference between this and Table 4 is that we now use the year 1997 for selecting the treatment and control groups. The dependent variable is the change in foreign debt over total assets between 1998 and 2000. Foreign currency debt is the sum of all liabilities indexed to or denominated in foreign currency, whether borrowed domestically or overseas. Total debt includes all liabilities whether it is denominated in foreign currency or not. The indicator variable I (Mismatched) assumes the value one for firms that did not have hedge positions in 1998 and zero for firms that hedged a minimum of 30% of their foreign currency debt. Hedge is the sum of financial assets in foreign currency and foreign currency derivatives. Foreign currency derivatives include currency swaps contracted domestically or overseas as well as other currency derivatives like dollar options, futures and forwards. Exports are sales to foreign countries reported by either the notes in the consolidated financial statements by SECEX (Brazilian Office of Foreign Trade), whichever is greater. Imports are purchases from foreign countries by the sample firms or any of its affiliates, as reported by SECEX. Both exports and imports were converted into domestic currency using the average exchange rate of each year. The log of total assets is the logarithm of total assets. Operating profit is profit before tax and interest. The coefficients significant to 10, 5 and 1% are indicated by *, ** and ***, respectively. We use clusters at the firm level to estimate standard deviations and to correct possible errors of serial correlation and heteroscedasticity. Robust *p*-values are reported in parentheses.