Foreign Exchange Exposure, Corporate Financial Policies and the Exchange Rate Regime: Evidence from Brazil[1]

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Abstract

This paper analyzes the relationship between the choice of the exchange rate regime and companies' exchange rate exposure for a sample of non-financial Brazilian companies during the period from 1996 to 2002. I find that the number of companies exposed to fluctuations on the exchange rate is much higher than the number in developed countries; about 40% of the companies are exposed to fluctuations on the exchange rate. Moreover, the results show that, on average, Brazilian companies do not benefit from depreciations of the home currency, evidencing their vulnerability to movements in the exchange rate. I also find that companies' exchange exposure varies considerably across the exchange rate regime. The results show that the number of companies exposed during the floating exchange rate regime is much lower than under the fixed one. The paper gives evidence that this reduction in companies' exchange rate exposure comes from the fact that under the floating exchange rate regime, not only do companies currency derivatives more extensively to reduce their foreign exchange rate exposure, but they also reduce the currency mismatch in their balance sheets.

Keywords: Debt composition, hedging, exposure, exchange rate regime.

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1 Introduction

Recent financial crises[2] showed that emerging countries are extremely vulnerable to sudden swings in international capital flows. In these countries, commonly, periods of relative tranquility, characterized by substantial capital inflows and real GDP growth, are followed by periods when capital flows abroad, and output plummets[3]. In some countries, such crises lead not only to economic downturns but also to social unrest. Although there is a consensus among economists that emerging markets should take measures to reduce their external vulnerability, there is no agreement about the role of the choice of the exchange rate regime in this matter. At the center of this debate is the fact that due to the widespread problem of the dollarization of liabilities, depreciations of the home currency in emerging markets would cause a collapse in companies' balance sheets, leading to a fall in output[4]. Therefore, one mechanism through which the choice of the exchange rate regime could affect countries' vulnerability would be to exert influence on corporate financial policies.

One hypothesis in the international finance literature is that fixed exchange rate regimes would increase countries' vulnerability by leading companies to disregard the exchange rate risk, biasing their borrowing towards foreign currency denominated debt[5], and/or reducing their hedging activities. According to this hypothesis, floating regimes would help to reduce countries' vulnerability by inducing creditors and debtors to take seriously their exchange rate exposure. On the other hand, the so-called 'original sin'[6] theory argues that, independently of the exchange rate regime, emerging countries will always be vulnerable to external shocks. There will always be a currency mismatch on companies' balance sheets, since domestic companies would never be allowed to borrow in the domestic currency, and most of their revenues come from domestic activities. In a similar way, Calvo and Mishkin (2003) argue that the construction of healthy macroeconomic institutions would be the key to countries' macroeconomic stability, and the choice of the exchange rate regime would likely be of second order importance to alleviate countries' external vulnerability[7].

Since the theoretical literature has not reached a consensus, at the end of the day, the answer for this question should be empirical, as pointed out by Eichengreen and Hausmann (1999), "...*gathering survey (and other) data on hedged and unhedged exposures and analyzing their determinants should be a high priority for academics*" [8]. This paper tries to shed light on this question by

[2] East Asia (1997), Russia (1998), Brazil (1999,2002), Turkey (2000), and Argentina (2001).

[3] This is called in the international finance literature - the sudden-stop problem.

[4] Even among politicians, there is a strong concern that the high levels of foreign denominated debt led the country to be vulnerable to external shocks. "It is very important to everybody to realize that Brazil is still a vulnerable economy… We are vulnerable because we owe a lot, and a fraction of this debt is expressed in dollars." Luis Inacio Lula da Silva, Brazilian President, 03/30/2004, O Globo.

[5] Dooley (1997), Burnside et al (1999), Schneider and Tornell (2003), Corsetti (1999), among others.

[6] Expression created by Eichengreen and Hausmann (1999).

[7] The authors consider the possibility that there might be a causal relationship between the choice of exchange rate regime and the improvement of economic institutions.

[8] Although slim, the literature on the relationship between the choice of the exchange rate and countries' vulnerability shows mixed results. Martinez and Werner (2002) found evidence that the fixed exchange rate regime in Mexico biased

analyzing the behavior of foreign currency exposure for a sample of non-financial Brazilian companies from 1996 to 2002. This includes a period under a (quasi-) fixed exchange rate regime (1996-1998), and a period under a floating regime (1999-2002). I analyze whether companies' exposure varies with the choice of the exchange rate regime. Moreover, I discriminate among the several determinants of companies' exchange rate exposure, and finally I study the relationship among corporate financial policies, the choice of the exchange rate regime, and the exchange rate exposure.

Brazil provides a perfect natural experiment for analyzing the relationship between foreign currency exposure and the choice of exchange rate regime in emerging markets. Brazil is one of the largest emerging markets economies, and had a (quasi-) fixed exchange rate regime from 1995 to January 1999. After that the currency was allowed to float freely, currency derivatives were available in both periods and companies kept substantial levels of foreign currency denominated debt. Finally, I know of no studies combining analysis of the exposure of companies, the determinants of that exposure and the role of the exchange rate regime in an emerging market economy in which fluctuations in the exchange rate and risk management policies are of major importance to the real economy.

The main results can be summarized as follows. Fluctuations in the exchange rate are indeed problematic for emerging markets like Brazil; about 40% of Brazilian companies are exposed to changes in the exchange rate, and, unlike those in the US, Brazilian companies do not on average benefit from devaluations of the home currency. A 1% change in the exchange rate leads to a 0.22% fall in the average company's stock market returns.

This paper also shows that the floating exchange rate regime has been able to reduce such exposure. Under the fixed exchange rate regime about 60% of the companies are exposed to fluctuations on the real exchange rate; this proportion drops to 23% under the floating exchange rate regime.

The results confirm that the high proportion of foreign currency denominated debt to total debt is the main source of risk for Brazilian companies, and that foreign sales and hedging activities are able to mitigate the negative exposure that comes from the impact of the fluctuations of the exchange rate on companies' foreign liabilities.

This paper also associates the reduction in the number of companies exposed to changes in the exchange rate with an improvement in companies' risk management activities associated with the change of the exchange rate regime. Under the floating regime, not only do more companies hedge their exchange rate exposure, but these firms also hedge a larger proportion of their foreign currency denominated debt. Following the optimal hedging literature, I find that companies' hedging activities are linked to the attempt to reduce their foreign currency exposure. Companies with higher ratio of foreign debt to total debt are more likely to use currency derivatives.

corporate behavior towards foreign debt. Arteta (2002) found in a cross-country sample that deposit dollarization is greater under floating regimes, while credit dollarization does not appear to differ across regimes; therefore he found little support for the view that flexible exchange rate regimes reduce currency mismatches.

Moreover, using a model developed by Holmstrom and Tirole (1997), and extended by Martinez and Werner (2003), I find that the fixed exchange rate regime induced companies to incur mismatches in their balance sheets, whereas the floating regime has been able to reduce such mismatches by leading companies to take seriously their exposure to fluctuations in the exchange rate.

The paper proceeds as follows. In section 2, I analyze the Brazilian experience, and show the data that will be used throughout the text. In section 3, I describe the methodology that will be used to estimate companies' exchange rate exposure. Then, I estimate the exposure of Brazilian companies to fluctuations in the exchange rate, and I show the results for the role of the exchange rate regime on companies' exposure. In section 4, I estimate the main determinants of companies' exchange exposure. In section 5, I estimate the main determinants of companies' hedging activities in both regimes. In section 6, I test the role of the exchange rate regime on companies' foreign currency borrowing. Section 7 concludes.

2 Data

2.1 Macroeconomic Background

The Brazilian economy offers a perfect natural experiment in which to analyze the role of the exchange rate regime in determining corporate exchange rate exposure. From 1995 to 1998, Brazil adopted a crawling-peg exchange rate regime.[9] During this period, Brazil suffered from several speculative attacks, especially during the Asian and Russian crises. The Central Bank reacted promptly to such attacks by raising interest rates in order to maintain the regime, demonstrating clearly its commitment to the exchange rate regime even at the cost of maintaining high interest rates, increasing the public debt, and causing an economic recession. Figure 1 shows the response of the Central Bank to these speculative attacks, and the behavior of some macroeconomic variables during the period. Table 1 shows that this first period is characterized by a low volatility of the nominal exchange rate and by a high volatility of the nominal interest rate, and domestic stock-market returns (Ibovespa).

After a speculative attack in January 1999, the currency was allowed to float, and an inflation-target system was adopted. After tightening monetary and fiscal policies, Brazil succeeded in stabilizing inflation and the exchange rate, and the economy recovered quickly from the crisis. Table 1 shows that under the floating regime the interest rate and stock-market volatilities were much lower than in the previous period, and the exchange rate volatility increased considerably, suggesting that 'fear of floating'[10] was not a characteristic of the new regime. In 2002, due to the possibility that a new president not aligned with the current policies would be elected, a reversal of capital flow took place, and the exchange rate depreciated more than 50% during the year with a consequent

[9] Strictly speaking a system of bands was adopted with the top and bottom of the band being devalued at a fixed rate.
[10] Calvo and Reinhardt (2001).

rise in inflation. This caused the Central Bank to react by raising the interest rates.

2.2 Data

I gather data from two main sources: Economatica, and companies' annual reports. Economatica gives stock market returns and accounting data for all publicly traded companies. I also gather data directly from companies' annual reports, if information is not available, or to confirm the quality of the data. I use data from a sample of Brazilian non-financial companies from 1996 to 2002. The description of all variables used throughout the text is shown in the appendix. The period from 1996 to 2002 was chosen not only because it is possible to compare the behavior of companies' foreign currency exposure under different exchange rate regimes, but also because the use of derivatives was required to be reported only after 1995[11]. I use data for all the companies that were in the database in 1996 and stayed until 2002, a total of 165 companies. This is a subset of all available companies, but I use this procedure in order to give a better comparison of companies' behavior under the two different exchange rate regimes.

Hedge and foreign currency debt variables are available in the annual reports under the explanatory notes. The amount of foreign debt is located under the item loans and financing. Hedge activity is registered under the item financial instruments. There is no systematic information about foreign sales. Sometimes it is reported together with gross sales, sometimes under the comments from the managers to shareholders, or in the explanatory notes. Some companies mentioned being exporters, but did not report the amount of sales; in this case, I contacted the companies directly through electronic mail. In the end, I had to discard seven companies that mentioned being exporters but neither reported the amount of their foreign sales nor answered my mail.

I use the index from Sao Paulo stock exchange (*IBOVESPA*) as my domestic market return. I use the 30-day SELIC interest rate as my risk-free rate. All variables are deflated by the general index of prices (IGP). As observed by Dahlquist and Robertsson (2001), and Dominguez and Tesar (2001) the use of a trade-weighted exchange rate might lead the researcher to reject the hypothesis that companies are exposed since fluctuations on different exchange rates might cancel out, resulting in a rejection of the hypothesis that the company is exposed. In order to avoid this problem, and since most of Brazilian trade is in American dollars and almost all foreign debt is issued in this currency, I develop the analysis of companies' exposure by using the exchange rate Real/Dollar. Therefore, I adopt the convention that companies with positive (negative) exposure benefit (suffer) from depreciations of the home currency. This definition will be carried throughout the text.

[11] Securities and Exchange commission of Brazil - CVM instruction Nr. 235/1995

3 Exchange Rate Exposure

The international finance literature characterizes the impact on companies' cash flow as the channel through which companies would be exposed to fluctuations of the exchange rate[12]. Therefore, the determination of the relationship between fluctuations in companies' cash flow and changes in the exchange rate is the central question for a better understanding of companies' foreign exposure. Yet, as argued by Bodnar and Wong (2000), the use of cash flow variables is not easily applicable for cross-firm comparisons, since it would make the analysis extremely complex[13].

Adler and Dumas (1984) show that assuming that company's value is the present value of future cash flows, a company's exposure to fluctuations in the exchange rate could be determined by the elasticity of the firm value with respect changes on the exchange rate. This approach has been extensively used in the corporate finance literature, and it is used in this paper in order to determine companies' vulnerability to fluctuations in the exchange rate, and the relationship with the exchange rate regime.

3.1 Methodology

Adler and Dumas (1984) show that one alternative for estimating companies' exchange rate exposure would be to regress a firm's stock market return on changes in the exchange rate.

$$R_{jt} = \alpha_j + \beta_{j,\exp osure}.\Delta s_t + \varepsilon_{jt} \quad (1)$$

where R_{jt} is the weekly (monthly) excess stock market return of firm j, and Δs_t is the percentage change in the real exchange rate over the same period. Bodnar and Wong (2000) show that there are some drawbacks with this specification. They show that this exposure captures not only the sensitivity of a firm's value to changes in the exchange rate, but also the relation between exchange rate changes and macroeconomic factors that affect the market value of the firm. Using this specification, they find that the exposure of the firm was extremely volatile with respect to the period of the estimation, and could not be rationalized for any change in the firm's or in industry's activities.

The solution found by researchers was to add a market portfolio return in (1) in order to control for macroeconomic variables. The new specification is:

$$R_{jt} = \alpha_j + \beta_{j.market}.R_{market,t} + \beta_{j,\exp osure}.\Delta s_t + \varepsilon_{jt} \quad (2)$$

where $R_{market,t}$ is the excess market portfolio return. Bodnar and Wong (2000) also show that this specification might suffer with respect to the choice of the market portfolio.

They argue that if the researcher uses a value-weighted portfolio return as the market portfolio return, the coefficient of the changes in the exchange rate cannot be interpreted as a 'total' exposure, but should be interpreted as the

[12] Shapiro (1974), Hodder (1982), Levi (1983), and Flood and Lessard (1986)

[13] See Marston (1998) for more details about the difficulties that arise from the use of cash flow variables.

difference between the firm's total exposure elasticity and the market exposure adjusted by the firm's market beta. Therefore, if the market portfolio is exposed to the exchange rate, the distribution of the firm's exposure will be shifted. They also argue that because large firms have more weight in value-weighted portfolios, and these firms are more likely to be exposed to fluctuations in the exchange rate (since they usually are multinational corporations) the estimates of the firm's exposure would be biased.

There are two ways to solve this problem. Bodnar and Wong (2000) show that the use of an equally-weighted portfolio improves the results of the estimation of (2), since this measure is not biased towards larger companies. A second way is advocated by Bris et al (2002). Inspired by Jorion (1991), although using the opposite approach, the authors use a two-step approach to mitigate the problem.

In the first step, they regress the market portfolio on the changes in the exchange rate, estimating the following regression,

$$R_{market,t} = \gamma_0 + \gamma_1.\Delta s_t + \upsilon_t \quad (3)$$

Then, they get the component of the market portfolio return that is orthogonal to the change in the exchange rate by calculating $F_{market,t} = R_{market,t} - (\hat{\gamma}_0 + \hat{\gamma}_1.\Delta s_t)$. Finally, they estimate the following equation,

$$R_{jt} = \alpha_j + \beta_{j,market}.F_{market,t} + \beta_{j,\exp osure}.\Delta s_t + \varepsilon_{jt} \quad (4)$$

where R_{jt} is the weekly (monthly) stock return of firm j, $F_{market,t}$ is the estimated orthogonal component of the market portfolio, and Δs_t is the percentage change in the real exchange rate over the same period.

This approach circumvents the critiques made by Bodnar and Wong (2000), and it has the advantage that the coefficients of the exposure are measured in absolute terms, and not relative to the market portfolio exposure.

3.2 Results

Table 2 shows that some interesting results arise from the estimation of companies' exchange exposure. First, table 2 shows the destabilizing potential of fluctuations of the exchange rate. On average, Brazilian companies do not benefit from a depreciation of the domestic currency. According model (2), a one-percent depreciation of the home currency leads to a 0.22 percent fall in stock market returns. This result confirms the hypothesis that in relatively closed and high indebted emerging countries like Brazil, depreciations of the home currency are more likely to cause a fall in asset prices[14].

Table 2 also reinforces the significance of the fluctuations of the exchange rate. In both models, about 35% of the companies are exposed to fluctuations of the exchange rate; this result is well above a random choice model, showing that

[14] Similar results are found by Dominguez and Tesar (2001) for Thailand. They find that most of significant exposures are negative.

these estimates are not the result of a spurious relationship between two high volatile variables.

Table 2 also confirms the importance of orthogonalizing the market returns. Using the market portfolio as the control variable, the number of companies with positive and negative significant exposure is almost the same. Once we orthogonalize the market returns, the number of companies with negative exposure increases considerably. Since in Brazil larger firms dominate market portfolio, and these companies, as shown in Rossi (2003), are more likely to hold debt denominated in foreign currency, the market portfolio is likely to be negatively affected by changes in the exchange rate[15]. Because market portfolio is negatively exposed to fluctuations of the exchange rate, it is expected that when controlling using the market portfolio, a higher number of companies with significant positive exposure and a lower number of companies with negative exposure show up, since these estimated exposures are relative to the market portfolio. Yet, once market portfolio is orthogonalized, there is a reduction in the number of companies with positive exposure, and an increase in those with negative exposure, since we now have absolute exposures, which are not relative to the market portfolio.

3.3 Exchange Rate Exposure and the Exchange Rate Regime

The results in table 2 can be interpreted as companies' average exposure over the period between 1996 and 2002. As argued by Dumas and Solnik (1995), and de Santis and Gerard (1998), the assumption that companies' exposure does not vary with time is too strong, especially during our period of estimation, when Brazil changed its exchange rate regime from a fixed exchange rate regime to a floating one. Table 3 sheds light on this subject. I divide the sample into the fixed exchange rate period from January 1996 to October 1998, and a flexible exchange rate period from April 1999 to December 2002. I discard the data from November 1998 to March 1999, since it corresponds to the period of the currency crises.

Table 3 shows that the floating exchange rate regime indeed helps to alleviate the problem of companies' exposure to fluctuations in exchange rate. Under the floating exchange rate regime, only 23% of the companies are exposed to fluctuations in the exchange rate; however, under the fixed exchange rate regime more than 60% of the companies are exposed to fluctuations in the exchange rate.

Table 3 also shows that independent of the exchange rate regime, the median of the companies' exchange rate exposure has a negative value, implying that although the adoption of a flexible exchange rate regime is able to reduce the number of companies significantly exposed, fluctuations in the exchange rate are still problematic for a reasonable number of companies.

[15] Indeed, the result of the estimation of the first step shows that $R_{market,t} = -0.004(0.010) - 0.45(0.37) * \Delta s_t$; confirming the hypothesis that market portfolio is negatively exposed.

3.4 Robustness checks

I perform several checks in order to verify the robustness of the results. Most empirical works trying to estimate exchange rate exposure use a trade-weighted exchange rate. I follow this procedure by using a traded-weighted exchange rate calculated by the average exchange rate between Brazil and its main trade partners. The results can be found in tables 4 and 5. The results confirm Dahlquist and Robertsson (2001) and Dominguez and Tesar (2001) who argue that the use of a trade-weighted exchange rate might understate the exposure of the companies. Tables 4 and 5 show that there is a reduction in the number of companies with significant exchange rate exposure when a trade-weighted exchange rate is used, but the results with respect to the importance of the exchange rate regime are robust with respect to the choice of the exchange rate.

Following Parsley and Popper (2002), I estimate the following equation:

$$R_{jt} = \alpha_j + \beta_{j,market}.R_{market,t} + \beta_{fixed,j}.\Delta s_t * Fixed + \beta_{flexible,j}.\Delta s_t * Flexible + \varepsilon_{jt} \qquad (5)$$

where Fixed stands for a dummy variable that assumes the value 1 during the fixed exchange rate period, and Flexible stands for a dummy variable that assumes the value 1 during the flexible exchange rate period. Again, the results (not shown) indicate a reduction in companies' exposure when a floating exchange rate regime is adopted.

4 The Determinants of Companies' Exchange Rate Exposure

The result found in the previous section, that the floating exchange rate regime was able to reduce the number of companies with a significant exchange rate exposure, might be driven for different reasons, since the exchange exposure of a company is related to multiple factors. In order to discriminate among these different factors, in this section I analyze the different determinants of companies' exchange rate exposure.

The literature identifies two types of exchange rate exposure: Economic and Translation exposure. Economic exposure represents the impact of changes in the exchange rate on companies' cash flow; this is the type of exposure we are concerned with, since it will affect the market value of the firm. Economic exposure can be divided into transaction and operating exposures. Transaction exposure takes place when a company has a contract denominated in foreign currency which is to be settled at a future date. Companies that sell products, that buy inputs from abroad, and that have foreign currency denominated debt are all subject to transaction exposure. The ratio of foreign sales to total sales is expected to be positively correlated with companies' exchange exposure since exporters benefit from depreciations of the home currency. The opposite is true for importers and foreign currency debtors.

Operating exposure reflects the effects of changes in the exchange rate on companies' financial or operational contracts. This type of exposure is directly

related to the degree of competition that the company has. Depreciations of the domestic currency reduce the competitiveness of the foreign companies, since it raises the price of imported goods in domestic currency, leading to an improvement in domestic companies' cash flow[16]; therefore, domestic companies that compete more fiercely with foreign ones are expected to be more exposed to fluctuations in the exchange rate.

Translation exposure refers to the effect of changes in the exchange rate on companies' financial accounting statements; companies that have foreign subsidiaries are subject to translation exposure, since the value of their foreign assets varies with changes in the exchange rate. It is important to realize that this type of exposure does not affect companies' cash flow, only their financial statements.

Companies would reduce their exposure to fluctuations of the exchange rate by making use of hedging instruments. The literature identifies two types of hedge: Operational hedges, and financial hedges.

Operational hedges pertain to companies with foreign subsidiaries, since these companies will be protected from fluctuations of the home currency by having a fraction of their revenue coming from abroad. The literature identifies operational hedges as being more effective for long-term fluctuations of the exchange rate.

Financial hedges stand for the use of currency derivatives – swaps, futures, forwards, and options – to mitigate companies' foreign exposure. This type of hedging is usually associated with short-term fluctuations of the exchange rate.

None of the many previous studies analyzes the determinants of foreign exposure for emerging markets; they primarily focus on developed countries. Jorion (1990) finds for a sample of American companies a positive relationship between the ratio of foreign sales and foreign exposure. Bodnar and Gentry (1993) find for a sample of U.S., Canadian and Japanese companies that non-traded industries and industries with higher import ratios gain from appreciations of the domestic currency, the opposite with respect to industries with higher export ratios. Moreover, they find that except for the U.S., industries with a higher level of the use of internationally-priced inputs benefit from appreciations, and companies with foreign assets have positive exposures. He and Ng (1998), for a sample of Japanese multinational companies, are able to link foreign exchange exposure with export ratio and variables that might explain the use of currency derivatives. Guay (1999) found that firm risk declines following derivatives use. Carter et. al. (2001) finds evidence that operational hedges (foreign operations) and financial hedges (use of derivatives) effectively reduce foreign currency exposure. Allayannis and Ofek (2001) find a positive relation between exchange rate exposure and the ratio of foreign sales to total sales and a negative relationship between the use of currency derivatives and foreign exposure, showing that foreign currency derivatives are effective in reducing companies'

[16] Nucci and Pozzolo (2001) and Campa and Goldberg (1995) study the relationship between investment, pass-through, industry competition, and changes in the exchange rate.

foreign exposure. Similar results are found by Hagelin and Pramborg (2004) for a sample of Swedish companies.

Table 6 shows the descriptive statistics for the main determinants of companies' foreign exposure, and their behavior during the sample period. The size of the company has an ambiguous effect on its exposure. On the one hand, larger companies might be able to borrow more from abroad; therefore, one should expect a negative relationship between exposure and size. On the other hand, if there are fixed costs of hedging, one should expect that larger companies would make a more extensive use of currency derivatives, implying a reduction in their exchange rate exposure. The logarithms of total assets and total sales expressed in US dollars are used as proxies for the size of the companies. Both variables had a similar behavior during the period. They dropped in the aftermath of the crisis, as a result of the devaluation of the currency. The t-test does not reject the hypothesis that the mean of the size variables is equal across both exchange rate regimes.

Table 6 reports that the number of exporters is stable under the two exchange rate regimes; around 60% of the companies in the sample sell their products abroad. Table 6 also shows that the traditional expenditure-switching effect took place after the devaluation. The ratio of foreign sales to total sales increases from 14.4% right before the crisis to 17.9% in 2002. Still, the t-test does not reject the hypothesis that the average ratio of foreign sales to total sales is equal across regimes.

Table 6 shows that the ratio of foreign debt to total debt is stable across the two exchange rate regimes. About 80% of the companies in the sample hold foreign denominated debt, and, on average, the companies keep about 50% of their total debt in foreign currency.

Table 6 reports that under the flexible exchange rate regime companies use currency derivatives more intensively. The only variables for which the t-test rejects the equality of the means under both regimes are the variables related to hedging activities. Under the flexible regime not only do more companies use foreign currency derivatives, but they also raise the ratio of the amount of derivatives to total assets. In 1998, right before the crisis, just 15% of the companies used foreign currency derivatives; in 2002, under the flexible exchange rate regime, more than 40% of the companies in the sample used foreign currency derivatives. The ratio of the amount of derivatives to total assets increased from 1.17% in 1999 to 4.73% in 2002.

Table 6 also shows that the flexible exchange rate regime was able to reduce the ratio of short-term debt to total debt, moving it from an average of 52% under the fixed exchange rate regime to 50% under the floating one. But the t-test does not reject the equality of the means under both regimes.

In order to perform a more formal analysis of the main determinants of companies' foreign exposure, I estimate the following equation:

$$\beta_i = const + a_1.(Foreign\ \ Sales / Total\ Sales) + a_2.(Derivatives / Total\ \ Assets) + a_3.(Foreign\ Debt / Total\ Debt) + \varepsilon_i \qquad (6)$$

where β_i are the foreign currency exposures estimated in table 2. The independent variables are the average of the variables during the sample period. The results are shown in Table 7.

The results in Table 7 indicate that there is a positive relationship between size and exchange rate exposure, but this result is not robust across different specifications. Therefore, there is (weak) evidence that size is an important determinant of companies' exchange exposure.

As expected, the ratio of foreign sales to total sales is positively related to companies' exchange exposure. According to the model (2), a one percent change in the ratio of foreign sales to total sales has a positive effect on the exposure of the companies by 0.82 percent. Agreeing with our predictions, the ratio of foreign debt to total debt negatively affects companies' exchange exposure. A one percent increase in the ratio of foreign denominated debt to total debt negatively impacts companies' foreign exposure by 0.54 percent. These results are robust across different specifications, and the presence of control variables.

Results in Table 7 show that the use of currency derivatives does alleviate companies' exposure to fluctuations in the exchange rate. If the ratio of the amount of derivatives to total assets increases by one percent, companies' exposure changes by 0.34. This positive effective of the use of currency derivatives on companies' foreign exposure is also robust with respect to the model used in the estimation, and with respect to the inclusion of control variables.

Among the control variables, the ratio of short-term debt to total debt is a significant determinant of companies' foreign exposure. Companies with higher levels of short-term debt are more likely to suffer from depreciations of the home currency, since there will be an increase in their interest expenses not only for their short-term foreign debt, but also for their domestic debt, since the Central Bank will react to devaluations of the exchange rate by raising domestic interest rates. Therefore, companies with a higher level of short-term debt are more likely to suffer from financial distress following depreciations of the domestic currency.

The results do not confirm the hypothesis that operational hedges have positive effects on companies' exposure. A dummy that assumes the value 1 if the firm has foreign subsidiaries is not statistically significant in all specifications, and it has the opposite sign from what was expected. Therefore, it seems that markets do not care whether companies have operations abroad.

The results show that the issue of ADRs has positive effects on companies' exchange exposure. This might be an indication that these companies are more likely to be able to manage their foreign exposure more effectively, yet ownership does not seem to matter with respect to the determination of exchange rate exposure; it seems that domestic and foreign companies have similar exposures.

The results so far have shown that companies' hedging activities, foreign currency borrowing, and foreign sales are the main determinants of companies' exchange rate exposure. In the next sections, I analyze how these variables interact with each other, and the mechanism through which the floating exchange

rate regime affects such variables resulting in a reduction in the number of the companies significantly exposed to fluctuations in the exchange rate.

5 Hedging and the exchange rate Regime

This section studies in more detail companies' hedging activities and their relation to the exchange rate regime. Table 8 shows the behavior of hedging activities during the period from 1996 to 2002.

Table 8 shows that companies' hedging activities vary considerably across exchange rate regimes. Under the fixed exchange rate regime, the number of hedgers is much lower than under the floating exchange rate regime. This result is consistent for any type of hedging alternative. Both, the number of companies that use currency derivatives, and those that use foreign assets increased steadily during the period. Table 8 also shows that companies prefer to use currency derivatives rather than foreign assets to hedge their exposure. During the whole period, more than half of the hedgers preferred currency derivatives to foreign assets. Table 8 also reports that under the floating regime, not only do more firms use currency derivatives, but also they raise the extent of their use. Right before the crisis in 1998, the average ratio of the amount of currency derivatives to total foreign debt was 6.56%; this ratio increased steadily during the floating regime, reaching 25% in 2002.

Table 9 reports the results for the choice among currency derivatives. It shows that currency swaps are the most preferred among all possible derivatives. This can be viewed as evidence that the hedging activities of Brazilian companies are linked to their attempt to reduce their foreign currency exposure, and are not for speculative purposes, since swaps are usually preferred when the sources of exposure extend for multiple periods but are predetermined. This is the case when liabilities are denominated in foreign currency. By contrast, forward contracts are preferred when the main source of exposure is related to short-term transactions that are characterized by uncertainty. This is the case of foreign revenues derived from exports. These practices are completely different from those found in previous studies of developed countries. Geczy et al (1997) show for a sample of U.S. companies that forward contracts, or a combination between forwards and options contracts, were the most preferred instruments. Judge (2002) finds similar results for a sample of British companies. He finds that forwards were the most frequently used instruments, followed by swaps and options. The preference for swaps is stable across periods and is therefore independent of the exchange rate regime. There is evidence that the main concern of Brazilian hedgers was the possibility that fluctuations of the exchange rate could affect their liabilities. This fact will be tested in the next section.

5.1 The Determinants of the use of Currency Derivatives

5.1.1 Related Literature

In order to identify the main determinants of the use of currency derivatives, the theoretical literature needs to depart from the assumptions of the Modigliani-Miller theorem (1958), since under their assumptions, a firm would be indifferent about whether to hedge or not, since its value would be independent of its capital structure.

Smith and Stulz (1985) assert that given the existence of taxes and bankruptcy costs it would be optimal for firms to hedge. They show that by reducing the variability of firms' cash flow, hedging would reduce their tax liability, and the probability of incurring in bankruptcy costs, therefore raising their post-tax value. They also analyze the possibility that risk-averse managers would prefer to hedge, because reducing the variability of a firm's cash flow would increase its expected utility, since it is dependent on the firm's payoffs.

Froot et al (1992) show that if capital markets are imperfect, hedging would increase firms' value by insuring they have sufficient internal funds. A variable cash flow would lead to more variability either in the amount raised externally, or in the investment. Therefore, firms with higher growth opportunities would want to hedge in order to mitigate their underinvestment problem. DeMarzo and Duffie (1995) show that hedging would allow the market to draw better inferences on manager ability.

Firms might use currency derivatives to reduce their exposure to fluctuations of the exchange rate. Firms whose cash flow is more sensitive to exchange rate fluctuations would derive great benefits from hedging; this would be the case for exporters, firms with foreign subsidiaries or firms that hold foreign currency denominated debt.

Foreign denominated debt per se might be used as a way to hedge exchange rate fluctuations. Firms with revenue in foreign currency might issue debt denominated in foreign currency in order to avoid mismatches in their balance sheets. This alternative seems implausible in emerging markets, where foreign currency debt is the main concern with respect to exchange rate exposure as shown in the previous section.

There is a vast empirical literature that attempts to discriminate among the different theories about the use of currency derivatives (Wysocki (1995), Mian (1996), Geczy et al. (1997), Graham and Rogers (2000), Allayannis and Ofek (2001), He and Ng (1998), and Carter et al. (2001), among others).[17] Although extensive, none of the previous papers analyzes the hedging practices in emerging markets, where exchange rate crises create a natural experiment in risk management practices. One exception is Allayannis et al. (2003). The authors study the use of foreign derivatives for a sample of East-Asian companies right before the financial crisis in 1997. Moreover, unlike this paper,

[17] For the relationship between the use of derivatives and investment see Allayannis and Mozumbar (1999). For the relationship between the use of currency derivatives and firm value see Allayannis and Weston (2001)

none of the previous works studies the relationship between the use of derivatives and the exchange rate regime.

5.1.2 Univariate Analysis

Table 10 reports summary statistics for the comparison between users and non-users of currency derivatives. Although Table 10 does not show any causal relationship, it helps to clarify the differences between foreign currency derivative users and non-users. Table 10 shows that the number of hedgers varies considerably between the two exchange rate regimes. Before 1999, just a fraction less than 8% of the companies use currency derivatives. This ratio jumps to 40% in 2002. These results suggest that the higher the volatility of the exchange rate, the higher the number of firms that use derivatives in order to hedge their exchange rate exposure.

Table 10 also shows that given that a firm is a hedger, when the economy moves from a fixed exchange rate regime to a floating one, the extent of hedging activities increases. Table 10 shows that the amount of foreign debt hedged increased from 39.6% in 1996 to 62.0% in 2002; therefore, not only did more firms use currency derivatives, but currency derivatives were used to a greater extent.

Companies can use foreign assets as substitutes for or complements to the use of derivatives. Table 10 suggests that Brazilian companies see foreign assets as a complement to the use of derivatives; derivatives users have higher ratios of foreign assets to total assets than non-users.

The corporate finance literature states that the relationship between the use of derivatives and size of the company is ambiguous. If fixed costs of hedging are important, one would expect large companies to hedge more than small firms. In opposition, if small firms are more constrained, therefore more dependent on their internal funds, they would hedge more in order to avoid fluctuations in their cash flow. Table 10 shows that under the floating exchange rate regime users of currency derivatives are larger than non-users, although the t-test does not reject the hypothesis that both means are equal. This relationship between size and the use of currency derivatives is weaker under the fixed exchange rate regime. This might be an indicator that larger firms that were exposed during the fixed regime try, with the adoption of the floating regime, to reduce their exposure by increasing their hedging activities.

Table 10 also supports the idea that companies use currency derivatives to reduce their foreign exposure. Companies with higher ratios of foreign sales to total sales, firms that have foreign operations, and those with higher levels of foreign debt to total debt are more likely to use currency derivatives.

The results with respect to the hypothesis that firms hedge in order to reduce their probability of financial distress are mixed. Users have lower levels of interest coverage than non-users, indicating that financial distress might be important to the decision whether to hedge. But there is no evidence that currency derivative users have higher levels of short-term debt to total debt than

non-users. The t-test indicates that there is no systematic difference between users and non-users with respect to this variable.

If firms want to hedge in order to mitigate the underinvestment problem, theory says that firms with higher growth opportunities would hedge more. Table 10 shows that this pattern does not appear in the data. There is no systematic relationship between investment opportunities measured by the ratio of capital expenses to total sales or by the market-to-book ratio and the use of derivatives. Only for 2000 does the t-test not reject the hypothesis that the mean of the market-to-book ratio is higher for users of currency derivatives.

Finally, there is evidence that companies hedge as a way to signal to investors. Derivative users issue more ADRs than non-users. Hedging would signal to investors that a firm is trying to minimize fluctuations of its cash flow and thus maximize the value of the company. Table 7 corroborates with this hypothesis, indicating a positive relationship between the use of currency derivatives and the issuance of ADRs.

5.1.3 Multivariate Analysis

The estimation results for the determinants of the use of foreign currency derivatives are in Table 11. I use two different dependent variables: the percentage of foreign debt hedged by the use of currency derivatives, and the ratio of the amount of currency derivatives to total assets. Given the characteristics of these variables, I perform TOBIT estimation. I analyze these determinants before and after the currency crisis in order to verify if the change in the exchange rate regime had any effect on the determination of companies' hedging activities.

Table 11 shows that the ratio of foreign debt to total debt is the main determinant of the extent of companies' hedging activities. This variable is statistically significant in all specifications. Adding the fact that the swap is the most used currency derivative I can conclude that Brazilian companies use currency derivatives in order to reduce the exposure of their balance sheets to fluctuations in the exchange rate.

Table 11 also shows that size is a significant variable in the decision of hedging, only under the floating exchange rate regime. Under this regime, larger firms are more likely to use currency derivatives. One possibility for this result is that under the floating exchange rate regime larger companies, especially in the non-tradable sector, use currency derivatives to reduce their exposure. In opposition, the fixed exchange rate does not give any incentive to these companies to hedge their exposure.

Table 11 reports that neither the ratio of foreign sales to total sales and nor the foreign operations dummy is statistically significant. These results differ from those of previous works, but there is some anecdotal evidence for them[18].

[18] I give anecdotal evidence by quoting a Brazilian journalist. "…Brazilian exporters should have avoided the complaints about the appreciation of the Real if they have considered that a floating exchange rate regime does not mean a movement towards a higher devaluation of the currency. As proved in recent times, the real can appreciate with respect to the dollar...Exporters could have avoided the losses caused by the volatility of the exchange rate by hedging

Defying expectations - under the floating regime- there is a negative (not significant) relationship between the ratio of foreign sales to total sales and hedging activities. Brazilian exporters might see their foreign sales as a 'natural' hedge to the exposure that comes from their foreign currency liabilities. Moreover, exporters give low probability to the possibility of an appreciation of the domestic currency; therefore they do not expect a loss of revenues due to fluctuations in the exchange rate. Given the costs of hedging, they prefer not to hedge. There is no evidence that Brazilian companies use currency derivatives to alleviate the underinvestment problem. The ratio of total investment to total sales, and the market-to-book ratio are not statistically significant in any of the specifications.

The results are mixed with respect to the possibility of financial distress. Under the fixed exchange rate regime, none of our proxies for financial distress are statistically significant. Indeed, there is (weak) evidence that under the floating exchange rate regime companies with higher levels of short-term debt and with lower levels of interest coverage are more likely to use currency derivatives. Again, this difference between the two periods can be attributed to the fact that under the floating regime companies are more aware of the dangers of fluctuation in the exchange rate, and use currency derivatives to reduce the possibility of financial distress.

Finally, I find that companies that issue ADR are more likely to hedge. These firms would try to send a signal to foreign investors that they are trying to maximize the value of the company by avoiding disruptions on their cash flow. Therefore, there is a positive relationship between the dummy for ADR, and the extent of the use of derivatives.

5.1.4 Robustness checks

I perform several checks to verify the robustness of the results. Nance et al (1993) suggest the possibility of several substitutes for hedging. They argue that issuing convertible debt, or preferred capital can reduce the incentives to hedge by controlling the agency problem and the expected financial distress costs. They also argue that by keeping more liquid assets a company can reduce the probability of financial distress, implying a negative relationship between liquidity and hedging. The same applies to more profitable companies since these companies are more able to have enough cash flow to offset negative shocks, they should hedge less. In a robustness check, I added the current ratio and the gross margin as measure of liquidity and profitability, respectively. Results show that none of them is significant. I obtain the same results if I remove the sectoral dummies from the estimation. All results are robust with respect to this matter.

Endogeneity might be a problem of our specification. This problem might be more severe in the case of the determination of the use of currency derivatives. As mentioned by Geczy (1997), choices of capital structure can be

their exposures, but they didn't do it, because they expected the Real to depreciate even more, and by hedging they would limit the value of their revenues". Sonia Racy, O Estado de São Paulo, 08/12/2003.

made simultaneously with the decision to use derivatives, leading to a simultaneity problem, and biasing our results. It is difficult to solve this problem; I use different specifications in order to mitigate it. First, I use the dependent variables for 1998 (2002) and the independent variables for 1997 (2001), and the results (not shown) corroborate our previous results. Since, in the case of serial correlated variables, this procedure is not completely satisfactory, I use a two-stage procedure[19] to estimate the simultaneous choice of capital structure and the use of currency derivatives. Table 12 shows that my findings are robust with respect to endogeneity. Brazilian companies use derivatives mainly to reduce the foreign exposure coming from their foreign currency denominated liabilities. The ratio of foreign debt to total debt is significant in all specifications.

In addition, I also estimate a two-stage model to split the choice of the use of currency derivatives, and the choice of the extent of hedging. In the first stage, I estimate a LOGIT specification where the dependent variable assumes the value of 1 if the company uses currency derivatives and 0 otherwise. In the second stage, I estimate an OLS specification using the extent of the use of derivatives as my dependent variable. Results shown (for the first stage) in Table 13 confirm the robustness of my results.

6 The determinants of Foreign Currency Debt and the Exchange Rate Regime

My previous results show that foreign currency denominated debt is the main source of risk among Brazilian companies. In this section, I test whether the choice of the exchange rate regime has an impact on companies' foreign currency borrowing. In particular, I answer whether the fixed exchange rate regime induced currency mismatches on companies' balance sheets. Moreover, I also test whether the floating exchange rate regime has been able to mitigate this problem by inducing firms to match the currency composition of their balance sheets. In order to formalize the empirical analysis, I use the model developed by Holmstrom and Tirole (1997) and extended by Martinez and Werner (2002) to analyze the role of the exchange rate regime on the choice of the currency of the debt.

6.1 Theoretical literature

The international finance literature indicates that the possible existence of implicit government guarantees related to the choice of the exchange rate regime might bias corporate borrowing towards foreign currency denominated debt.

Dooley (1997), in the spirit of the first generation models of currency crises, identifies financial crises as being caused by a policy conflict between the government's desire to insure financial liabilities of citizens and its desire to hold reserve assets as a form of self-insurance. According to the author, a fixed

[19] Nelson and Olson (1978)

exchange rate regime would be an easy way to insure investors against losses, serving as an implicit guarantee.

Burnside et al (1999) build a model in which implicit guarantees induce firms and financial intermediaries to borrow from abroad but do not completely hedge against exchange rate risk. According to the authors, a bank has no incentive to hedge since the expected value of this strategy is nil. In case of no devaluation, buying forward to hedge would generate losses to the bank, and, in case of devaluation, the government would seize profits derived from these hedging activities. Moreover, they show that absent government guarantees, it would be optimal for firms to hedge their exchange rate risk completely. They show that as a result of these guarantees, banks lower their interest rates, causing a boom in the economy, but this boom leads to a more fragile banking system and, consequently, to a financial crisis. Government guarantees are also present in Corsetti et al (1999). In their model, these guarantees lead to overborrowing, translated as an unsustainable path for the current account deficit. Since government bailouts are costly, speculators foresee the use of seignoriage by the government, causing the collapse of the currency.

Schneider and Tornell (2003) emphasize the role of government guarantees and asymmetries in sectoral behavior[20]. They highlight the dichotomy between tradables and non-tradables. In their model, given the presence of bailout guarantees and the inability of the non-tradable sector to make a clear commitment to the repayment of its debt, currency mismatches arise endogenously, since foreign creditors would extend credit to the non-tradable sector. This currency mismatch would lead to a self-fulfilling crisis. Again, if there were no guarantees, managers would have no incentive to create currency mismatches. In the presence of bankruptcy costs, they would prefer to hedge the exchange rate risk. The authors show that under the fixed regime, firms in the non-tradable sector can grow faster by relaxing their borrowing constraints, but in the event of a depreciation, these companies will suffer heavily from balance sheet problems[21]; therefore, the existence of government guarantees related to the choice of a fixed exchange rate regime imposes temporal restrictions on companies' capital structure. The existence of government guarantees implies that under the fixed exchange rate regime, companies will not fully internalize the risk of exchange rate fluctuations, incurring currency mismatches on their balance sheets; on the contrary, the floating exchange rate regime would induce companies to take seriously the exchange rate fluctuations, leading them to improve their risk management activities by matching the currency composition of their assets, and liabilities.

[20] Bris and Koskinen (2002) also emphasize differences in sectoral behavior in explaining currency crises. They view the crisis as an attempt by government to rescue exporters, given their high leverage and low profitability under the fixed exchange rate regime. Their argument rests on the fact that it is optimal for the government to save exports by allowing the currency to float since it wants to boost investment in the economy. The depreciation would increase the profitability of the exporter sector by increasing their revenues in foreign currency and lowering their costs in domestic currency.

[21] The authors claim that this fact would explain the observed boom in the non-tradable sector before the recent currency crises.

6.2 The Model

The model has two periods. In the first period contracts are signed, and investment decisions are made. In the second period, investment returns are realized, and claims are settled. There are three risk-neutral parties: entrepreneurs, domestic banks that work as financial intermediaries, and foreign investors.

The entrepreneur owns the amount of capital A, and wants to invest the amount I. If I exceeds A, the entrepreneur must borrow the difference I-A. Entrepreneurs can privately choose between three versions of the project: a good version in which private benefit is 0 and the probability of success is P_H, a bad project with low private benefit b, and a bad project that gives high private benefit B, with B>b>0. For both bad projects, the probability of success is given by P_L. The Moral Hazard problem comes from the fact that without monitoring, firms will not have enough benefits in order to behave well. They will deliberately reduce the probability of success and get the private benefit B.

Domestic banks act as financial intermediaries by monitoring entrepreneurs, reducing the firm's opportunity cost from B to b. All firms cannot be monitored because domestic banks must invest some of their own capital in the project in order to be credible monitors. Domestic banks demand a rate of return r on their investment. Monitoring is privately costly, as domestic banks pay the amount c>0 in order to eliminate the possibility of firms obtaining private benefit B. Finally, foreign investors are uninformed and demand a rate of return r*.

Following Martinez and Werner (2002), the optimal contract will establish that the entrepreneur invests all its capital A, everybody is paid 0 in case the project fails, and when the project is successful, the firm gets paid $R_f>0$, the domestic bank is paid $R_b>0$ and the foreign creditors get $E_{t+1}.R_u>0$, where R_u is the return in dollars and E_{t+1} is the exchange rate in the second period. The investment has a rate of return for unit invested given by $R=S_dE_{t+1}+S_p-W_p$, where S_d is the firm's sales in foreign currency, S_p are the domestic sales, and W_p is the cost in domestic currency. The investment return R is divided among all parties; therefore,

$$R_f+R_b+E_{t+1}.R_u \leq R \tag{7}$$

Total investment has to be financed by all parties, therefore,

$$A+I_b+E_t.I_u=I \tag{8}$$

where A is the entrepreneur's capital, I_b is the domestic bank investment, and I_u is the foreign investment.

The incentive compatibility constraint for the firm to undertake a successful project and for the bank to monitor are given by

$$R_f \geq \frac{b}{P_h - P_l} \tag{9}$$

$$R_b \geq \frac{c}{P_h - P_l} \tag{10}$$

Since domestic banks demands rate of return r and foreign investor r*, the participation constraints are given by

$$R_b \geq \frac{r}{P_h} \tag{11}$$

$$R_u \geq \frac{r^*}{P_h} \tag{12}$$

Given r, r*, and A, entrepreneurs choose the level of investment I, R_b, R_u, I_b ,and I_u in order to maximize their profits subject to (7) to (12). In equilibrium, all constraints will bind, given the firms' profit function. After some algebra[22], I get

$$\frac{E_t.I_u}{E_t.I_u + I_b} = \frac{\frac{P_h}{r^*}[S_d.E_t + (S_p - W_p - \frac{(c+b)}{P_h - P_l}).\frac{E_t}{E_{t+1}}]}{\frac{P_h}{r^*}[S_d.E_t + (S_p - W_p - \frac{(c+b)}{P_h - P_l}).\frac{E_t}{E_{t+1}}] + \frac{P_h}{r}.\frac{c}{P_h - P_l}} \tag{13}$$

Equation (13) shows that the ratio of foreign debt to total debt is positively related to the probability of success P_h, and negatively related to the interest rates r and r*, monitoring costs c, and the private benefit b. Rearranging (13), I get

$$\frac{E_t.I_u}{E_t.I_u + I_b} = \frac{P_h}{r^*}(\frac{\text{Foreign Sales}}{\text{Total Debt}}) + \frac{P_h}{r^*}.\frac{E_t}{E_{t+1}}.[\frac{\text{net domestic sales}}{\text{Total Debt}} - \frac{\frac{(c+b)}{P_h - P_l})}{\text{Total Debt}}] \tag{14}$$

If there are implicit guarantees, creditors give the same weight to foreign and domestic revenue, disregarding the exchange rate risk. However, if creditors are aware of the exchange rate risk, the weight of domestic revenue will be decreasing with the expected devaluation. This happens because depreciation will reduce the value of the domestic sales in foreign currency, decreasing their pleadgeable income in foreign currency, and consequently the amount invested in the project. This effect will be higher for firms with lower foreign sales, since these are less affected by devaluation.

6.3 Empirical Specification

Given (14), I estimate the following equation,

[22] It is beyond the scope of this text to go into the details of the derivation of equation (8). For more details, see Martinez and Werner (2002).

$$fdebt_i^t = \beta_1 + \beta_2 . fdebt_i^{t-1} + \beta_2 . size_i^t + \beta_3 . fsales_i^t + \beta_4 . dsales_i^t + \beta_5 . controls_i^t + \varepsilon_i^t \qquad (15)$$

where $fdebt_i^t$ is the ratio of total foreign debt to total debt for company i at the end of time t, $fdebt_i^{t-1}$ is the ratio of total foreign debt to total debt at the beginning of time t, $size_i^t$ is the logarithm of total assets of firm i at the end of period t, $fsales_i^t$ is the ratio of foreign sales to total debt, $dsales_i^t$ is the ratio of domestic sales to total debt. I use as control variables a dummy that assumes the value 1 if a company issued ADRs, and 0 otherwise, in order to control for monitoring costs and the benefits of shirking. In addition, I include the ratio of investment to sales to control for companies' growth opportunities, and industry dummies. I follow the same strategy in the previous section, and I split the sample according the exchange rate regime. Given the limits of the dependent variable I perform a TOBIT estimation.

I test whether during the fixed exchange rate regime and the floating exchange rate regime the coefficients of the ratio of foreign sales to total debt and the ratio of domestic sales to total debt are equal. In the case in which the test does not reject the null that both coefficients are equal, I conclude that creditors totally disregard the exchange rate risk, and that implicit guarantees were an important characteristic of the period. On the other hand, if the test rejects the null, I conclude that there were no implicit guarantees and that agents are aware of the risk of exchange rate fluctuations.

6.4 Results

Table 14 shows the results for the estimation of equation (15). The results confirm the hypothesis that the fixed exchange rate regime led creditors and debtors to disregard their exchange rate risk. Under the fixed exchange rate regime, both coefficients for domestic sales and foreign sales are not statistically significant at 10% level of confidence, and I cannot reject the hypothesis that both coefficients are equal. Therefore, under the fixed regime, the size of the company was the main determinant of its foreign exposure, and companies are induced to incur currency mismatches in their balance sheets.

In opposition to this, under the floating exchange rate regime, both the ratio of foreign sales to total debt and the ratio of domestic sales to total debt are now statistically significant at 10%. Moreover, the F-test rejects at 10% level of significance the null hypothesis of the equality of the coefficients. Thus, under the floating exchange rate, exports are more exposed to fluctuations on the exchange rate since their dollar income is less sensitive to these fluctuations.

Table 14 shows that neither the coefficient for ADR nor the ratio of total investment to sales is statistically significant. As discussed in Allayannis et al (2003), the negative relation between the ADR variable and the ratio of foreign debt to total debt might come from the fact that the firms that issued ADRs move up in the pecking order[23], preferring to finance their new investment by issuing

[23] Myers and Majluf (1984).

equity. The agency cost theory might explain the negative relation between growth opportunities and leverage. Companies with higher growth opportunities would have less incentive to choose risky projects, and would therefore prefer to keep a lower level of foreign debt to total debt.

7 Conclusion

This paper analyzes the relationship between the choice of the exchange rate regime and companies' exchange rate exposure for a sample of non-financial Brazilian companies. Some interesting patterns arise from the analysis. First, the paper shows that the number of companies vulnerable to fluctuations on the exchange rate in an emerging country like Brazil is much higher than the number in developed countries. In the period between 1996 and 2002, around 40% of companies were exposed to fluctuations on the exchange rate Real against Dollar. Second, I show that this exposure varies according to the exchange rate regime. The number of companies exposed during the floating exchange rate regime is much lower than under the fixed one. I estimate that the ratio of foreign sales to total sales, the ratio of foreign debt to total debt, and the extent of companies' hedging activities are the main determinants of companies' exchange rate exposure. I then give evidence that the reduction in companies' exposure comes from the fact that under the floating exchange rate regime, not only do companies use more currency derivatives more extensively to reduce their foreign exchange rate exposure, but they also try to reduce the currency mismatches on their balance sheets.

Eichengreen and Hausmann (1999) define the "original sin" as the difficulty for domestic firms in emerging markets to borrow in local currency. According to them, it is not the case that these companies do not want to hedge their exposure, but that they are not allowed to do it, since hedging would mean these companies could borrow in local currency. As a result, both fixed and floating regimes would be problematic for these countries. I show that, at least with respect to Brazil, this is not completely true. I provide some evidence that the floating regime can *mitigate* the problem of the 'original sin'. I show that not only does the floating regime induce more firms to hedge, but also that these companies hedge more their currency exposure, leading them to reduce the currency mismatch on their balance sheets. Therefore, there is a clear relationship between the choice of the exchange rate, and countries' vulnerability. Under the floating exchange rate regime, countries are less vulnerable. Being less vulnerable does not mean that the floating exchange rate regime completely insulates countries from external shocks. Fluctuations in the exchange rate are still problematic for the country, but the floating exchange rate regime leads companies to be more aware of the risk of keeping unhedged positions, thus reducing the possibility of huge economic downturns. Brazil is a clear example of such a situation. In 2002, under the floating regime, the Real depreciated more than 50% and months later the Brazilian economy was back on track, showing that the floating regime induced companies to be prepared for sudden swings in the behavior of the exchange rate. Therefore, even if the

choice of the exchange rate might not be the primary solution for the reduction of countries' external vulnerability, it is clearly an important piece of the puzzle.

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Table 1
Interest rate and Exchange Rate Volatility

Table 1 reports the standard deviation of monthly percent changes in the SELIC interest rate, the nominal exchange rate Real versus Dollar, and domestic stock market returns (Ibovespa) in Reais.
Source: Central Bank of Brazil, and Economatica.

Year	*Interest Rate*	*Exchange Rate*	*Ibovespa(in Reais)*
1996	3.11%	0.08%	6.04%
1997	24.07%	0.11%	12.16%
1998	24.26%	0.17%	16.99%
1999	17.70%	19.73%	10.29%
2000	8.23%	2.00%	8.89%
2001	13.95%	5.04%	9.90%
2002	11.56%	11.60%	10.50%

Figure 1
Macroeconomic Performance

Figure 1 shows Brazilian macroeconomic performance from 1996 to 2002. Interest rate is SELIC basic rate, Exchange rate is Real versus US$ dollar, and inflation is calculated using IGP-DI.
Source: Central Bank of Brazil.

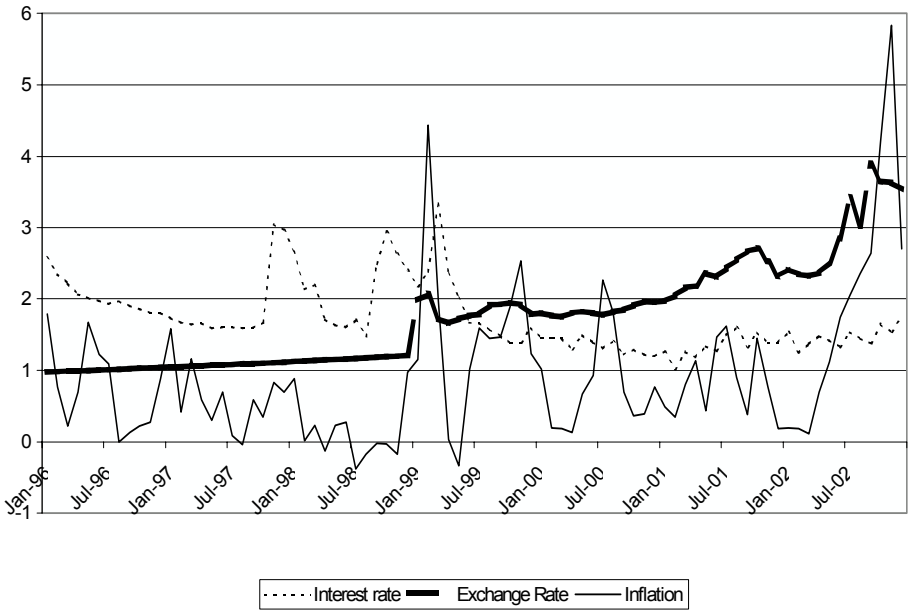

Table 2
Exchange Rate Exposure for Brazilian Companies 1996-2002

Table 2 reports the mean, median, maximum, and minimum of companies' exchange rate exposure. Model 1 stands for the estimation of the equation: $R_{jt} = \alpha_j + \beta_{market,j}.R_{market,t} + \beta_j.\Delta s_t + \varepsilon_{jt}$. Where R_{jt} is the monthly excess stock return of firm j, $R_{market,t}$ is the market portfolio excess return (Ibovespa) and Δs_t is the percentage change in the real exchange rate over the same period. Model 2 stands for the estimation of $R_{jt} = \alpha_j + \beta_{market,j}.F_{market,t} + \delta_j.\Delta s_t + \varepsilon_{jt}$ Where R_{jt} is the monthly stock return of firm j, $F_{market,t}$ is the estimated orthogonal component of the market portfolio, and Δs_t is the percentage change in the real exchange rate over the same period. Table 2 reports the number of firms with positive and negative significant exposure at 10% level of significance. Newey-West consistent covariance matrix is estimated.

Model	(1)	(2)
Mean	-0.032	-0.22
Median	-0.10	-0.24
Maximum	2.97	2.33
Minimum	-1.48	-1.68
Negative	27	55
Positive	24	9
Number of Companies	165	165

Table 3
Exchange Rate Exposure for Brazilian Companies and the Exchange rate regime

Table 3 reports the mean, median, maximum, and minimum of companies' foreign exposure for two different periods. *Fixed* stands for the fixed exchange rate period from Jan.1996 to Oct. 1998. *Flexible* stands for the floating exchange rate regime from April.1999 to December 2002. Model 1 stands for the estimation of the equation: $R_{jt} = \alpha_j + \beta_{market,j}.R_{market,t} + \beta_j.\Delta s_t + \varepsilon_{jt}$. Where R_{jt} is the monthly excess stock return of firm j, $R_{market,t}$ is the market portfolio excess return (Ibovespa) and Δs_t is the percentage change in the real exchange rate over the same period. Model 2 stands for the estimation of $R_{jt} = \alpha_j + \beta_{market,j}.F_{market,t} + \beta_j.\Delta s_t + \varepsilon_{jt}$ Where R_{jt} is the monthly stock return of firm j, $F_{market,t}$ is the estimated orthogonal component of the market portfolio, and Δs_t is the percentage change in the real exchange rate over the same period. Table 3 reports the number of firms with positive and negative significant exposure at 10% level of significance. Newey-West consistent covariance matrix is estimated.

	Model 1		**Model 2**	
	Fixed	**Flexible**	**Fixed**	**Flexible**
Mean	0.009	-0.066	-0.18	-0.25
Median	-0.13	-0.041	-0.27	-0.23
Maximum	5.34	2.30	4.98	1.66
Minimum	-2.64	-2.21	-2.85	-2.32
Negative	64	13	72	31
Positive	39	14	29	7
Number of Companies	165	165	165	165

Table 4
Exchange Rate Exposure for Brazilian Companies 1996-2002

Table 4 reports the mean, median, maximum, and minimum of companies' foreign exposure. Model 1 stands for the estimation of the equation: $R_{jt} = \alpha_j + \beta_{market,j} \cdot R_{market,t} + \beta_j \cdot \Delta s_t + \varepsilon_{jt}$. Where R_{jt} is the monthly excess stock return of firm j, $R_{market,t}$ is the market portfolio excess return (Ibovespa) and Δs_t is the percentage change in the real trade-weighted exchange rate over the same period. Model 2 stands for the estimation of $R_{jt} = \alpha_j + \beta_{market,j} \cdot F_{market,t} + \beta_j \cdot \Delta s_t + \varepsilon_{jt}$ Where R_{jt} is the monthly stock return of firm j, $F_{market,t}$ is the estimated orthogonal component of the market portfolio, and Δs_t is the percentage change in the real trade weighted exchange rate over the same period. Table 4 reports the number of firms with positive and negative significant exposure at 10% level of significance. Newey-West consistent covariance matrix is estimated

Model	(1)	(2)
Mean	-0.19	-0.22
Median	-0.18	-0.20
Maximum	2.36	2.28
Minimum	-3.82	-3.81
Negative	35	39
Positive	11	8
Number of Companies	165	165

Table 5
Exchange Rate Exposure for Brazilian Companies and the Exchange rate regime

Table 5 reports the mean, median, maximum, and minimum of companies' foreign exposure for two different periods. *Fixed* stands for the fixed exchange rate period from Jan.1996 to Oct. 1998. *Flexible* stands for the floating exchange rate regime from April.1999 to December 2002. Model 1 stands for the estimation of the equation: $R_{jt} = \alpha_j + \beta_{market,j} \cdot R_{market,t} + \beta_j \cdot \Delta s_t + \varepsilon_{jt}$. Where R_{jt} is the monthly excess stock return of firm j, $R_{market,t}$ is the market portfolio excess return (Ibovespa) and Δs_t is the percentage change in the real trade weight exchange rate over the same period. Model 2 stands for the estimation of $R_{jt} = \alpha_j + \beta_{market,j} \cdot F_{market,t} + \beta_j \cdot \Delta s_t + \varepsilon_{jt}$ Where R_{jt} is the monthly stock return of firm j, $F_{market,t}$ is the estimated orthogonal component of the market portfolio, and Δs_t is the percentage change in the real trade weight exchange rate over the same period. Table 5 reports the number of firms with positive and negative significant exposure at 10% level of significance. Newey-West consistent covariance matrix is estimated.

	Model 1		**Model 2**	
	Fixed	**Flexible**	**Fixed**	**Flexible**
Mean	-0.018	-0.24	-0.013	-0.28
Median	-0.24	-0.23	-0.20	-0.26
Maximum	8.83	1.81	8.63	1.20
Minimum	-4.41	-4.93	-4.65	-5.02
Negative	59	32	59	39
Positive	39	6	36	5
Number of Companies	165	165	165	165

Table 6
Summary Statistics

Table 6 provides summary statistics for the main determinants of companies' foreign exposure for the period from 1996 to 2002. The descriptions of the variables can be found in the appendix. Fixed stands for the mean of the variables under the fixed exchange rate regime, and flexible stands for the mean under the flexible exchange rate regime. T-test stands for a t-test for the equality of the means for the variables under the two exchange rate regimes. * means the test rejects the null that both means are equal.

	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**Fixed**	**Flexible**	**T-test**
Total Assets (US$ millions)	1,811	1,822	1,765	1,330	1,334	1,252	989	1,792	1,223	0.87(0.39)
Total sales (US$ millions)	874	914	902	737	881	891	688	893	797	0.36(0.72)
% of Exporters	60.6	61.6	62.8	62.8	62.8	63.4	63.4	61.6	63.0	-0.28(0.78)
Foreign Sales/Total Sales (%)	14.7	14.5	14.4	16.0	15.9	16.6	17.9	14.6	16.7	-0.89(0.37)
% of Foreign Debtors	83.5	82.3	85.9	82.3	80.5	80.5	81.1	83.8	80.9	0.79(0.43)
Foreign Debt/ Total Debt	47.9	49.5	48.0	49.7	48.0	48.1	49.7	48.5	49.0	-0.13(0.89)
% of Users of derivatives	7.9	9.8	14.6	19.5	25.0	34.8	40.2	10.7	29.7	-5.27(0.00)*
Derivatives/Total Assets (%)	0.63	0.68	1.17	1.42	1.78	3.31	4.73	0.82	2.80	-4.49(0.00)*
Short term Debt / Total debt (%)	55.8	50.3	51.1	48.3	49.4	49.9	51.2	52.38	49.71	0.96(0.33)

Table 7
The Determinants of foreign currency exposure

Table 7 shows the results of the estimation of the determinants of foreign currency exposure by weight least squares with the weight equals to the standard deviation of companies' exchange rate exposure estimated in the first step. The following equation was used in the estimation:

$$\beta_i = const + a_1.(Foreign\ Sales / Total\ Sales) + a_2.(Derivatives / Total\ Assets) + a_3.(Foreign\ Debt / Total\ Debt) + a_4.controls + \varepsilon_i .$$

Where β_i are the foreign currency exposures estimated in table 2 . *,** means significance at 5, and 10% . Standard errors are in parenthesis.

Variable	Coefficient			
	Model 1		Model 2	
Constant	-1.29(0.41)*	0.17(0.68)	-1.18(0.38)*	-0.19(0.63)
Size (log Total Assets)	0.12(0.04)*	0.023(0.044)	0.088(0.033)*	0.020(0.041)
Foreign Sales / Total sales	1.09(0.24)*	1.02(0.25)*	0.90 (0.22)*	0.82(0.23)*
Derivatives / Total assets	0.50(0.14)*	0.44(0.19)*	0.37(0.16)*	0.34(0.18)**
Foreign Debt / Total debt	-0.64(0.19)*	-0.63(0.14)*	-0.55(0.18)*	-0.54(0.17)*
Control Variables				
Total Short term Debt / Total Debt		-0.74(0.28)*		-0.51(0.26)**
Foreign Operations		-0.11(0.17)		-0.060(0.16)
ADR		0.63(0.18)*		0.49(0.17)*
Ownership		0.12(0.21)		0.14(0.19)
R2	0.25	0.34	0.19	0.25

Table 8
Summary Statistics for Companies' Hedging Activities

Table 8 reports firms' choice of hedging and the extent of their hedging activities from 1996 to 2002 to all firms in the sample. Foreign Assets include government bonds, and investment abroad. Currency Derivatives include the use of swaps, futures, and options.

	1996	1997	1998	1999	2000	2001	2002
Number of firms	165	165	165	165	165	165	165
Only Foreign Currency Derivatives	10	12	18	22	27	35	41
Only Foreign Assets	3	4	10	14	16	18	19
Both	3	4	6	10	14	22	25
Total	16	20	34	46	57	75	85
Currency Derivatives/Total Foreign Debt (%)	3.12	3.28	6.56	7.78	11.73	18.98	25.01

Table 9
The Choice of Currency Derivatives

Table 9 shows the choice of currency derivatives among Brazilian companies reported in their annual reports from 1996 to 2002.

Year / Type	1996	1997	1998	1999	2000	2001	2002
Swap	8	8	17	24	27	39	49
Swap+Forwards	2	3	2	4	7	10	10
Swap+Options	0	0	0	0	0	0	0
Swap+Options+Forward	0	0	0	0	2	3	3
Forward	3	3	3	2	4	4	3
Options	0	1	1	1	1	1	1
Options+Forward	0	1	1	1	0	0	0
Total	13	16	24	32	41	57	66

Table 10
Univariate Tests

Table 10 shows the results for two-samples t-test of equality of means between users and non-users of foreign currency derivatives. Tests assume equal variances unless the null-hypothesis of equal variances is rejected at a 5% level of significance. Asterisks (*,**) denote statistical significance at 5%, and 10% level of significance.

Variable/Year		1996	1997	1998	1999	2000	2001	2002
Number	**No**	152	149	141	133	124	108	99
	User	13	16	24	32	41	57	66
Derivatives / Total Foreign Debt (%)	**No**	0	0	0	0	0	0	0
	User	39.6	33.6	45.1	40.1	47.1	55.2	62.0
Foreign Assets / Total Assets (%)	**No**	0.27	0.30	0.53	0.96	1.00	1.22	1.16
	User	1.81**	2.05**	3.41*	3.12**	3.85*	3.89*	3.49*
Size								
Total Assets (US$ Millions)	**No**	1,818	1,796	1,810	1,337	1,026	967	759
	User	1,737	1,957	1,430	1,302	2,295	1,787	1,330
Foreign Exposure								
Foreign Sales / Total Sales	**No**	0.13	0.13	0.13	0.14	0.14	0.13	0.14
	User	0.34*	0.30*	0.24**	0.25**	0.23**	0.23*	0.24*
Foreign Operations Dummy	**No**	0.16	0.15	0.15	0.15	0.14	0.12	0.11
	User	0.31	0.38**	0.29	0.25	0.27**	0.26*	0.26*
Foreign Debt / Total Debt	**No**	0.46	0.47	0.44	0.44	0.41	0.40	0.39
	User	0.72*	0.75*	0.72*	0.74*	0.71*	0.64*	0.66*
Financial Distress								
Short term debt / Total debt	**No**	0.55	0.51	0.57	0.50	0.52	0.53	0.55
	User	0.60	0.50	0.50	0.51	0.51	0.54	0.55
Interest Coverage	**No**	5.65	4.23	4.18	3.24	4.51	4.57	4.00
	User	2.87*	2.39*	2.60**	2.01	3.58	3.34	2.49
Underinvestment								
Capital expenses-to-sales	**No**	0.10	0.13	0.13	0.11	0.07	0.10	0.11
	User	0.24	0.15	0.10	0.08	0.09	0.15	0.10
Market-to-book	**No**	0.76	0.91	0.70	1.28	0.40	0.69	1.32
	User	0.87	0.76	0.47	1.25	1.25*	0.63	1.30
Other								
ADR Dummy	**No**	0.13	0.13	0.11	0.09	0.08	0.07	0.08
	User	0.38**	0.38**	0.38*	0.38*	0.34*	0.28*	0.24*

Table 11
Tobit results for the determinants of the use of Currency Derivatives

Table 11 reports the results for the determinants of the use of currency derivatives under the fixed exchange rate regime and under the floating regime. Model (a) uses the ratio of the amount of currency derivatives to total foreign debt as the dependent variable. Model (b) uses the ratio of the amount of currency derivatives to total assets as the dependent variable. Asterisks (*,**) denote 5%, and 10% level of significance. Robust standard errors are estimated.

	Fixed Exchange Rate				**Floating Exchange Rate**			
	(a)		**(b)**		**(a)**		**(b)**	
Variable	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Intercept	-0.075	1.27	-0.025	0.235	-3.814*	1.074	-0.650*	0.194
Size	-0.077	0.092	-0.016	0.017	0.225*	0.079	0.0396*	0.0141
Foreign Sales / Total Sales	0.247	0.449	0.065	0.080	-0.033	0.410	-0.0435	0.075
Foreign Debt / Total debt	1.01*	0.424	0.244*	0.079	0.386**	0.195	0.166*	0.055
Foreign Operations Dummy	0.343	0.249	0.062	0.045	0.101	0.210	0.0085	0.038
Short-Term Debt / Total debt	-0.567	0.488	-0.091	0.091	0.759*	0.321	0.0886	0.058
Interest Coverage	-0.033	0.044	-0.004	0.008	-0.030	0.027	-0.012*	0.0056
Market-to-book ratio	-0.251	0.266	-0.042	0.041	-0.012	0.013	-0.0029	0.0024
Capital expenses/ Total sales	-0.067	0.470	-0.008	0.046	-0.308	0.587	-0.0499	0.110
Foreign Assets / Total assets	0.397	1.722	0.032	0.312	0.655	1.223	0.072	0.217
ADR	0.443**	0.261	0.085**	0.048	-0.0233	0.243	0.017	0.044
Industry Dummies	Yes		Yes		Yes		Yes	
N	165		165		165		165	
Left Censored	140		140		97		140	
Right Censored	2		0		14		0	

Table 12
Results for the determinants of the use of Currency Derivatives – Two-stage procedure

Table 12 reports the results for the determinants of the use of currency derivatives under the fixed exchange rate regime and under the floating regime. Model (a) uses the ratio of the amount of currency derivatives to total foreign debt as the dependent variable. Model (b) uses the ratio of the amount of currency derivatives to total assets as the dependent variable. Asterisks (*,**) denote 5%, and 10% level of significance. Robust standard error are estimated.

	Fixed Exchange Rate				**Floating Exchange Rate**			
	(a)		**(b)**		**(a)**		**(b)**	
Variable	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Intercept	2.44	2.09	0.37	0.40	-2.96*	1.19	-0.47*	0.22
Size	-0.28	0.19	-0.05	0.04	0.15	0.10	0.022	0.018
Foreign Sales / Total Sales	-0.25	0.57	-0.022	0.11	-0.46	0.52	-0.13	0.10
Foreign Debt / Total debt	2.68**	1.48	0.49**	0.29	1.23**	0.70	0.32*	0.14
Foreign Operations Dummy	0.32	0.25	0.06	0.05	0.07	0.21	0.05	0.40
Short-Term Debt / Total debt	-0.34	0.43	-0.04	0.08	0.82*	0.31	0.10**	0.05
Interest Coverage	-0.009	0.40	0.006	0.007	-0.02	0.03	-0.008	0.005
Market-to-book ratio	-0.23	0.22	-0.04	0.04	-0.013	0.013	-0.003	0.002
Capital expenses/ Total sales	0.040	0.20	0.01	0.04	0.06	0.61	0.03	0.12
Foreign Assets / Total assets	0.29	1.54	0.07	0.30	0.57	1.20	0.10	0.22
Foreign Equity Listing	0.45**	0.26	0.08**	0.05	0.009	0.24	0.02	0.05
Industry Dummies	Yes		Yes		Yes		Yes	
N	165		165		165		165	

Table 13
Logit results for the determinants of the use of Currency Derivatives

Table 13 reports the results for the determinants of the use of currency derivatives under the fixed exchange rate regime and under the floating regime. The dependent variable assumes the value 1 if the firms used currency derivatives, and 0 otherwise. All variables are measure in 1998 (2002). Asterisks (*,**) denote 5%, and 10% level of significance. Robust standard errors are estimated.

	Fixed Exchange Rate		**Flexible Exchange Rate**	
Variable	**Coeff.**	**Std. Error**	**Coeff.**	**Std. Error**
Intercept	0.559	4.012	-9.568*	2.578
Size	-0.344	0.287	0.624*	0.184
Foreign Sales / Total Sales	0.903	1.657	1.180	1.037
Foreign Debt / Total debt	3.832*	1.199	1.483*	0.676
Foreign Operations Dummy	1.190	0.862	0.184	0.550
Short-Term Debt / Total debt	-2.175	1.897	1.240*	0.682
Interest Coverage	-0.111	0.110	-0.105	0.069
Market-to-book ratio	-0.435	0.546	-0.0326	0.025
Capital expenses/ Total sales	-0.123	0.306	-0.456	0.969
Foreign Assets / Total assets	4.352	5.267	1.870	3.589
Foreign Equity Listing	1.519*	0.907	-0.447	0.638
Industry Dummies	Yes		Yes	
N	165		165	

Table 14

Exchange Rate Regimes and the existence of implicit guarantees

Table 14 reports the results for the test of the relation between companies' financial policies and the exchange rate regime. The dependent variable is the ratio of foreign debt to total debt in 1998(2002). Independent variables are for 1997(2001). Asterisks (*,**) denote 5%, and 10% level of significance. Tobit estimation is performed. Robust Standard errors are in parenthesis. F-Statistic is reported for the test of equality of the coefficients of ratio of foreign sales and domestic sales to total debt.

	Fixed Exchange Rate		**Floating Exchange Rate**	
Variable	**Coeff.**	**Coeff.**	**Coeff.**	**Coeff.**
Intercept	-0.55(0.13)*	-0.70(0.17)*	-0.060(0.14)	-0.13(0.21)
Size	0.047(0.010)*	0.059(0.014)*	0.010(0.011)	0.012(0.015)
$(\text{Foreign debt/total Debt})_{t-1}$	0.81(0.052)*	0.79(0.06)*	0.89(0.07)*	0.86(0.071)*
Foreign Sales/ Total Debt	0.013(0.010)	0.014(0.011)	0.012(0.004)*	0.013(0.004)*
Domestic Sales/Total debt	-0.00009(0.0001)	-0.0008(0.0001)	-0.007(0.002)*	-0.007(0.002)*
ADR Dummy	-	-0.036(0.050)	-	-0.013(0.06)
Capital Expenses/Total Sales	-	-0.07(0.094)	-	-0.19(0.13)
Industry Dummies	No	Yes	No	Yes
F-Statistic	1.69	1.56	14.02	14.43
Prob>F	0.196	0.213	0.003	0.002
N	165	165	165	165
Left Censored	24	24	31	31
Right Censored	2	2	3	3

Appendix

Description of Variables[24]

- ADR - Dummy variable assumes the value of 1 if the company issues American depository receipts.
- Current ratio - the ratio of current assets to current liabilities.
- Debt-to-assets - Total Debt in Reais divided by total assets.
- Exchange rate volatility - The standard deviation of monthly percent changes in the nominal exchange rate Real versus US\$. Source: Central bank of Brazil
- Interest rate volatility - The standard deviation of the SELIC rate. Source: Brazilian Central Bank.
- Domestic Sales / Total Sales - Total net sales in Reais divided by total sales.
- Domestic Sales / Total Debt -Domestic sales in Reais divided by the total debt expressed in Reais.
- Foreign Assets – The sum of government bonds (NTN-E), Central Bank bonds (NBC-E), and financial investments abroad expressed in US$, and converted in Reais.
- Foreign Debt / Total Debt - Foreign debt in US\$ converted to Reais by the exchange rate at the end of the year divided by the total debt expressed in Reais.
- Foreign Sales / Total debt -Foreign sales in US\$ converted to Reais by the exchange rate at the end of the year divided by the total debt expressed in Reais.
- Foreign Sales / Total sales -Foreign sales in US\$ converted to Reais by the exchange rate at the end of the year divided by the total sales expressed in Reais.
- Foreign Operations - dummy variable assumes the value 1 if the company has foreign production subsidiaries.
- Investment-to-sales - Total investment in capital, and subsidiaries divided by total net sales.
- Gross Margin - Total calculated EBIT divided by sales.
- Debt - Dummy variable assumes the value 1 if the firm issued debt in foreign currency.
- Derivatives / Foreign debt - Proportion of foreign debt hedged by the use of derivatives.
- Interest Coverage - Calculated as Total EBIT divided by interest expense.

[24] If not mentioned, the data was obtained directly from companies' annual reports.