EXCHANGE RATE EXPOSURE, FOREIGN CURRENCY DEBT AND THE USE OF DERIVATIVES: EVIDENCE FROM BRAZIL

José Luiz Rossi Júnior

Ibmec São Paulo, Rua Quatá 300 – Vila Olímpia, Brazil

ABSTRACT

This paper studies the exchange rate exposure and its determinants for a sample of non-financial Brazilian companies from 1996 to 2006. The results show that more than 25% of the firms in the sample have significant exchange rate exposure. Moreover, the results indicate that the number of firms exposed is higher in periods of crisis and under a fixed exchange rate regime. In addition, the results point out that although companies' international activities, operational hedging and financial policies are important determinants of firms' foreign exposure, the changes in companies' exposure that took place when the country moved from a fixed to a floating exchange rate regime were mainly driven by changes in companies' foreign currency borrowing and the use of derivatives that occurred in the period.

INTRODUCTION

Several episodes of crises and economic downturns in developing countries are associated with depreciations of the home currency. Differently from what happens in their developed counterparts, depreciations are usually viewed as an important source of risk for these countries. Following a sequence of financial crises in the 1990s, a new generation of models of currency crises has placed corporate financial policies, especially foreign currency borrowing and the use of derivatives, at the center of the debate about the relationship between movements of the exchange rate and economic activity.

In these models, negative balance sheet effects caused by depreciations of the home currency would offset the textbook positive expenditure switching effect, leading to a fall in the economic activity, especially in private investment; therefore, the fact that both public and private sector hold a considerable amount of unhedged foreign currency denominated debt would lead depreciations to be more problematic for developing countries when compared to developed ones.

The empirical literature that tries to ascertain the importance of these balance sheet effects obtained mixed results. Analyzing the impact of the exchange rate fluctuations on private investment by using a sample of Latin-American firms, Bleakley and Cowan (2002) find no evidence of the significance of the balance sheet effects. In a survey of six studies for different countries using a similar methodology, Galindo, Panizza and Schiantarelli (2003) find that

four out of six countries show a negative balance sheet effect. This paper departs from the previous literature to analyze the role of foreign currency borrowing and the use of derivatives in explaining the impact of exchange rate fluctuations on corporate sector and consequently on economic activity.

The paper takes a systematic look at companies' exchange rate exposure and its determinants for a sample of non-financial Brazilian companies from 1996 to 2006. The analysis employs a unique database constructed directly from companies' annual reports containing information about their international activities, currency composition of the debt and use of derivatives.

The paper contributes to the literature by analyzing whether corporate financial policies play a role in the determination of companies' exchange rate exposure. Most of previous studies about the determinants of companies' exchange rate exposure focused on developed countries with the exception of Muller and Verschoor (2007) for East Asian countries and Dominguez and Tesar (2006) for Chile and Thailand. Yet, none of the papers for developing economies studied whether corporate international activities together with financial policies, especially foreign currency borrowing and use of derivatives have an impact on companies' exchange rate exposure.

Moreover, the fact that during the period of this study Brazil adopted two different exchange rate regimes – a (quasi-) fixed exchange rate regime from 1996 to 1999 and a flexible exchange rate regime from 1999 to 2006 – allows us to test not only the impact of the adoption of each regime on companies' exchange rate exposure but also whether changes in companies' exchange rate exposure that took place when the country moved from a fixed to a floating exchange rate regime may be associated with changes in their financial policies.[1]

First, this study analyzes to what extent Brazilian companies are exposed to exchange rate fluctuations using different methods proposed by the literature. According to our findings, on average, Brazilian companies – unlike their counterparts in the U.S. – do not benefit from depreciations of home currency and a significant number of companies is exposed to fluctuations in the exchange rate.[2] In fact, this study confirms that a depreciation of the Brazilian Real led to a fall in the average company's stock market returns, evidencing that exchange rate fluctuations are indeed troublesome for developing economies like Brazil. Moreover, this study shows that depending on the method of estimation, from 25% to 38% of the companies in the sample are exposed to exchange rate fluctuations in the period from 1996 to 2006, indicating that Brazilian companies are significantly affected by movements in the exchange rate.

Second, this study investigates whether these results depend on the time-period used in the analysis. The results show that there is a substantial time-variation in companies' exchange rate exposure. The number of companies exposed to exchange rate fluctuations is higher during the fixed exchange rate regime period than under the flexible one and during periods of crisis. In addition, we show that when the country moved from a fixed to a floating exchange rate regime, besides the fact that the number of companies with a significant exchange rate exposure is lower, there is a change in the distribution of companies' exchange rate exposure with a reduction in the number of companies that do not benefit from depreciations of home currency, implying that depreciations become less problematic after the adoption of a flexible exchange rate regime.

Finally, this analysis provides evidence that companies' exchange rate exposure is determined not only by their international activities but also by their financial policies, especially foreign currency borrowing and use of derivatives. In addition, it is shown that the documented changes in companies' exchange rate exposure that took place when moving from a fixed to a floating exchange rate regime were mainly determined by changes in companies' financial policies. The improvement in companies' prudential measures led to a reduction in their exchange rate risk. This study shows that the reduction in companies' foreign currency denominated debt and the increase in their use of foreign currency derivatives have an impact on their exchange rate exposure.

The paper proceeds as follows. In section 2, it describes the Brazilian macroeconomic environment and shows the data that will be used throughout the text. In section 3, it estimates companies' exchange rate exposure and analyzes whether this exposure changes across different periods. Section 4 analyzes the main cross-sectional determinants of companies' exchange rate exposure and tests whether changes in corporate financial policies have an impact on changes in companies' exchange rate exposure. Section 5 summarizes the results and gives some policy implications.

2. MACROECONOMIC BACKGROUND AND DATA

2.1. Macroeconomic Background

In the period between the stabilization plan in 1994 and January 1999, Brazil adopted a "crawling-band" exchange rate regime.[3] During this period, Brazil suffered from several speculative attacks, especially during the Asian and Russian crises. The Central Bank promptly reacted to those attacks by raising interest rates in order to maintain the regime, clearly demonstrating 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 displays the behavior of some macroeconomic variables from 1996 to 2006.

After a speculative attack in January 1999, currency was allowed to float, and an inflation-targeting regime was adopted. By tightening monetary and fiscal policies, Brazil succeeded in stabilizing inflation and the economy quickly recovered from the crisis. In 2002, due to the possibility that a new president against current policies would be elected, a reversal of capital flows took place and the exchange rate depreciated more than 50% during the year with a consequent rise in inflation. After 2003, home currency started to appreciate because the new government opted to reinforce the orthodox macroeconomic policy and a positive external shock represented by an increase in the price of the main exported commodities struck the country.

2.2. Data

Data for this analysis were collected from both companies' annual reports and Economática, a database that contains stock market and financial data for all Latin-American publicly traded companies. A sample of Brazilian non-financial publicly traded companies from 1996 to 2006 is used. The description of all variables used throughout the text is shown in the Appendix. The

Figure 1: Evolution of Main Macroeconomic Variables for Brazilian Economy from 1996 to 2006
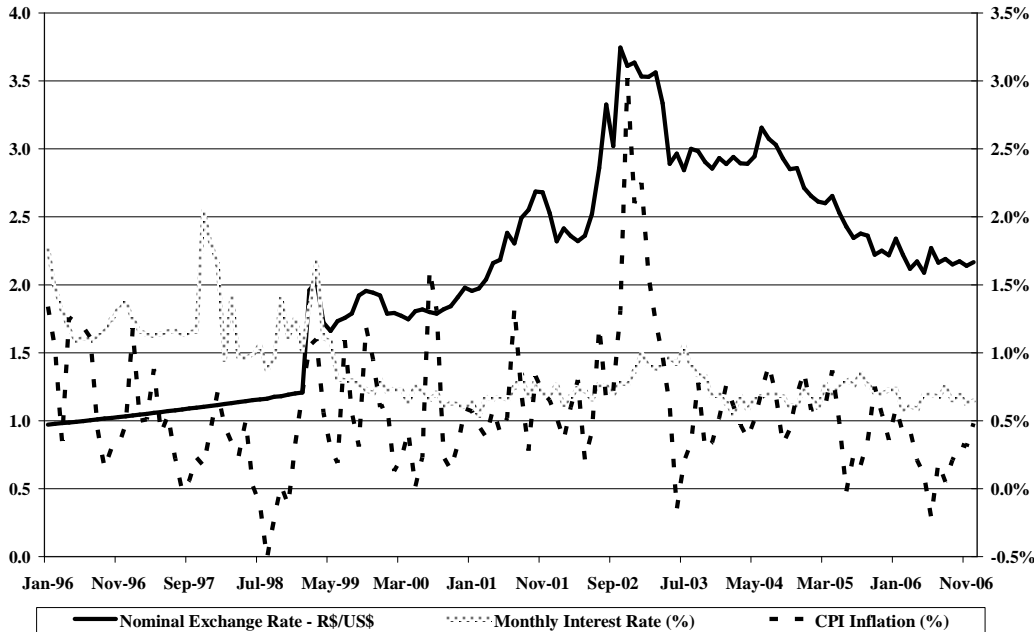
Notes: The nominal exchange rate stands for the exchange rate between Brazilian Real and US dollar. The monthly interest rate stands for the monthly rate for savings account. Inflation is the CPI inflation.
Source: Central Bank of Brazil.

choice upon the period 1996 - 2006 is made because the use of derivatives was required to be reported only after 1995.[4] The sample contains information for all the companies that were in the database in 1996 and stayed until 2006, a total of 173 companies.[5] This procedure was followed in order to give a better comparison of companies' behavior under different time periods. All information was obtained from the consolidated balance sheet in case a company has subsidiaries that are also publicly traded. The final sample comprises more than 50% of all publicly traded companies in Brazil and 67.9% of all market capitalization.

The São Paulo stock exchange index (IBOVESPA) was adopted as the domestic stock market return. This index was used because the São Paulo stock exchange is the most important and liquid stock market in Brazil. The savings account interest rate was used as the risk-free interest rate.

Because most of Brazilian trade is in American dollars and almost all foreign currency debt is issued in this currency, the analysis of companies' exchange rate exposure is developed by using the exchange rate Real/Dollar. The convention adopted is that companies with positive (negative) exposure benefit (suffer) from depreciations of home currency. This definition holds throughout the text.

Data about foreign sales, the currency composition of the debt and the use of derivatives were collected directly from companies' annual reports. Unfortunately, Brazilian companies

do not have a systematic procedure to register information about their foreign sales. Sometimes it is reported together with their total gross sales, sometimes it is reported under the comments from managers to shareholders, and sometimes it is found in the explanatory notes. In some cases, companies mention being exporters, but do not report the amount of foreign sales; in this case, the companies were directly contacted through electronic mail. In the end, seven companies mentioned as exporters had to be discarded because none reported the amount of their foreign sales or answered the emails.

Data about companies' import inputs are reported by the Secretary of Trade. The Secretary of Trade reports the value of imports in US$ only for the 250 largest importers, for all others the Secretary of trade reports only the interval of the value of imports. We create then a variable that assumes discrete values for all intervals reported by the Secretary of Trade starting from 0 for non-importers.

Information about corporate foreign currency borrowing and the use of currency derivatives is available in the annual reports under the explanatory notes. The amount of foreign currency denominated debt is located under the item loans and financing and the use of derivatives is registered under the item financial instruments.

The total gross notional value of currency derivatives is used as proxy for the extension of the use of currency derivatives. Graham and Rogers (2002) argue that ideally in order to identify a more precise picture of companies' risk management practices one should compute the net position of the companies in the derivatives markets. However, as this information is only made available to a small number of firms, we opted to use the total gross notional value that is available to a larger number of companies.[6]

2.2.1 Sample Characteristics

A summary of the statistics for the main variables in this paper can be found in Table 1. Table 1 shows that although the number of exporters and importers is reported to be stable during the period, the ratio of foreign sales to total sales follows a different pattern. From 1996 to 1998, during the fixed exchange rate regime, the ratio remained stable; yet after the currency was allowed to float until 2002, the ratio increased steadily. After 2002, with the appreciation of the home currency, there was a slight reduction in the ratio of foreign sales to total sales, but still in a proportion higher than the fraction observed before 1999. This fact corroborates the idea that the traditional expenditure-switching effect took place with exports rising after the depreciation of the domestic currency, and falling after the appreciation.

Table 1 displays the behavior of corporate foreign currency borrowing during the period. It reports that the proportion of companies in the sample that hold foreign currency denominated debt reached a peak in 1998 right before the currency crisis. This proportion decreased after the crisis, especially after 2004, reaching its minimum value in 2006. Similar pattern was followed by the ratio of foreign debt to total debt that reached its peak in 1999 and suffered a significant fall after 2002.

Table 1 also shows that the proportion of companies that keep subsidiaries abroad was stable until 2003, increasing only after 2004, although its level is still very close to what it was in 1996.

Table 1
Summary Statistics

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Number of firms	173	173	173	173	173	173	173	173	173	173	173
Exporters (%)	56.6	56.0	57.8	58.3	58.3	58.3	58.3	58.3	57.8	55.6	55.0
Foreign Sales / Total Sales (%)	12.3	12.3	12.3	14.0	14.1	14.9	16.1	15.8	16.0	15.3	15.3
Importers (%)	66.4	66.4	67.0	64.7	64.7	67.0	68.2	68.2	68.2	69.3	69.3
Debtors (%)	76.9	77.4	82.1	78.6	76.8	76.3	76.8	72.8	73.4	72.1	64.6
Total Foreign Debt/ Total Debt (%)	44.4	46.5	46.6	49.7	48.8	48.8	49.1	42.4	41.5	36.1	31.7
Foreign Subsidiaries (%)	17.9	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.9	18.1	18.1
Users-Currency Derivatives (%)	6.93	8.67	13.8	16.2	24.9	33.5	38.7	34.7	32.3	34.3	26.5
Derivatives / Total Assets (%)	0.53	0.63	1.06	1.29	1.84	3.15	3.90	3.13	2.10	2.34	1.76
Derivatives / Total Foreign Debt (%)	5.91	3.83	7.21	7.38	15.4	19.7	25.1	23.1	34.5	54.3	48.3
(Net) Foreign Debt/ Total Debt (%)	42.6	44.6	42.9	45.8	42.9	38.5	37.1	33.2	32.9	27.4	23.9

Notes: Exporters represents the percentage of exporters in the sample. *Debtors* represents the percentage of companies in the sample that hold foreign currency denominated debt. *Foreign Subsidiaries* represents the percentage of companies in the sample that have foreign affiliates. *Users* represents the percentage of companies that use foreign currency derivatives. All other variables are described in the appendix.

In table 1, the use of currency derivatives is reported to have a considerable variation from 1996 to 2006. This table shows that the number of users of derivatives increased from 1996 to 2002. Likewise, the extent of hedging activities represented by the ratio of the total notional amount of derivatives to total assets and the total notional amount of derivatives to total foreign debt also increased during the same time frame. An interesting pattern arises after 2002 with respect to the use of currency derivatives; there is a reduction in the ratio of derivatives to total assets, indicating that firms used derivatives less intensively. This reduction can be explained by the fact discussed by Rossi (2007), Brazilian firms use derivatives to protect themselves from fluctuations in the exchange rate on the liability side of their balance sheets, with the reduction of the ratio of foreign debt to total debt, firms reduce the total amount of currency derivative used.

Yet data from table 1 also show that the ratio of derivatives to total foreign debt increased until 2005 and even after a reduction in 2006 the level of this ratio is much higher than before; the ratio of (net) foreign debt to total debt defined as the total amount of foreign debt to total debt minus the total amount of currency derivatives used by the firm – a better proxy for the exposure of the liability side of the companies – decreased steadily since 1999. These results are consistent with theory that a flexible exchange rate regime would have an impact on companies' currency mismatches. The data evidence that the floating exchange rate regime reduces the currency mismatches on companies' balance sheets. Cowan, Hansen and Herrera (2006) show a similar pattern for Chilean companies.

Summarizing, the data show that although Brazilian companies' international activities changed during the period of the study, corporate financial policies especially the amount of foreign currency denominated debt and the use of currency derivatives suffered from more substantial changes within the period. Companies took the exposure of the liability side of their balance sheets more seriously, reduced the amount of their debt expressed in foreign currency and increased the use of derivatives, which resulted in reducing currency mismatches on their balance sheets. In the next sections, we will test whether these changes have an impact on their foreign exposure.

3. EXCHANGE RATE EXPOSURE

3.1. Methodology

The international finance literature characterizes the impact on companies' cash flow as the channel through which companies would be exposed to exchange rate fluctuations.[7] 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 (2003), the use of cash flow variables is not easily applicable to cross-firm comparisons, since it would make the analysis extremely complex.[8]

Adler and Dumas (1984) show that assuming that companies' 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 to changes on the exchange rate. Therefore, the following equation was estimated:

$$R_{it} = \alpha_i + \beta_i.\Delta S_t + \varepsilon_{it} \qquad (1)$$

Where R_{it} is the stock-return of firm i in period t, ΔS_t is the change in exchange rate and β_i represents firm i exchange rate exposure. i.e., the sensitivity of firm i stock-returns to movements in the exchange rate. Jorion (1990) argues that other macroeconomic variables could covary with firm i stock-returns and the exchange rate, therefore the estimation of (1) could be attributing an exaggerate weight to the impact of the exchange rate. In order to control for these variables, the author adds a market portfolio to the estimation of (1). So, we have the following equation:

$$R_{it} = \alpha_i + \beta_i.R_{mt} + \theta_i.\Delta S_t + \varepsilon_{it} \qquad (2)$$

Bodnar and Wong (2003), using a sample of US firms over the period 1977-1996, show that the inclusion of a market portfolio in the specification results in significant changes to the exposure estimates with exposure coefficients more stable and meaningful across different periods. As this approach has since then been extensively used in the corporate finance literature, we will utilize this specification as our baseline result for the estimation of companies' exchange rate exposure.

Since the studies of Jorion (1990) and Amihud (1994) found that exchange rate fluctuations matter only for a small number of companies in the U.S., the literature has been focusing on different methods in order to verify the robustness of the results.[9]

Bodnar and Wong (2003) discuss that the lack of significance of the exchange rate coefficient is due to the fact that the market portfolio is a value-weighted market portfolio which induces a bias in the estimation of companies' exchange rate exposure since 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 are usually multinational corporations). In this case, the coefficient of the changes in the exchange rate cannot be interpreted as 'total' exposure; rather it should be interpreted as the 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 firms' exposure will be shifted. Using an equally-weighted portfolio, the authors found a larger number of companies with significant exchange rate exposure. So, we also estimate (2) using an equally-weighted market portfolio return encompassing all firms in the sample.

Another procedure to control for multicolinearity problems is used by Bris, Koskinen and Pons (2004) and Kiymaz (2003). Companies' exchange rate exposure is estimated by following a two-step procedure. In the first step, the market portfolio is regressed on the changes in the real exchange rate as shown by equation (3).

$$R_{market,t} = \gamma_0 + \gamma_1.\Delta S_t + \varepsilon_t \tag{3}$$

Then, the component of the market portfolio return that is orthogonal to the changes in the exchange rate is obtained by calculating $F_{market,t} = R_{market,t} - (\hat{\gamma}_0 - \hat{\gamma}_1.\Delta s_t)$. Finally, companies' exchange rate exposure is estimated by regressing companies' excess stock market return on the orthogonal component of the market portfolio and on changes in the exchange rate as illustrated by equation (4).

$$R_{i,t} = \alpha_i + \beta_{i,market}.F_{market,t} + \beta_{i,exposure}.\Delta s_t + v_{i,t} \tag{4}$$

Where $R_{i,t}$ is the stock return of firm i, $F_{market,t}$ is the estimated orthogonal component of the market portfolio (Ibovespa), and ΔS_t is the percentage change in the exchange rate over the same period.[10] We also estimate companies' exchange rate exposure using (4) in order to analyze the robustness of the results.

Dominguez and Tesar (2006) discuss that in a world of perfectly integrated financial markets, the market portfolio might be better represented by a global portfolio. In order to control for this fact, we also add a global portfolio – the world index reported by Datastream expressed in Brazilian home currency – to the estimation of (2).

Finally, Chow, Lee and Solt (1997) argue that due to the fact that market participants make errors in forecasting the long-term effects of exchange rate fluctuations, the estimation of (2) using short-term horizon returns would fail to detect companies' exposure to exchange rate fluctuations. The authors confirm this fact showing that a large number of firms have significant exchange rate exposure when large horizon returns are used in the estimation of (2). Similar results were found by Dominguez and Tesar (2006), Bodnar and Wong (2003) among others. Besides our baseline estimation using monthly returns, we also estimate (2) using weekly returns to analyze the dependence of the results with respect to the horizon of the returns.

3.2 Results

Table 2 shows that some interesting results arise from the estimation of companies' exchange rate exposure from 1996 to 2006. First, Table 2 reports the destabilizing potential of exchange rate fluctuations. On average, Brazilian companies do not benefit from a depreciation of the domestic currency. According to our baseline specification, a one-per cent depreciation of home currency leads to a 0.11 per cent fall in stock market returns. This result is consistent with the hypothesis that in relatively closed and high indebted emerging countries like Brazil, depreciations of home currency are more likely to cause a fall in asset prices due to presence of negative balance sheet effects.[11] This result contradicts Bleakley and Cowan (2002) that found for a sample of Latin-American companies that the negative balance sheet effects generated by depreciations of home currency are completely offset by the positive expenditure-switching effects. Our results show that with respect to Brazil, this is not true. Instead, the negative effect, on average, surpasses the positive effect of depreciations, leading to a fall in stock market returns. This result is robust across the different methods presented in table 2.

Table 2 also shows that independently of the method used, about 25 per cent of the companies are exposed to fluctuations of the exchange rate. This proportion of companies exposed is higher than most studies for U.S. companies, evidencing that exchange rate fluctuations, besides having negative effects, affect a large number of Brazilian companies. Among the methods adopted to estimate (2), table 2 confirms the importance of orthogonalizing the market returns. When the market portfolio is used as a control variable to estimate (2), 27 companies stand out with positive exposure and 17 with negative and statistically significant exposure. Once the market returns are orthogonalized, the number of companies with negative exposure increases considerably and the number of companies with positive exposure decreases. Indeed, the result of the estimation of the first step shows that the market portfolio is negatively exposed to changes in the exchange rate[12] Because the market portfolio is negatively exposed to exchange rate fluctuations, it is expected that when using the market portfolio as control, a higher number of companies with significant positive exposure and a lower number of companies with negative exposure would show up, since these estimated exposures are relative to the

Table 2
Exchange Rate Exposure for Brazilian Companies 1996-2006

Model	Baseline	EquallyWeighted	Orthogonal	MSCI	Weekly
Mean	-0.109	-0.117	-0.196	-0.118	-0.0581
Median	-0.0681	-0.0546	-0.1534	-0.0896	-0.0363
Maximum	0.948	0.842	0.742	0.915	0.780
Minimum	-1.977	-1.716	-1.971	-2.020	-1.398
Significant	44	42	65	47	27
Negative	27	31	52	32	17
Positive	17	11	13	15	10
Number of Companies	173	173	173	173	173

Notes: The *Baseline* is an OLS estimate with robust standard errors. *Equally weighted* uses an equally weight market portfolio index instead of a value-weighted portfolio index. *Orthogonal* represents the estimation in two steps in order to control for multicolinearity. *MSCI* adds the MSCI world index in the estimation of (2). *Weekly* shows the results of estimation of (2) using 1-week returns instead of monthly returns. Results for companies' exchange rate exposure considered 5% level of significance.

market portfolio. Yet, once the 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 now absolute exposures rather than relative exposures to the market portfolio are estimated. In our subsequent estimations, as a robustness exercise, we will also use the exposure estimated from this method.

Interesting to note that, although less pronounced once we use an equally weighted portfolio as our market portfolio, there is also an increase in the number of firms with negative exposure and a decrease in the number of companies with a positive and significant exchange rate exposure. It might be explained by the fact that larger firms dominate the market portfolio, and these companies are more likely to hold debt denominated in foreign currency, consequently the market portfolio is likely to be negatively affected by changes of in the exchange rate.[13]

Results in table 2 also confirm previous results that the significance of companies' exchange rate exposure depends on horizon returns considered in its estimation. Once we use one-week returns instead of monthly returns, the number of companies with significant exchange rate exposure fall from 44 in our baseline estimation to 27, indicating as argued by Chow, Lee and Solt (1997) that, in the short-term, investors make errors about the role of exchange rate fluctuations on the firms' cash flow, reducing its impact on firm value. Finally, results in table 2 indicate that the inclusion of a world index does not have any influence on the results. As discussed by Dominguez and Tesar (2006), the global portfolio does a poor job of explaining returns; therefore, adding the world index to the estimation of (2) does not change the results significantly.[14]

3.3 Exchange Rate Exposure, Time Variation and the Exchange Rate Regime

Several studies show that companies' exchange rate exposure is not stable across different time periods.[15] As argued by Dominguez and Tesar (2006), the assumption that companies' exposure does not vary with time is too strong, since companies are likely to change to adapt to exchange rate risk.

Following Ihrig and Prior (2005), this study tests whether the exchange rate exposure varies in periods of crisis and non-crisis. The authors find that the number of companies with a significant exchange rate exposure is higher under periods of crisis and that some firms have significant exposure only in crisis periods while others have significant exposure only during normal exchange rate fluctuations.

The events that took place in the Brazilian economy also allow us to test whether the change from a fixed to a floating exchange rate regime have an impact on companies' exchange rate exposure. Parsley and Popper (2006) found for a sample of East-Asian countries that foreign exchange exposure was much more widespread under a peg than under a floating exchange rate regime.

The following equation is estimated:

$$R_{it} = \alpha_i + \beta_i.R_{mt} + \sum_j D_j.\theta_i.\Delta S_t + \varepsilon_{it} \qquad (5)$$

Where D_j are dummy variables that assume the value of 1 during the subperiods where the sample is divided and 0 otherwise. First, we divide the sample into two different subperiods:

one denominated fixed, from January 1996 to December 1998, where the country adopted a fixed exchange rate regime; second, between January 1999 and December 2006, covering the period of a floating exchange rate regime. In order to study the impact of the crises on companies' exchange rate exposure, the sample is also divided into five subperiods: the first, from January 1996 to August 1998, comprehends the period of the fixed exchange rate regime; the second, subperiod from September 1998 to April 1999 and represents the period of the currency crisis and the change in the exchange rate regime; the third, from April 1999 to March 2002, a tranquil time under the floating exchange rate regime; the fourth comprehends the period before the presidential election, from April 2002 to December 2002; and the last encompasses the period after January 2003 until December 2006.

Table 3 reports that the floating exchange rate regime indeed helps to alleviate the problem of companies' exposure to fluctuations in the exchange rate. Under the floating exchange rate regime, 14% of the companies are exposed to fluctuations in the exchange rate; however, under the fixed exchange rate regime more than 20% of the companies are exposed to fluctuations in the exchange rate. Therefore, one can reject the hypothesis that the fixed exchange rate regime would give a more stable environment for business; leading companies' value to be less volatile. Indeed, the opposite is observed. Under the fixed regime, companies' value is much more sensitive to changes in the exchange rate, leading to a more unstable environment. The results are robust with respect to the method used for estimation of (2).[16]

The results in table 3 also show that when the country moves from a fixed to a floating exchange rate regime there is not only a change in the number of companies with statistically significant exchange rate exposure but also a shift in the distribution of companies' exposure. Under the floating exchange rate regime, the median exposure is positive, and the opposite, under the fixed regime. This fact reflects the increase in the number of companies with positive exchange rate exposure and the decrease of companies with negative exposure under the floating regime.

The results presented in table 3 confirm the results of Ihrig and Prior (2005). The number of companies with a statistically significant exchange rate exposure increases in periods of crisis. In the currency crisis of 1999, 52% of the firms in the sample were exposed to exchange rate fluctuations. Yet, in the 2002 crisis, 30% show a significant exchange rate exposure. Interesting to note that although this proportion is higher than during not-crisis period, it is lower than the proportion of firms exposed during the crisis in 1999.

The results in table 3 also show a steady change in the distribution of companies' exchange rate exposure across different periods. The median of companies' exchange rate exposure moved from -0.154 during the first crisis to +0.002 in the final subsample. At the same time, there was also an increase in the maximum positive exposure and a reduction in the minimum negative exposure. When we compare non-crisis periods in table 3, we observe that again the fixed exchange rate regime presents the highest number of companies with significant exchange rate exposure (33) and consistently with our previous results; during the floating period, there is an increase in the number of companies with positive exchange rate exposure and a decrease in the number with negative exchange rate exposure.

Table 3
Time Variation of Brazilian Companies' Exchange Rate Exposure

	Pegged	*Flexible*	*Pegged*	*Crisis*	*Flexible*	*Crisis2*	*Flexible2*
Mean	-4.772	-0.043	-4.399	-0.263	-0.148	-0.035	-0.031
Median	-4.195	+0.001	-4.221	-0.154	-0.091	-0.050	+0.002
Maximum	4.502	1.281	6.267	1.590	1.867	1.833	2.678
Minimum	-6.460	-1.607	-6.732	-5.445	-3.430	-2.333	-2.076
Significant	36	25	33	90	28	52	19
Negative	30	13	26	63	18	33	10
Positive	6	12	7	27	10	19	9
Number of Companies	173	173	173	173	173	173	173

Notes: In the first two columns, the sample is divided into two periods. Pegged, from January 1996 to December 1998, with the country adopting a fixed exchange rate regime, and flexible, from January 1999 to December 2006, covering the period of a floating exchange rate regime. The last five columns show the results of the estimation of (5) splitting the sample into five periods. Pegged, from January 1996 to August 1998, comprehends the period of the fixed exchange rate regime. The second sub period covers from September 1998 to April 1999 and represents the period of the currency crisis and the change of the exchange rate regime. The third, from April 1999 to March 2002, a tranquil time under the floating exchange rate regime; the fourth comprehends the period before the presidential election from April 2002 to December 2002, and the last from January 2003 to December 2006. All results are from our baseline procedure. Results for companies' exchange rate exposure considered 5% level of significance.

Table 4 takes a closer look at the dynamic of companies' exchange rate exposure across different subsamples. Results in table 4 confirm the instability of companies' exchange rate exposure. The results show that when we split the sample into fixed and floating periods, only 7 companies show a statistically significant exchange rate exposure in both periods; 47 are exposed to exchange rate fluctuations only in one period; and 119 were never exposed. In addition, when we split into crisis and non-crisis periods none of the companies in the sample were exposed in all periods and most of the companies were exposed during fewer than two periods.

The results in table 4 also indicate that the change in distribution of companies' exchange rate exposure observed when the country moved from a fixed to a floating exchange rate regime took place mainly because of the Brazilian companies' shift towards a positive exchange rate exposure. Twenty-six firms in the sample changed from a negative statistically significant exposure to a non-significant exposure, four directly from a negative to a positive exchange

Table 4
Exchange Rate Exposure for Brazilian Companies and the Exchange Rate Regime

Both Periods	*In One Period*	*Never*	*In all Periods*	*4 Periods*	*3 Periods*	*2 Periods*	*1 Period*	*Never*
7	47	119	0	6	15	48	57	47

Changes from Fixed to Flexible

Positive-Negative	*Positive-Non Significant*	*Negative-Positive*	*Negative-Non Significant*	*Non Significant-Positive*	*Non Significant-Negative*
0	0	4	26	7	10

Notes: The first two lines show the number of companies that have statistically significant exchange rate exposure in different periods. The last two lines show the change in the distribution of companies' exchange rate exposure from the fixed to flexible exchange rate regime period.

rate exposure, and seven from a non-significant exposure to a positive exposure. None of the firms changed from a positive to a negative or non-significant exposure and 10 changed from a non-significant exposure to a negative exchange rate exposure.

4. THE DETERMINANTS OF COMPANIES' EXCHANGE RATE EXPOSURE

The results in the previous section showing that companies' exchange rate exposure varies across different time periods might be driven by changes in different factors. International activities (exports, import inputs), industry competitive structure, operational hedging, and corporate financial policies, especially foreign currency borrowing and use of derivatives, are among the factors identified by the literature as exerting impact on companies' exchange rate exposure.[17] In this section, we discriminate the role of these different factors that have impact on companies' exchange rate exposure and we analyze which factors were important in causing the time variation in the exposure observed in the last section.

4.1. Methodology and Results

In order to perform a formal analysis of the main determinants of companies' exchange rate exposure, the following equation is estimated:

$$\beta_i = \alpha_0 + \alpha_1.\log (\text{Total Sales}) + \alpha_2.(\text{Foreign Sales/Total Sales}) + \alpha_3.(\text{Imports})$$
$$+ \alpha_4.(\text{Foreign Operations Dummy}) + \alpha_5.(\text{Foreign Debt/Total Debt})$$
$$+ \alpha_6.(\text{Derivatives/Total Assets}) + \alpha_7. \text{ Sectoral Dummies} + \varepsilon_i \qquad (6)$$

Where β_i are the exchange rate exposures estimated in Table 2. The independent variables are the average of the variables during the whole period of the estimation for all firms.

Larger firms might be able to manage fluctuations of the exchange rate better, leading to a positive relationship between exposure and the size of the company; therefore we expect α_1 to be positive. 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; therefore we expect α_2 to be positive and α_3 to be negative.

Companies can reduce their exposure to exchange rate fluctuations by making use of hedging instruments. The literature identifies two types of hedges: operational hedges and financial hedges. Operational hedges pertain to companies with foreign subsidiaries, since these companies will be protected from fluctuations in the home currency by having a fraction of their revenue coming from abroad. In this case, we expect $\alpha_4 > 0$.

Financial hedges stand for the use of currency derivatives – swaps, futures, forwards, and options – to mitigate companies' foreign exposure. The previous literature mainly focused on developed countries included foreign currency denominated debt as a hedging instrument since the companies in these countries would use foreign debt as a way to offset the exchange rate fluctuations on their revenue side. In this paper, given the destabilizing effect of foreign currency liabilities on the companies' balance sheet in developing countries, these two variables are disentangled. The coefficient of the ratio of derivatives to total assets is expected to be positive, confirming the efficiency of hedging activities and the coefficient of the ratio of foreign currency

debt to total debt to be negative, indicating the risk of keeping currency mismatches on companies' balance sheets. Sectoral dummies were included in the estimation of (6) to control for the competitive structure of each industry.[18] The results are shown in Table 5.

Table 5
The Determinants of Foreign Currency Exposure

Variable	Baseline	Orthogonal
Size (log Total Sales)	0.672 (1.18)	0.662 (1.76)**
Foreign Sales / Total Sales	0.082 (0.29)	0.283 (1.85)**
Imports	-0.070 (-1.99)*	-0.014 (-3.17)*
Foreign Operations Dummy	0.486 (2.70)*	0.336 (3.01)*
Derivatives / Total Assets	0.042 (2.03)*	2.02 (1.71)**
Foreign Debt / Total Debt	-0.767 (-3.72)*	-0.284 (-2.14)*
Industry Dummies	Yes	Yes
R^2	0.400	0.285
Number of Companies	173	173

Notes: *Baseline* represents the use of exchange rate exposures obtained in our baseline regression. *Orthogonal* represents the use of the exposures obtained using the orthogonalization procedure. The description of all variables is in the appendix. *,** indicate significance at 5% and 10% level of significance. t-statistics are in parentheses.

The results in Table 5 indicate that there is a positive relationship between size proxied by the logarithm of total sales and the exchange rate exposure. This confirms that larger companies are able to manage fluctuations of the exchange rate better, leading to a positive relationship between exposure and the size of the company. This result is not robust across different specifications.

Although not robust across the different definitions of exchange rate exposure, the results in table 5 gives evidence that the ratio of foreign sales to total sales is positively related to the companies' exchange rate exposure. Agreeing with our predictions, the variable proxy for the amount of imports is negative and statistically significant, confirming that importers do not benefit from depreciations of the home currency.

The results do confirm the hypothesis that operational hedges have positive effects on the companies' exchange rate exposure. A dummy that assumes the value 1 if the firm has foreign subsidiaries is statistically significant in all specifications. Therefore, contrary to Allayannis and Ihrig (2001), there is evidence that operational hedging is efficient for Brazilian companies.

Results in Table 5 also show that the use of currency derivatives does alleviate companies' exposure to exchange rate fluctuations. The results indicate that the use of currency derivatives have a positive effect on the companies' exchange rate exposure. The result is robust with respect to the proxy for the use of derivatives. If we use a variable dummy that assumes the value of 1 in case the firm uses derivative and 0 otherwise instead of the ratio of total notional derivatives to total assets – we obtain similar results.

Finally, the results point out that the ratio of foreign debt to total debt affects the companies' exchange rate exposure negatively. This result indicates the importance of the negative balance sheet effects on companies' value. The results confirm the idea that foreign currency denominated debt exposes Brazilian companies to a significant source of risk, and that the negative effect of the interaction between foreign debt and exchange rate fluctuations is not negligible.[19]

4.1.1 Endogeneity Issues

Results in table 5 may suffer from endogeneity problems. Foreign borrowing and the use of derivatives may be, respectively, able to boost or mitigate companies' exchange rate exposure, but the causation may run in the opposite direction. Companies whose exchange rate exposure is higher for reasons other than dollarized liabilities may have restricted their access to international capital markets by reducing their foreign borrowing. These companies will be more likely to use currency derivatives in order to reduce their exposure. Therefore, a higher level of exposure may cause low levels of foreign borrowing and a more extensive use of currency derivatives, leading to a negative correlation between exchange rate exposure and the ratio of foreign debt to total debt and a positive correlation between exposure and the use of currency derivatives, biasing our previous results. We move one step further in the literature by trying to solve this endogeneity problem.[20]

First, it is necessary to find instrumental variables to solve the problem. The optimal capital structure and hedging literature shed light on possible instruments for the estimation of (6).

In a survey of the empirical literature, Harris and Raviv (1991) found that, among other factors, leverage is negatively related to growth opportunities and profitability. Companies with greater growth opportunities are expected to use less debt in order to avoid underinvestment costs related to debt overhang problems (Jensen and Meckling, 1976). Moreover, Froot, Scharfstein, and Stein (1993) argue that given capital market imperfections, firms would hedge in order to mitigate their underinvestment problem; therefore, firms with higher growth opportunities are more likely to use currency derivatives. In addition, Rossi (2007) finds the existence of a relationship between profitability and the use of currency derivatives by Brazilian firms. The author shows that more profitable firms use currency derivatives more intensively, indicating that profitability is a complement for the use of derivatives. These facts make the ratio of capital expenses to total sales - a proxy for growth opportunities – and the firms' gross margin – a proxy for profitability - good instruments for the estimation of (6).

Table 6 shows the results of the instrumental variable estimation using our baseline results.[21] First, it is possible to see that endogeneity is indeed a problem in our estimation. A standard Hausman test rejects the hypothesis that the coefficients are the same in the ordinary least squares and in the instrumental variables estimation. Yet, the main results are robust to this problem. Exports positively affect the companies' exchange rate exposure, the opposite with respect to imports. The results in table 6 also confirm that operational hedging represented by the presence of foreign affiliates have a positive impact on the companies' exchange rate exposure.

Once the endogeneity is controlled, the hold of foreign currency denominated debt is still significant for the determination of companies' exchange rate exposure. Therefore, there is much ado about this problem. The presence of liabilities expressed in foreign currency in companies' balance sheets is a severe source of risk to developing countries.

The results also confirm that the use of currency derivatives is effective in offsetting the negative exposure that comes from the companies' foreign liabilities; there is a positive and statistically significant relationship between the use of currency derivates and companies' exchange rate exposure.

Table 6
The Determinants of Foreign Currency Exposure - Instrumental Variables Estimation

Variable	IV-2SLS Baseline	First Stage Foreign Debt / Total Debt	First Stage Derivatives / Total Assets
Size (log Total Sales)	0.758 (0.13)	0.081 (8.23)*	0.276 (2.44)*
Foreign Sales / Total Sales	0.547 (1.97)**	0.233 (2.56)*	-0.034 (-1.70)**
Imports	-0.015 (-1.96)**	0.081 (3.89)*	0.078 (1.53)
Foreign Operations Dummy	0.377 (2.67)*	0.026 (0.64)	0.041 (0.041)
Derivatives / Total Assets	1.29 (1.92)**	-	-
Foreign Debt / Total Debt	-0.938 (-2.18)*	-	-
Industry Dummies	Yes	Yes	Yes
Capital Expenses to Sales	-	-0.624 (-5.97)*	0.130 (5.76)*
Gross Margin	-	-0.060 (-5.40)*	0.482 (2.00)*
F-instruments	-	25.4	10.89
R^2	0.354	0.485	0.285
Number of Companies	173	173	173

Notes: Estimation method 2SLS. Results are for the exposures obtained using the baseline procedure. Columns 2 and 3 show the results of the estimation of the first step of the procedure with the ratio of total foreign debt to total debt and the ratio of derivatives to total assets as dependent variables. *,** indicate significance at 5% and 10% level of significance. t-statistics are in parentheses.

One likely problem in the IV estimation is that if the instruments are weak, the 2SLS estimates may be biased. The joint F tests on the instrumental variables shown in Table 6 are above the relevant critical values (Staiger and Stock 1997, Stock and Yogo 2003). Therefore, according to these tests, our instruments are not weak.

4.1.2 The Determinants of Time Variation in Companies' Exchange Rate Exposure

The results in table 3 and 4 show that when the country moves from a fixed to a floating exchange rate regime there is not only a decrease in the number of companies exposed to exchange rate fluctuations but also a change in the distribution of the firms. There is a reduction in the number of firms with a negative exchange rate exposure and an increase in the number of companies with a positive exposure. Table 7 sheds light on the question whether changes in international activities or financial policies were the main factors driving these results. We regress the changes in companies' exchange rate exposure from the floating to the fixed period against changes in international activities and corporate financial policies.

The results in table 7 indicate the factors that were behind the change in companies' exchange rate exposure that took place from the fixed to floating exchange rate period. Both specifications show that an increase in the size of the companies has a positive impact on the companies' exposure. It may be explained by the fact that larger firms would manage their exchange exposure more efficiently. Rossi (2007), for example, shows that fixed costs of hedging lead size to be positively related to the use of derivatives; therefore, larger firms are more likely to incur in risk management practices.

In addition, results in table 7 point out the importance of corporate financial policies. The results indicate that both - the use of currency derivatives and foreign currency denominated debt – played a role in the reduction of the number of companies exposed to exchange rate fluctuations since the adoption of the floating exchange rate regime and in the shift of the distribution of companies' exposure.

The results show that the increase in the use of currency derivatives and the reduction in companies' ratio of foreign currency denominated debt to total debt and the consequent reduction in the currency mismatches on their balance sheets led Brazilian companies to be better prepared to face home currency depreciations. As a result, there was a reduction in the number of companies exposed to exchange rate fluctuations and, on average; there was also a reduction in the negative impact of depreciations.

Table 7
The Determinants of Changes in Companies' Exchange Rate Exposure between Fixed and Floating Exchange Rate Periods Dependent variable: Change in Exchange Rate Exposure

Variable	Baseline	Orthogonal
Size (log Total Sales)	0.294 (2.80)*	0.298 (2.76)*
Foreign Sales / Total Sales	0.221 (0.14)	0.260 (0.18)
Imports	-0.010 (-0.72)	-0.012 (-0.98)
Foreign Operations Dummy	-0.699 (-0.13)	-0.827 (-0.16)
Derivatives / Total Assets	1.21 (3.77)*	0.951 (3.02)*
Foreign Debt / Total Debt	-1.51 (-3.21)*	-1.44 (-3.13)*
Industry Dummies	Yes	Yes
R^2	0.324	0.298
Number of Companies	173	173

Notes: All independent variables except industry dummies are the differences between their means in the two different periods. *Baseline* uses the exposures estimated by using the baseline procedure. *Orthogonal* uses the exposures obtained through the orthogonalization procedure. *,** indicate significance at 5% and 10% level of significance. t-statistics are in parentheses.

5. CONCLUSION

This paper studies the companies' exchange rate exposure and its determinants for a sample of non-financial Brazilian companies from 1996 to 2006. We find that a large number of Brazilian companies are exposed to exchange rate fluctuation and that, on average, Brazilian companies do not benefit from home currency depreciations. Yet, the results indicate that there is a substantial time-variation in the companies' exposure. The number of companies exposed to exchange rate fluctuations is higher during moments of crisis and under the fixed exchange rate regime. In the case of Brazilian companies, although international activities represented by exports and imports, operational hedging and financial policies are important determinants of the companies' exchange rate exposure, the reduction in the number of companies exposed to fluctuations of the exchange rate and the shift in the distribution of companies' exposure that took place when the country moved from the fixed to the floating exchange rate regime can be associated to the changes in corporate financial policies especially the use of derivatives and the hold of foreign currency denominated debt.

The results are consistent with the hypothesis that the floating exchange rate regime reduces the companies' external vulnerability by leading them to take measures against their exchange rate risk, inducing the companies to lower the currency mismatches in their balance sheets.

The results of this analysis indicate that the adoption of an exchange rate regime is a significant determinant of the countries' external vulnerability since it plays an important role in companies' financial policies. This result is consistent with Cowan, Hansen and Herrera (2005) for Chile and Kamil (2006) for a set of Latin-American countries that found that floating exchange rate regime alleviates currency mismatches on companies' balance sheets.

After the financial crises of the 1990s, most emerging markets underwent similar experience to that in Brazil by abandoning their fixed exchange rate regimes in favor of flexible ones, and like the Brazilian case, this change led them to be less vulnerable to external shocks. It is important to emphasize that vulnerabilities remain, and governments should carry out additional economic reforms in order to improve the countries' institutions. However, as this study indicates, the adoption of a floating exchange rate regime by emerging markets like Brazil, indeed leads companies to be more aware of the risk of keeping unhedged positions, reducing the possibility of huge economic downturns. Thus, even if the choice of the exchange rate might not be the primary solution to reduce the countries' external vulnerability, it is clearly an integral part of the solution toward beneficial economic reforms.

Notes

1. The implicit guarantees theory asserts that due to the guarantees given by the government to companies, a fixed exchange rate regime would lead companies to disregard the exchange rate risk, biasing their borrowing towards foreign currency denominated debt and/or reducing their hedging activities. In opposition, a floating exchange rate regime would induce companies to take their exchange rate exposure seriously, reducing the currency mismatches on their balance sheets; therefore, this literature establishes a possible relationship between companies' exchange rate exposure, financial policies and the exchange rate regime. For this literature, see Dooley (2000), Schneider and Tornell (2003) and Burnside, Eichembaum and Rebelo (2001).

2. In an influential paper, Jorion (1990) found that only a small proportion of U.S. multinational firms are exposed to fluctuations in the exchange rate. Similar results were found by Amihud (1994) using a sample of the 32 largest U.S. exporting firms.

3. Strictly speaking a system of bands was adopted with the top and bottom of the band being devalued at a fixed rate.

4. Securities and Exchange Commission of Brazil - CVM instruction Nr. 235/1995.

5. The results are robust if a sample of all publicly traded companies is used.

6. This problem is minimized in the Brazilian case, given that most of the companies keep only one position in the derivatives markets, suggested by the fact that swaps are the preferred derivative (Rossi, 2007).

7. Shapiro (1974) and Flood and Lessard (1986).

8. See Marston (2001) for more details about the difficulties that arise from the use of cash flow variables.

9. For a survey about the evolution of methods for estimation of companies' exchange rate exposure, see Muller and Verschoor (2006).

10. Priestley and Odegaard (2007) develop an empirical methodology that orthogonalizes both the market portfolio and the exchange rate from common macroeconomic factors that may be correlated with individual stock returns, but have nothing to do with exposure.

11. Similar results are found by Dominguez and Tesar (2006) for Thailand, and Parsley and Popper (2006) and Muller and Verschoor (2006) for Asian countries.

12. Indeed, the result of the estimation of (3) is given by: $r_{market,t} = -0.004(0.010) - 0.45(0.37) * \Delta s_t$ Showing that the market portfolio is negatively exposed to changes of the exchange rate. As noted by Bris, Koskinen and Pons (2003) if the coefficient $\hat{\gamma}_1$ is not different from zero, the variance β_i,exposure. will be inflated. Our results do not suffer from this problem.

13. Rossi (2007) shows that there is a positive and significant relationship between size and the proportion of companies' debt denominated in foreign currency.

14. Other methods (not shown) were also used to estimate companies' exchange rate exposure. Muller and Verschoor (2006) suggested a GARCH (1,1) specification to control for heteroskedasticity. Miller and Reuer (1998) suggested the inclusion of macroeconomic variables as control. We add then the industrial production, unemployment rate and inflation rate as control variables. Fraser and Pantzalis (2004) estimated (2) adding a lagged exchange rate. None of the methods change our results.

15. Examples are Dominguez and Tesar (2006), Allayannis and Ihrig (2001), Koutmos and Martin (2007), Muller and Verschoor (2006) among others.

16. Results using the orthogonalized market returns are placed in the appendix.

17. See Jorion (1990) and Dominguez and Tesar (2006) for the role of foreign activities. Allayannis and Ihrig (2001) and Williamson (2001) for the importance of competitive structure and Allayannis and Ofek (2001), Allayannis, Ihrig and Weston (2001), Nguyen, Faff and Marshall (2007) and Muller and Verschoor (2006) for the impact of hedging activities.

18. Ideally, measures of industry markups should be included to control for industry competitive structure. Unfortunately, these variables are not available.

19. This contrasts with Allayannis, Brown and Klapper (2003). They find no evidence that unhedged foreign currency debt was the primary cause of poor performance of a sample of companies during the Asian crisis.

20. Usually this problem is not analyzed in the empirical literature.

21. Similar results were found for the orthogonalized estimation.

References

Adler, M., Dumas, B. (1984), Exposure to Currency Risk: Definition and Measurement, *Financial Management* 13, 41-50.

Allayannis, G., Ihrig, J. (2001), Exposure and Markups. *Review of Financial Studies* 14, 805-835.

Allayannis, G., Ihrig, J., Weston, J. (2001), Exchange Rate Hedging: Financial Versus Operational Strategies. *The American Economic Review* 91, 391-395.

Allayannis, G., Weston, J., Klapper, L. (2003), Capital Structure and Financial Risk: Evidence from Foreign Debt use in East Asia. *The Journal of Finance* 43, 2667-2709.

Allayannis, G., Ofek, E. (2001), Exchange Rate Exposure, Hedging and the use of Foreign Currency Derivatives. *Journal of International Money and Finance* 20, 273-296.

Amihud, Y. (1994), Exchange Rates and the Valuation of Equity Shares. In Y. Amihud and R. M. Levich (eds.), Exchange Rates and Corporate Performance, Irwin, New York, pp. 49-59.

Bartov, E., Bodnar, G. (1994), Firm Valuation, Earnings Expectation, and the Exchange Rate Exposure Effect. *The Journal of Finance* 44, 1755-1786.

Bleakley, H., Cowan, K. (2002), Corporate Dollar Debt and Depreciations: Much Ado About Nothing?. mimeo, MIT.

Bodnar, G., Wong, M. (2003), Estimating Exchange Rate Exposures: Issues in Model Structure. *Financial Management*, Spring, 35-67.

Bris, A., Koskinen, Y., Pons, V. (2004), Corporate Financial Policies and Performance Around Currency Crises. *Journal of Business* 77, 749-796.

Burnside, C., Eichembaum, M., Rebelo, S. (2001), Hedging and Financial Fragility in fixed Exchange Rate Regimes. *European Economic Review* 45, 1151-1193.

Chow, E., Lee, W., Solt, M. (1997), The Exchange Rate Risk Exposure of Asset Returns. *Journal of Business* 70, 105-123.

Cowan, K., Hansen, E., Herrera, L. (2005), Currency Mismatches, Balance-sheet Effects and Hedging in Chilean Non-financial Corporations. Inter-American Development Bank Working Paper #521.

Dominguez, K., Tesar, L. (2006), Exchange Rate Exposure. *Journal of International Economics* 68, 188-218.

Dooley, M. (2000), A Model of Crises in Emerging Markets. *The Economic Journal* 110, 256-272.

Flood, E., Lessard, D. (1986), On the Measurement of Operating Exposure to Exchange Rates: A Conceptual Approach. *Financial Management*, Spring, 25-37.

Froot, K., Scharfstein, D., Stein, J. (1993), Risk Management: Coordinating Corporate Investment and Financing Policies. *The Journal of Finance* 48, 1629-1658.

Fraser, S., Pantzalis, C. (2004), Foreign Exchange Rate Exposure of US Multinational Corporations, a Firm Specific Approach. *Journal of Multinational Financial Management* 14, 261-281.

Galindo, A., Panizza, U., Schiantarelli, F. (2003), Debt Composition and Balance Sheet Effects of Currency Depreciation: A Summary of the Micro Evidence. *Emerging Markets Review* 4, 330-339.

Geczy, C., Minton, B., Schrand, C. (1997), Why Firms use Currency Derivatives. *The Journal of Finance* 52, 1323-1354.

Graham, J., Rogers, D. (2002), Do Firms Hedge in Response to Tax Incentives? *The Journal of Finance* 57, 815-839.

Harris, M., Raviv, A. (1991), The Theory of Capital Structure. *The Journal of Finance* 46, 297-355.

Ihrig, J., Prior, D. (2005), The Effect of Exchange Rate Fluctuations on Multinationals' Returns. *Journal of Multinational Financial Management* 15, 273-286.

Jensen, M., Meckling, W. (1976), Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics* 3, 305-360.

Jorion, P. (1990), The Exchange Rate Exposure of U. S. Multinationals. *The Journal of Business* 63, 331-345.

Kamil, H. (2006), Does Moving to a Flexible Exchange Rate Regime Reduce Currency Mismatches in Firms' Balance Sheets?. IMF Working Paper.

Kiymaz, H. (2003), Estimation of Foreign Exchange Exposure: An Emerging Market Application. *Journal of Multinational Financial Management* 13, 71-84.

Koutmos, G., Martin, A. (2007), Modeling Time Variation and Asymmetry in Foreign Exchange Exposure. *Journal of Multinational Financial Management* 17, 61-74.

Marston, R. (2001), The Effects of Industry Structure on Economic Exposure. *Journal of International Money and Finance* 20, 149-164.

Miller, K., Reuer, J. (1998), Firm Strategy and Economic Exposure to Foreign Exchange Rate Movements. *Journal of International Business Studies* 29, 493-514.

Muller, A., Verschoor, W. (2006), Foreign Exchange Risk Exposure: Survey and Suggestions. *Journal of Multinational Financial Management* 16, 385-410.

Muller, A., Verschoor, W. (2006), Asymmetric Foreign Exchange Risk Exposure: Evidence from US Multinational Firms. *Journal of Empirical Finance* 13, 495-518.

Muller, A., Verschoor, W. (2007), Asian Foreign Exchange Risk Exposure. *Journal of the Japanese and International Economies* 21, 16-37.

Nguyen, H., Faff, R., Marshall, A. (2007), Exchange Rate Exposure, Foreign Currency Derivatives and the Introduction of the Euro: French Evidence. *International Review of Economics and Finance* 16, 563-577.

Parsley, D., Popper, H. (2006), Exchange Rate Pegs and Foreign Exchange Exposure in East Asia. *Journal of International Money and Finance* 25, 992-1009.

Priestley, R., Odegaard, B. (2007), Linear and Nonlinear Exchange Rate Exposure. *Journal of International Money and Finance* 26, 1016-1037.

Rossi, J. (2007), The Use of Currency Derivatives by Brazilian Companies: An Empirical Investigation. *Brazilian Review of Finance*, 5-25.

Appendix
Description of Variables

Derivatives - Total notational amount of currency derivatives used by the firm. The amount of derivatives is reported in the companies' annual reports under the item financial instruments.

Total Foreign Debt - Total foreign currency denominated Debt reported by the companies' reports under the item loans and financing.

Total Debt - Total amount of companies' Debt. It is a sum in Reais (domestic currency) of domestic and foreign currency denominated debt.

(Net) Foreign Debt – Total Foreign Debt minus the total notational amount of currency derivatives used by the firm.

Capital Expenses - Total amount spent in the acquisition of permanent assets.

Foreign Sales - sales in US\$ converted to Reais by the exchange rate at the end of the year.

Total Sales - Total gross sales expressed in Reais.

Total Assets - Book value of firm's assets expressed in Reais.

Foreign Operations Dummy - Dummy variable assumes the value 1 if the company has foreign production subsidiaries.

Gross Margin - Total calculated EBIT divided by total sales.

Imports - Ordered discrete variable for the value of Brazilian companies' imports. Source: Secretary of Trade.

Table A.1
Time Variation of Brazilian Companies' Exchange Rate Exposure

	Pegged	*Floating*	*Fixed*	*Crisis*	*Flexible*	*Crisis2*	*Flexible*
Mean	-5.160	-0.148	-4.494	-0.344	-0.229	-0.090	-0.011
Median	-4.612	-0.078	-4.372	-0.266	-0.174	-0.037	-0.069
Maximum	4.023	1.258	6.371	1.696	1.471	1.608	2.608
Minimum	-7.971	-1.858	-6.169	-5.444	-3.570	-2.475	-2.097
Significant	42	28	35	85	30	50	24
Negative	39	21	29	66	23	38	17
Positive	6	7	6	19	7	12	7
Number of Companies	173	173	173	173	173	173	173

Notes: In the first two columns the sample is divided into two periods. Pegged from January 1996 to December 1998 where the country adopted a fixed exchange rate regime and flexible from January 1999 to December 2006, covering the period of a floating exchange rate regime. The last 5 columns show the results of the estimation of (5) splitting the sample into 5 periods. Pegged from January 1996 to August 1998 comprehends the period of the fixed exchange rate regime. The second subperiod covers from September 1998 to April 1999 and represents the period of the currency crisis and the change of the exchange rate regime. The third from April 1999 to March 2002 a tranquil time under the floating exchange rate regime, the fourth comprehends the period before the election from April 2002 to December 2002 and the last from January 2003 until December 2006. All results are from the procedure using orthogonalized market-returns. Results for companies' exchange rate exposure considered 5% level of significance.