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Demand for Foreign Exchange Derivatives in Brazil: Hedge or Speculation?

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Abstract

This paper examines empirically the demand of foreign exchange derivatives by Brazilian corporations. We build an original database of 25,457 contracts of foreign exchange swaps between firms and financial institutions open at the end of 2002. From these contracts we identify 53 corporations that hedge in the foreign exchange derivatives market and 40 corporations that speculate. The data show that the existence of external debt and the size of the company affect positively the probability of hedging, whereas revenues from exports affect positively the probability of speculation. These results suggest that during periods of great volatility of the exchange rate – such as in 2002 – the corporations' demand for foreign exchange derivatives is strongly related to speculative motives.

Keywords: foreign exchange swaps, hedge, speculation, corporations
JEL Classification: G13, G32, G38

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1. Introduction

Géczy, Minton e Schrand (1997) show that 41.4% of North American companies pertaining to the Fortune 500 group use foreign exchange derivatives in 1990. These financial instruments impose gains and losses to these companies according to the variation of the nominal exchange rate. What makes these North American firms add financial risk to their operations?

The risk of an isolated asset does not necessarily increase the risk of a portfolio of assets. On the contrary, assets with a significant level of risk such as foreign exchange derivatives can induce cash flow fluctuations that nullify the risk of individual assets essential to a company's operations. We refer to this risk management strategy as a *hedge*. A common explanation for the frequent use of foreign exchange derivatives in the USA is, therefore, that firms seek to diminish the volatility of their cash flows.

In fact, Géczy, Minton e Schrand (1997) show that firms with a high cost of financial stress and with high cash flow volatility are more likely to use foreign exchange derivatives, which suggests that these firms are trying to protect themselves from changes in the exchange rate, that can induce losses capable of taking them to the point of financial stress. Géczy, Minton e Schrand (1997), however, do not explicitly show that the use of foreign exchange derivatives diminishes a firm's foreign exchange risk. It is possible that, for example, this use is in response to opportunities for speculative gain derived from private sources (see Merton (1987)). In this respect, foreign exchange derivatives can increase a firm's foreign exchange risk, reflecting a demand for speculative measures.

This paper builds an original database of 74,567 contracts of foreign exchange swaps written between corporations and financial institutions from January 1999 to December 2002. Of these 25,457 are open at the end of 2002. This database allows us to identify the use of foreign exchange derivatives in order to hedge and in order to speculate in 2002. This year seems appropriate due to an enormous depreciation of the foreign exchange rate during the year (from the start to the end of the year there was a 60% depreciation). In a situation like this the incentives for speculation or hedge are of course much more evident.

By identifying these two demands for derivatives, we show that the existence of debt in a foreign currency is the principal determinant of the demand to hedge for 53

Brazilian corporations with open contracts of foreign exchange derivatives in 2002, whereas gross revenues from exports is the principal determinant of speculation for another 40 Brazilian corporations. Thus, the data suggest that during periods of great exchange rate volatility – such as in 2002 – the firms' demand for foreign exchange derivatives is strongly related to speculative motives.

We compare our results of the year 2002 with the results of hedge and speculation of the years from 1999 to 2001. In these years, the foreign exchange rate was much less volatile and average depreciation much less pronounced than in 2002. We observe that the year 2002 is atypical year as far as speculation is concerned. Not only the number of firms that speculated during these years is much less than the number of firms that speculated in 2002 but also exports are not anymore the driving force of speculation.

The data used in this study is obtained from confidential information of Banco Central do Brasil. Additional available data from the two institutions that register the total volume of operations of foreign exchange derivates in Brazil – Brazilian Mercantile & Futures Exchange (BM&F) and CETIP Custody and Settlement – show that, between 1999 and 2002, the contracts for exchange of interest denominated in reals for dollar-denominated interest (foreign exchange swaps) are by far the most important instrument of foreign exchange derivatives used by companies with operations in Brazil. Based on this information, the Banco Central do Brasil solicited 50 authorized financial institutions that operate in the foreign exchange derivatives to inform the name of all the companies with which they signed contracts of foreign exchange swap from January 1999 to December 2002 as well as the notional amount, currency and maturity of these contracts.

In response to these information solicited by the Central Bank, 43 financial institutions described details of 74,567 contracts of foreign exchange swaps. Of these 25,457 are still outstanding at the end of 2002, the year in which the exchange rate increased from R$2.31 per dollar in January to R$3.50 per dollar in December – a depreciation of 60.0%, which in part was due to uncertainties regarding the elections. The year 2002 seems to be a good candidate, therefore, to capture uses of foreign exchange derivatives for speculation as well as for hedging.

Our results show that 93 public owned firms had currency swaps positions open at the end of 2002. Of these 93 corporations, 40 held speculative positions for swaps that increase their foreign exchange risk. We classify speculation in two different types: reverse speculation and neutral speculation. Reverse speculation occurs when a firm holds open positions in swaps contrary to its operational currency exposure (difference between export revenues in dollars and the sum of imports expenses in dollars and debt in dollars). That is, companies that, due to operational currency exposure, lose (gain) with an appreciation (depreciation) of the exchange rate are long (short) in swaps, magnifying these monetary losses. Of 40 firms with speculative positions, 16 did reverse speculation. We define neutral speculation when the firm does not have operational currency exposure but still has open foreign exchange swaps positions. Of the 40 firms that speculated, 24 did neutral speculation.

On the other hand, of the 93 companies with contracts for open currency swaps 53 intend to diminish their currency exposure. Among these companies that hedge, 35,84% are concentrated in the public service sector and all have dollar-denominated debt.

The main contribution of this paper comes from the use of a unique database of foreign exchange derivatives[1]. This database makes it possible to get a much better understanding of which firms speculate and those that hedge the foreign exchange exposure. This is very rare in the literature that studies the demand of foreign exchange derivatives by firms. This literature normally looks at off balance sheet information of firms[2].

The rest of the article is organized as follows: Section 2 describes the data and presents the results of the univariate analysis. Section 3 describes tests of multivariate analysis and presents the results. Section 4 analyzes the robustness of the results, and finally section 5 presents the main conclusions of the paper.

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[1] There are other papers that study the demand of foreign exchange derivatives in Brazil, like for example Shiozer and Saito (2006). The authors use off balance sheet information of firms. This paper studies the reasons firms hedge with foreign exchange derivatives. Our paper differs because our main objective is to compare firms that hedge with firms that speculate with foreign exchange derivatives using a database that was built with swap contracts of foreign exchange.

[2] See Tirole (2006) for a discussion of the problems related to off balance sheet information of corporations.

2. The Data

Our primary data source is a unique database, composed of 74,567 contracts of currency swaps signed between 1999 and 2002 between 43 financial institutions and non-financial corporations in Brazil. These contracts correspond to nearly 98% of the total volume of currency swaps transacted in 2002[3].

In order to understand the importance of our database, we need to explain briefly the structure of the Brazilian foreign exchange derivatives market. There are various types of foreign exchange derivatives used by firms and financial institutions: public bonds indexed to the dollar, operations with foreign exchange futures, options and forwards. In the currency swap contracts, the investor in the long position trades interest in reals for dollar-denominated interest; this implies gains (losses) with a depreciation (appreciation) of the exchange rate.

The initial demand for public bonds indexed to the dollar is made by the financial institutions and is registered in the System of Liquidation and Custody of Federal Public Securities (SELIC). The other derivatives are registered at Brazilian Mercantile and Futures Exchange (BM&F) or at the CETIP Custody and Settlement.

The main contracts of registered firms at BM&F are future contracts and dollar options. According to available data at BM&F, dollar-denominated future contracts are only liquid for maturities within 20 days and their open total daily stock is almost always less than 3% of total open stock of currency swaps between firms and financial institutions registered at CETIP. Dollar options are even less liquid and present daily stock levels even lower than those of dollar-denominated future contracts.

The fact that currency swaps are the main instrument of foreign exchange derivatives used by corporations can be explained in part by simply observing the data. The data show that a great number of corporations that use foreign exchange derivatives have debt in a foreign currency. In general, this debt has middle to long-term maturities, with disbursement of interests done irregularly. Futures contracts, options or forward contracts of foreign exchange with long maturities are, in general, not liquid or inexistent, arising from this the need for corporations to demand counter operations, such as swaps, that better reflect the cash flow of their external obligations[4].

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[3] The Central Bank initially solicited information from 50 financial institutions. Some of these institutions were purchased by others of the group of 50, between 1999 and 2002. The purchasing financial institutions became responsible for the information regarding the contracts for currency swaps of those

The total volume of transacted currency swaps between firms and financial institutions is quite superior to the volume negotiated among non-financial firms. This fact is not peculiar to Brazil. Mian (1996) shows that, in the majority of countries, non-financial corporations seek financial institutions as the other party in their derivatives operations. Available data of the CETIP show that, between 1999 and 2002, the daily stock of currency swaps among corporations is on average 3% of the daily stock of currency swaps done between financial institutions and corporations. Among the currency swaps, those for which the US dollar is one of the objects of operation represent more than ninety-five percent of the total volume negotiated[5]. Therefore, the Central Bank's database of US dollar-based currency swaps is fairly representative of the demand for foreign currency derivatives of Brazilian companies.

The empirical analysis will have as its focus the corporations that have open positions in currency swaps at the end of 2002. We combine these corporations with the following control group: all of the non-financial corporations that do not pertain to the same economic group and have some form of exchange rate exposure[6]. We consider a firm having exchange rate exposure if it has debt in foreign exchange, or exports or imports or is a part of a sector of the economy that has foreign exchange exposure. This group consists of 250 corporations that together with those that have open positions in currency swaps at the end of 2002, 93 corporations, comprise a total of 343 corporations[7].

Table 1 shows the financial characteristics of the corporations that have open positions and of those that do not. The corporations with open positions are larger, show more debt in US dollars, have greater ratios of external revenue to gross revenue and

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institutions that were purchased. This explains why the number of institutions that responded the initial request was 43 and not 50.

[4] Other possible explanations are: the swaps do not need collateral (which is required by BM&F); they do not suffer daily adjusts and they also do not require an initial payment.

[5] A great majority of these contracts have maturities of less than two years and on the other end of the contract are pre and post-fixed interest rates.

[6] The selection has as base financial statements of the exercise of 2002, which became public and available at the Comissão de Valores Mobiliários (CVM). We choose those that furnished all the necessary accounting information.

[7] Close to 90% of businesses in the sample are among the 1000 largest Brazilian companies in terms of net revenue in the year 2002, according to the annual Valor 1000 of August 2003.

have more executives participating in the profits. In all of these cases, the hypothesis of average equality is rejected at the 5% significance level.

Of the 93 corporations in our sample, 7 (7.13%) are multinationals. These corporations probably have a natural demand to hedge in order to protect the investment of their shareholders in the country of origin from fluctuations of the nominal exchange rate. By taking the multinationals out of the sample, the only difference is that the corporations with open positions in currency swaps in 2002 become smaller than those corporations without open positions.

Next, we define which of these corporations hedge or which speculate. The corporations that hedge are those for whom the product between the open net position in currency swaps and what we call operational currency exposure (the difference between export revenues in dollars and the sum of the imports expenses and debt in dollars) is less than zero. This product can be negative in two cases: when a corporation has an operational currency exposure greater than zero and tries to protect itself from a currency appreciation taking short positions in dollars; and when it has an operational currency exposure less than zero and tries to protect itself from a currency depreciation taking long positions in dollars.

The corporations that speculate are classified in two groups. We define reverse speculation when the product of the operational currency exposure and the net open position of the currency swap is greater than zero. This case includes the corporations whose value would diminish due to currency depreciation, even when they opt for short positions in currency swap contracts, and those whose value would increase with a currency appreciation and would nonetheless remain in long positions in currency swaps.

If a corporation does not possess operational currency exposure, it speculates if it holds an open long or short position in the currency swap. We call this neutral speculation. This latter type of speculative position is less reliable given that the company, in spite of apparently not having operational currency exposure, can have input or sales of products whose prices have a direct or maybe indirect relationship with the foreign exchange. Later on in our analyses we will control for this possibility.

In order to find the open net position of the firm in currency swaps, we transform all the values in reals to dollars, using the exchange rate of the date the operation. Next, we verify all of the open operations at the end of 2002 (long and short) and we find the net position of each corporation as the difference between the total volume in dollars of the long positions and the total volume in dollars of short operations[8]. Table 2 presents a classification by sectors of the corporations that hedge or that speculate, and shows the form they choose (long or short positions), in addition to information about the operational currency exposure of each of the different sectors.

Panel A of Table 2 shows that the number of corporations that speculate is a little less than the number of corporations that hedge. Among these, the number of neutral firms that speculate is greater than the number of those that speculate in reverse positions. All of the corporations that speculate hold long positions. This suggests expectations of currency depreciation. This occurs even among predominantly export sectors, such as food products and beverages. In terms of hedge, we can see that all corporations are long in dollars. Corporations that hedge are primarily from the concessionary of public service sector of the economy. This is the sector that in the aggregate shows the most significant debt in foreign exchange relative to its assets.

There are some sectors in which the average of the ratio between the values of open net positions in currency swaps and net worth is relevant. This occurs in both the case of the hedge (8.0% in the case of Electro/Electronic) and in the case of reverse speculation (4.0 % for the food and beverage sector). Given that the firms of these sectors are long in dollars, this fact reveals, once again, the expectation on the part of the firms of substantial currency depreciation during 2002.

Panel B of Table 2 shows that debt in dollars is ubiquitous among corporations that hedge. All of them have debt in dollars[9]. In addition, panel C of Table 2 shows that firms that export predominate in the case of reverse speculation. Some of these firms also show some imports expenses and debt in dollars, but in volumes inferior to those of their exports revenues. Finally, Panel D of Table 2 shows that 84.94% of the corporations that speculate or that hedge are private domestic firms, whereas only 7.93% are state-owned and 7.13% are multinationals.

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[8] We also tried the average value of the exchange rate of the month to transform the notional value of the contracts and the results did not change.

[9] We also looked at “Adiantamento de Contratos de Câmbio”, ACC. These are loan contracts that exporters write with banks in which the collateral is future exports. We can consider them as a form of foreign exchange debt contracts. Very few exporters in our database have these contracts, though. Our results did not change by considering them foreign exchange debt as well.

In summary, the results presented in Table 2 indicate that the demand for foreign exchange derivatives at the end of 2002 had a strong speculative component.

3. Multivariate Analysis

In this section we study the determinants of the demand for currency swaps for the purpose of speculation or hedging. To do so, we follow Géczy, Minton and Schrand (1997) and Mian (1996) and estimate a logit model with the sample that we describe in the previous section composed of 343 firms. In the estimations of hedge, the dependent variable is equal to one for the firms that hedge and zero for those that do not. For the speculation estimations, the dependent variable is equal to one when the firm speculates and zero in the contrary. Next, we present the different control variables that we use in our regressions, grouped in accordance with diverse theoretical explanations both for hedging and for speculation.

3.1 Control Variables.

3.1.1 Costs of Bankruptcy

Smith and Stulz (1985) argue that a hedge is a method by means of which corporations can reduce the volatility of their cash flow. The choice to hedge occurs more frequently among firms with greater costs of bankruptcy or greater probabilities of bankruptcy.

However, a corporation with high leverage has a greater probability of bankruptcy. For an empirical approximation of the level of leverage we follow Géczy, Minton and Schrand (1997) and use the ratio of the accounting value of the long term debt to the size of the firm. This last variable is defined, as in Graham and Rogers (2002), as the logarithm of the volume of assets.

Export revenues and import expenses increase the currency exposure of corporations and thus can increase the probability of bankruptcy in the case of a currency appreciation or depreciation, respectively. As an empirical approximation for export revenues and import expenses we use the ratio of the volume of external revenue to total gross revenue, and the ratio of the total importation expenses in relation to gross revenue respectively.

In the same manner, external debts, which result in mismatches between currencies of assets and currencies of liabilities, increase the firms' currency exposure and can imply that currency depreciations increase the probability of bankruptcy. For empirical approximations for a firm's external debt we use a binary variable equal to one if the business has dollar-denominated debt and zero otherwise; the ratio between the total short term external debt and the logarithm of total assets; and the ratio between the total external debt and the logarithm of total assets.

Finally, the ratio between current assets and current liabilities shows the degree of the firm's current liquidity. Extremely liquid businesses will have less incentive to hedge and greater incentive to speculate because, in this case, they have a lesser probability of bankruptcy.

3.1.2 Costs of Agency with Creditors

Myers (1977) demonstrates that indebted businesses have distorted incentives in terms of their policies for investment. To summarize, the distortion occurs due to the priority that the creditors have over the shareholders for receiving cash flow generated by corporations. Given this priority, the shareholders do not have incentives to contribute resources for investments whose returns – because of the highly indebted situation – will likely be used in the payment of debt. Excessive debt, however, can impede lucrative projects from being implemented. Thus, creditors anticipate the conflict of interest and incorporate their costs in the interest rate.

Mayers and Smith (1982) show that a hedge reduces the probability of a company not fulfilling its obligations, thus reducing the probability that the investments are distorted and, consequently, benefiting the shareholders through the reduction of the interest rate. Hedging, therefore, takes a firm's investment policy closer to that which maximizes the firm's value.

On the other hand Jensen and Meckling (1976) argue that business with great amounts of debt can choose excessively risky investments. Following this thread, Géczy, Minton and Schrand (1997) show that costs of agency with creditors can induce the businesses to speculate. This can occur if shareholders turn their shares into options above the value of a leveraged firm, speculating to increase the volatility of the firm's cash flow when close to bankruptcy.

We have, therefore, two conflicting forecasts. On the one hand, Mayers and Smith (1982) argue that corporations highly in debt are more likely to hedge. On the other hand, Géczy, Minton and Schrand (1997) argue that corporations with significant debt have greater incentive to speculate. In order to determine which of these effects prevail, we use two variables to capture costs of a suboptimal investment policy: the ratio between the total value of fixed assets and the size of the corporation and the ratio of the market value of corporation and its book value.

The higher the ratio between the fixed assets and the logarithm of total assets, the greater the firm's capacity to offer real collateral to creditors, that can reduce the creditors' loss due to financial stress and, consequently, reduce the incentives to distort the investment policy. Therefore, a greater ratio between fixed assets and the logarithm of the total assets reduces both the probability to hedge and to speculate.

In contrast, a high ratio between a corporation's market value and the book value suggests that future gains (embedded in the market value of the firm's shares) still do not correspond to the value of the existing assets. Such a corporation should have greater difficulty offering real collateral to creditors compatible with the profitability of the existing investment opportunities. Thus, we expect a positive relationship between the ratio of the market value and book value and the probability of hedging or speculation.

Another characteristic of a firm related to its cost of agency with creditors is its size. Larger firms, in general, have greater reputation, a fact that can reduce costs of agency. Therefore, we can expect that the size, defined as above, reduce the probability of the firm using hedge or speculation.

Nance, Smith and Smithson (1993) argue that corporations, by substituting debt for preferential shares, reduce the probability of bankruptcy, thus reducing the cost of agency, without the need to hedge. The authors anticipate a negative relationship between the volume of preferential shares and the probability of hedging. Géczy, Minton and Schrand (1997), on the contrary, argue that there is a positive relationship:

firms with more financial restrictions tend to adopt a suboptimal investment policy. Because, according to the authors, the preferential shares increase the financial costs, the probability to hedge increases. In order to test these hypotheses, we include in our regressions the ratio between the book value of the preferential shares and the logarithm of the firm's total assets.

We also consider another explanatory variable that is related to both the costs of bankruptcy and to the cost of agency with creditors: the firm's profitability. The firm's profitability is defined as the ratio of the company's net revenue to its net worth. This variable gives an idea about the capacity of the corporation to internally finance itself, avoiding the capital market or bank loans. The less a company needs to finance externally, the less are the costs of bankruptcy and the less is the necessity to hedge. Or the company can run greater risks, for example, by speculating. On the contrary, more lucrative firms can be subject to greater costs related to investment policies because they have more available projects from which to choose, a fact that suggests a greater demand to hedge. This being the case, the impacts of profitability over the probabilities to hedge or speculate are uncertain.

3.1.3 Assymetric Information

De Marzo and Duffie (1991) suggest that corporations with greater asymmetry of information between executives and shareholders can obtain larger profits by hedging. De Marzo and Duffie are concerned with the shareholders' capacity to choose from their portfolios of assets. Hedging reduces the volatility of the companies' cash flow that, in turn, reduces the uncertainties of the shareholders' set of information. Consequently, the shareholders accept a hedge because this improves their portfolio choices. As an empirical approximation for asymmetric information between executives and shareholders we use the number of institutional investors of the firm. The idea is that institutional investors invest in the acquisition of information diminishing the uncertainty about the value of the firms in their portfolios. Therefore, a great number of institutional investors indicate a lesser probability of the firm performing a hedge.

3.1.4 Aversion of Executives or Shareholders to Risk

The volatility of their compensation imposes costs to executives or controllers contrary to risk. Stulz (1984) and Smith and Stulz (1985) argue that if the optimum contracts for compensation of executives or controllers contrary to risk are related to the volatility of the corporation' revenue or cash flow, these volatilities can be costly for these agents. If the executives or controllers do not manage to hedge on their own, or if it is up to the corporations to choose to hedge, then a hedge done by the firm can increase the well being of the administrators. At the same time, Ljungqvist (1994) shows that, in firms severely in debt, the participation of executives or controllers in profits can serve as an incentive for them to speculate.

We use two variables as approximations for the executive's risk exposure: one binary variable equal to one if the executive has participation in profit and zero otherwise; and another variable that shows the executives total compensation. The participation in profits and executives compensation are obtained by the firms' financial statements provided by CVM[10].

3.1.5 Taxes

Graham and Rogers (2002) discuss the impact of taxes on incentives for corporations to hedge. They examine two impacts. The first is related to the increase in the level of debt of the firm. In countries in which financial expenses imply a fiscal benefit, hedging increases value by increasing a firm's capacity for debt and, consequently, by allowing a lower tax payment.

A second fiscal incentive to hedge is related to the convexity of the expectation of tax payments. Mian (1996) presents evidence that the awaited payment of taxes is a convex function of the generation of a firm's cash. In this case, the Jensen's inequality shows that a hedge can reduce the expected payment of taxes.

In order to test for the impact of taxes on the decisions to hedge, we use a binary variable equal to one when the company pays taxes and zero otherwise. We expect that firms that pay taxes have are more likely to hedge.

3.1.6 Economies of Scale

Mian (1996) argues that risk management programs by means of derivatives can present initiation, implementation and maintenance costs. If these costs are significant, a company may not use these programs. Such costs present economies of scale related to the size of the firm. Therefore, the size of the firm – measured by the log of assets can be positively related to the probability of hedging *or* the probability of speculation.

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[10] The empirical literature makes use of the total shares or of the total volume of options of shares of the corporations in the hands of the executives to study the relationship between the volatility of their compensation and the cash flow of corporations. Such variables are not available in Brazil.

3.1.7 Multinational Firms

In the regressions to study speculation as well as those to study hedge, we use as a control variable a binary variable equal to one if the firm is multinational and zero otherwise. Multinational corporations can be interested in protecting the interests of shareholders in the origin country against fluctuations of the nominal exchange rate, even without possessing export revenues, import expenses or debt in dollars. In this case, multinational firms should be more likely to use a hedge and less likely to speculate.

3.1.8 Privileged Information in the Foreign Currency Market

Corporations with revenues from exports or expenses from imports are natural candidates to speculate with foreign exchange derivatives. The nature of their activities makes these corporations follow regularly the foreign exchange market, maintaining close contact with agents that are probably the first to detect changes in the trends of the nominal exchange rate (*dealers* of foreign currency, for example). Therefore, they can participate in the foreign exchange market using privileged information. Our prior is that corporations, which have relative relevant export revenues or imports expenses, are more likely to speculate.

Additionally, we use in our regressions explanatory variables that indicate the participation of firms in sectors where export revenues or import costs are more relevant. These sectors are more affected by exchange rate fluctuations. To verify if this participation is important in order to explain a business' decision to hedge, we include binary variables equal to one when a business is part of one of these sectors, zero otherwise[11].

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[11] We consider the concessionaries of public services in the group of firms with high currency exposure. One simple observation of the data we dispose is sufficient to make clear that a large number of corporations of this sector perform currency swap operations during our sample period and have debt in dollars.

3.2 Results

Table 3 presents Pearson's correlations of the diverse independent variables that we use in our estimations. Only three correlations are significant at the 5% level and are related to variable size, defined as the logarithm of a firm's total assets.

We now move on to the analysis of a firm's probability to hedge or to speculate. The results of the logit estimations of these probabilities are presented in Table 4. As the Table shows, the $\chi 2$ statistics of the test for the ratio of maximum likelihood does not reject the overall significance of the variables. Although they are not reported in the table, we also do several diagnosis tests for omitted variables. In particular, we include squared terms of the independent variables that are not dummy variables and verify that the coefficients of these additional variables are not collectively different from zero[12]. These tests indicate a correct specification of the model.

Column A of Table 4 highlights the importance of the existence of external debt as a determining factor in the choice to hedge. The existence of external debt increases the probability of hedge by 3%. On the contrary, other factors related to operational currency exposure such as export revenues and import expenses are not significant. The first result is what we would expect.

The positive relationship between the existence of dollar-denominated debt and the probability to hedge is robust. Tests not described in the tables show corporations with debt in dollars of the most varied sectors, tradeables and non-tradeables, hedging, trying to prevent depreciations of the nominal exchange rate from negatively affecting their financial obligations and, consequently, their cash flows.

Economies of scale also affect positively the probability to hedge. Larger firms, for which the relative costs to start up and to maintain risk management programs by means of derivatives are relatively small, are more likely to hedge, as suggested by the positive coefficient for firm size. Therefore, since smaller companies have greater costs of bankruptcy and greater asymmetry of information, we have evidence in favor of the hypothesis of economies of scale and against hypotheses centered on asymmetric information and costs of bankruptcy.

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[12] For example, for the mentioned estimation for the probability to hedge, the p-value of the test for omitted variables is 0.35, whereas for the estimation for the probability to speculate the p-value is 0.22.

The fact that a firm is multinational positively affects the probability to hedge. It was what we expect a *priori*, given that, as we have already argued, multinationals possess natural demand to hedge.

Although we do not show the estimated coefficients of the indicator variables of the industries, it is important to mention that the participation of the corporations in the majority of the economic sectors that we select is not relevant to explain the increase in the probability to hedge. Even the coefficient for the concessionaries of public service sector, which we suspected would have a greater tendency towards currency protection, does not appear to be significant. Of the export sectors, only the transportation sector negatively affects the disposition of the firms' to seek currency protection.

The data do not identify aversion of risk of executives or controllers as a determinant in the choice to hedge. The participation in profits is not significant in affecting the probability to hedge. The results are also not indicative that the level of firms' leverage affects significantly the decision to hedge, as postulated by the theory of cost of agency with creditors. In the same manner, the evidence does not support the models of asymmetric information or models related to taxes. Finally, none of the variable coefficients that suggest opportunities for growth are significant.

The results of the speculation analysis are presented in column B of Table 4. The results show that export revenues affect positively the probability to speculate. A 1% increase in the ratio of export revenues and gross revenues increases the probability of speculation by 5%. The existence of debt in dollars does not affect speculation. This is fairly reasonable; given that column A of Table 4 shows that external debt increases the probability to hedge.

Besides export revenues, only one other variable positively affects the probability of speculation: the participation of corporations in the transportation sector (results not shown in the table). This participation positively affects the speculative demand and is consistent with our univariate analyses, which show that the firms of this sector with open positions speculated, and with the results from the logit estimation of the demand to hedge, which show that the firms participation in this sector negatively affects the probability to hedge.

Concluding, we can confirm that, in 2002, the results of the logit estimations provide evidence that factors of currency exposure – debt in dollars and revenues from exports are the most important determinants of hedging and of currency speculation, respectively. Following, we show that these results are robust in different samples of open capital firms, in different control variables and other econometric techniques.

4. Analysing Hedge and Speculation in the Years from 1999 to 2001

In a first attempt to investigate the robustness of our results, we analyze whether the decisions to hedge or speculate are similar in other years, between 1999 and 2001. During this period, the volatility of the exchange rate was much lower than it was during 2002. Even in 1999, the currency crisis occurred in the beginning of the year and lasted for much less time than the currency crisis in 2002. Therefore, the incentives, especially for speculation, are quite different than those of 2002.

We look at open foreign exchange swaps at the end of each year. We consider the net position, long minus short in foreign exchange. We use again the same definition as before for hedge and speculation, reverse or neutral. The number of firms that hedge during this period is 21 in 1999, 32 in 2000 and 40 in 2001. The number of firms that speculate is 8 in 1999, 13 in 2000 and 15 in 2001. Of the latter, the number of firms that do reverse speculation is 7 in 1999, 4 in 2000 and 7 in 2001.

Initially, we make logit regressions for the years 1999 to 2001. The results to hedge, which we present in Panel A of Table 6 show once again that the presence of foreign exchange debt is the most important reason for companies to hedge in these periods. It is significant in all periods.

However, when we perform the logit regressions for speculation for these years, we observe as shown in Table 6 that the results change substantially from the ones we obtain in 2002. Export revenues divided by gross revenues are no more significant in explaining speculation.

The results indicate that the year 2002 was atypical in terms of incentives placed for speculation. Possessing privileged information in the market made exporters take advantage of these incentives in 2002. This does not occur in other years as the results of the logit estimations clearly demonstrate.

To verify how relevant these incentives are for speculation on the part of exporters, we turn to a balanced Panel analysis considering the whole sample period from 1999 to 2002 panel. We consider random effects[13]. We change slightly our basic model, including a dummy for the year 2002, the year of great volatility of the exchange rate, as well as interacting this dummy with the variable that measures export revenues.

The results are presented in Table 7. In the case of hedge, the results are very similar to those that we obtain in the logit estimation of the year 2002. Existence of debt and size are still positively related to the probability to hedge. The dummy 2002 is also significant, p-value of 0.05, which indicates the relevance of this year for hedge too.

In the case of speculation, we see that the variable for exports revenues divided by gross revenues affect the probability of speculation only in 2002, p-value of 0.09. The dummy for the year 2002 is highly significant, as well, p-value of 0.0. This confirms that the year 2002 is very much atypical as far as speculation on the part of firms that exports is concerned.

As Table 7 shows, the $\chi 2$ statistic does not reject the overall significance of all of the independent variables in the model. Although we do not mention this in the tables, we once again perform several tests for omitted variables and redundant variables (squared terms of the non-dummy independent variables) that do not reject the specification of the model.

We also try several other specifications. In one, we include a dummy for 1999, where a foreign exchange crisis occurs at the beginning of the year, and another variable in which we interact it with the variable that measures exports revenues. Both variables are not significant. These results indicate once more that the incentives for speculation in 2002 are very strong and different from the incentives of speculation of other years.

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[13] We have a dummies as regressors which makes fixed effects not possible.

5. Testing the Robustness of Our results

5.1 Excluding Neutral Speculation

In our second attempt to test the robustness of the results, we will exclude the corporations that speculate in neutral form, or rather, those that do not have operational currency exposure, which we continue to define as the existence of export revenues, import expenses, or debt in dollars, but that still maintain open positions in currency swaps. As we argue earlier, these corporations are more likely to be incorrectly classified as speculators.

Table 5 presents the results of the logit estimations for the two possible alternatives in the sample that exclude neutral speculation: hedge and reverse speculation (currency exposures and open positions of swap of the same signal). As in our initial sample, the $\chi 2$ statistics of the tests of the ratio of maximum likelihood does not reject the combined significances of all the variables. We implement, once again, several tests for omitted variables (squared terms of the independent variables that are not dummy variables) that, though not presented in the tables, indicate a correct specification of the model.

Once again, debt in dollars and the size of the firm positively affect the probability of corporations to hedge. At the same time, external revenues positively affect the probability for speculation.

5.2 Endogeneity of Debt

One relevant critique of the empirical tests done so far is that some independent variables, which measure potential incentives to hedge or speculate, also can be choice variables. In particular, the variables that cause the greatest concern are those related to the cost of bankruptcy, this because the choice of capital structure, which affects the expected cost of financial stress, is a joint decision with the decision to hedge.

One way to minimize this problem is by simultaneously modeling the debt decisions and the decision to hedge, as do Géczy, Minton and Schrand (1997). Following these authors, we suppose that: the gross revenues and the ratio between the fixed assets and the logarithm of the firm's assets show the firm's ability to provide collateral, with the following increase of the capacity for debt; the existence of a hedge increases the capacity for debt by diminishing the risk of financial stress; and finally, we use indicator variables for industries (one for each of the eight classifications of industry) as a way to control characteristics inherent to the actuation industry that could affect the cash flows of the creditors (for example, regulatory risks).

Finally, again following Géczy, Minton and Schrand (1997), we suppose that the decision to hedge is explained by the same independent variables of the logit estimations of Tables 4 and 5. We have, therefore, a system of two equations to be estimated: the equation for debt and the equation for the decision to hedge, which we estimate by minimum squares in two stages. Based on these estimations we test the restrictions of the coefficients of the models (Wald tests) that prove that, in fact, the two equations should be estimated simultaneously.

In order to save space, once again we do not present the complete results of the regressions. However, it is worth mentioning that, for the equation for debt, the expected estimated coefficient for hedge is not statistically significant and that, in the equation for the decision to hedge, the coefficient for debt is also not statistically significant. More importantly, however, is that, in the equation for the decision to hedge, the other coefficients have the same signal for the variables that also entered in the logit equation to hedge that ignored endogeneity of debt. Therefore, we can confirm that our empirical results about the decisions to hedge were not affected by problems of endogeneity of debt.

5.3 Future Flux of Exports Revenues and Imports Expenses

In the empirical analyses done so far, we consider only current export revenues and import expenses, that is, those related to the 2002 fiscal year. Nevertheless, it is possible that exporter or importer firms decide to speculate or hedge in a certain year taking into account the expected value of future fluxes of export revenues and import expenses. To analyze this possibility, we suppose that the expected future values of these revenues or expenses are equal to their 2002 values. We then define operational currency exposure as the present value of export revenues minus the sum of debt in dollar and the present value of import expenses. Note, however, that the positions of hedging, neutral speculation and reverse speculation continue to be defined by the sign of the product between the net position of open swaps and the operational currency exposure.

We verify that the change in the definition of operational currency exposure does not alter the classification of hedging, neutral speculation and reverse speculation for any of the 93 corporations with open positions in currency swaps. However, the new definition of operational currency exposure modifies the classification of the positions of 9 firms of the control group of 250 businesses that we use. This difference forced us to re-estimate all of the logit estimations of Tables 4, 5, 6 and 7, substituting the present values of external revenues and imports for their future values in the regressions. The results not reported are qualitatively similar to those presented until now.

6. Conclusion

Géczy, Minton and Schrand (1997) show that, in 1990, 41.1% of North American firms pertaining to the Fortune 500 group use foreign exchange derivatives in the year 1990. Why do so many corporations demand foreign exchange derivatives?

In order to investigate this question, we build an original database made up of 25,457 contracts for open currency swaps open at the end of 2002. Looking at these contracts we identify 93 corporations with open position in foreign exchange swaps. Of these 93 corporations, 53 demanded swaps in order to hedge. Or rather, the contracts to swap reduce the firms' exposure to currency risk.

Of the 53 firms that purchase swaps in order to hedge, all hold long positions– gains with currency depreciation – 21 concentrated in the utilities sector and all have debt in dollars. In fact, the existence of external debt proves to be the principal determinant of hedge.

The data show, however, that various corporations demand swaps in 2002 for speculative purposes. Of 93 businesses with open positions in currency swaps at the end of 2002, 40 speculate. Of these, 18 speculate increasing the risk of their operational currency exposures. The other 20 speculate without having operational currency exposure. We also conclude that firms with larger export revenues are more likely to speculate.

In summary, this study suggests that in periods of great volatility of the exchange rate as in the year 2002 – the existence of debt in dollars is the principal determinant of the demand to hedge, and that the firms' demand for foreign exchange derivatives is indeed related to speculative motives.

This paper contributes in a relevant way to the literature because by using a unique database made of swap contracts of corporations in Brazil it makes it possible to distinguish much better the incentives related to speculation and hedge in the foreign exchange market by corporations. As the literature shows the capacity to distinguish these incentives is rare due to the fact that previous research has had access only to off balance sheet information of corporations[14]. Future research should assess whether in the last few years firms have resorted to increased hedged of their cash-flows in dollars, either through derivatives or through "natural hedges", such as investing abroad.

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[14] See Tirole(2006) for a discussion of the problems related to off balance sheet information of corporations.

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Table 1. Financial Characteristics

This table presents the financial and accounting characteristics of the firms that demand currency swaps and of those that do not. The sample of the firms is formed by a group of 343 non-financial open capital corporations. They are not of the same economic group, divulged all of the necessary accounting information and have some form of exchange rate exposure. All of the information is from the end of the 2002 fiscal year, and relative to the financial statements that are available at CVM. The existence of external debt is equal to one when a firm possesses debt in dollars and zero otherwise; the participation of administrators in profit is equal to one when administrators participate in profit and zero otherwise; tax is equal to one when the firm pays tax and zero otherwise; institutional investors show the number of institutional investors of the firm; preferential shares are the book value of the firm's preferential shares. The number of observations of each characteristic is in the second column (N). The t statistics are presented for the average test between financial characteristics of the firms' diverse categories. The tests suppose equal variances unless the hypothesis is rejected at 5%. The p-values are in parentheses.

Panel A: Firms with and without Open Positions in Currency Swaps

Financial Characteristics	Firms with open positions in currency swaps at the end of 2002 (A)				Firms without open positions in currency swaps at the end of 2002 (B)				Average Tests
	N	Average	Median	Standard Deviation	N	Average	Median	Standard Deviation	A-B
Log(Assets)	93	13.43	13.98	2.74	250	12.14	12.70	3.42	3.19 (0.0)
Existence of External Debt	93	0.68	1.0	0.46	250	0.45	0.0	0.49	0.23 (0.0)
Export Revenues/ Gross Revenues	93	7.7	1.24	49.1	250	4.4	1.88	20.5	3.3 (0.05)
Import Expenses/Gross Revenues	93	1.79	1.04	13.10	250	1.25	0.44	10.8	0.54 (0.18)
Administrators Participation in Profits	93	0.53	0.98	0.49	250	0,38	0,0	0,48	0,25 (0,0)
Administrators Compensation (R$mil)	93	239,56	250	14897	250	28031	0,0	276500	-4417 (0,0)
Tax	93	0,49	0	0,50	250	0,74	1,0	0,43	-0,25 (0,0)
Fixed Assets/ Log(Assets)	93	142814	3500	630.777	250	192500	27000	800.351	49686 (0.55)
Market Value/Book Value	93	0,56	0,0	1.33	250	0,29	0,0	2,64	0,27 (0,35)
Number of Institutional Investors	93	80,29	0,0	280,78	250	1142	0,0	17129	-1062,20 (0,55)
Preferential Shares /log(Assets)	93	52192	0,0	257100	250	10919	0,0	63186	41273 (0,43)
Long Term Debt/Log(Assets)	93	274019	23454	158521	250	183374	5600	10800	92030 (0.38)
Total Dollar Debt/Log(Assets)	93	29337	0,0	64595	250	14834	0,0	99050	14335 (0,32)
Short Term Dollar Debt/Log(Assets)	93	34640	0,0	199383	250	16552	4050	34325	18058 (0,49)

Table 2. Hedge or Speculation

Panel A presents the corporations with open contracts of currency swaps in 2002 by type of position: hedge, reverse speculation and neutral speculation. The firm hedges when the product between its operational currency exposure, defined as the difference between export revenues and the sum of import expenses and debt in dollars, and its open positions in currency swaps is less than zero. The firm speculates when the product between its operational currency exposure, defined as the difference between export revenues and the sum of import expenses and debt in dollars, and its open positions in currency swaps is greater than zero. The speculation is reverse when the product of the open positions in currency swaps and the operational currency exposure is greater than zero. The speculation is neutral when the firm does not possess operational currency exposure, but possesses open positions in currency swaps. Swaps/NW is the average level in the industry of the ratio of net positions in currency swaps to net worth. Panel B presents the firms that hedge and those that perform reverse speculation classified by sectors; the form in which they do so and if they possess debt in dollars or not. Panel C presents the firms that hedge and those that perform reverse speculation classified by sectors; the form in which they do so and if they have exports or imports in dollars. Panel D shows the origin of the corporations that hedge, or that perform reverse or neutral speculation.

Panel A: Types of Positions and Currency Exposures

Industries	Hedge			Reverse Speculation			Neutral Speculation			Total
	Net Position		**Swaps/ NW**	**Net Position**		**Swaps/ NW**	**Net Position**		**Swaps/ NW**	**Total**
Chemical and Petroleum	9	0	0,05	2	0	0,03	1	0	0,04	12
Food and Beverages	1	0	0,05	7	0	0,04	2	0	0,05	10
Mining and Metallurgy	2	0	0,01	0	0	N.A.	5	0	0,06	7
Electro/Electronic Equipment	6	0	0,08	5	0	0.026	4	0	0,07	15
Transportation	3	0	0,05	0	0	N.A	0	0	N.A.	3
Concessionaries for Public Service	19	0	0,06	0	0	N.A	6	0	0,015	25
Textiles	5	0	0,04	0	0	N.A	5	0	0,03	10
Metallurgy	6	0	0,07	2	0	0,03	0	0	0,12	8
Other	2	0	0,04	0	0	N.A	1	0	0,047	3
Total (long + short)	53			16			24			93

Panel B: Hedge and Reverse Speculation – With and Without Debt in Dollar

Industries	Hedge				Reverse Speculation				
	With Debt		Without Debt		With Debt		Without Debt		
	Short	Long	Short	Long	Short	Long	Short	Long	Total
Chemical and Petroleum	9	0	0	0	1	0	1	0	11
Food and Beverages	1	0	0	0	4	0	3	0	8
Mining and Metallurgy	2	0	0	0	0	0	2	0	4
Electro/Electronic Equiptment	6	0	0	0	3	0	2	0	11
Transportation	3	0	0	0	0	0	0	0	3
Concessionaries of Public Service	19	0	0	0	0	0	0	0	19
Textiles	5	0	0	0	0	0	0	0	5
Metallurgy	6	0	0	0	2	0	0	0	8
Other	2	0	0	0	0	0	0	0	2
Total (with debt + without debt)	53		0		10		0		63

Panel C: Hedge and Reverse Speculation - Exports and Imports

Industries	**Hedge**				**Reverse Speculation**				**Total**
	Exports		**Imports**		**Exports**		**Imports**		
	Long	**Short**	**Long**	**Short**	**Long**	**Short**	**Long**	**Short**	
Chemical and Petroleum	4	0	3	0	1	0	0	0	8
Food and Beverages	0	0	0	0	7	0	4	0	11
Mining and **Metallurgy**	0	0	0	0	0	0	0	0	0
Electro/Electronic Equipment	3	0	3	0	5	0	2	0	13
Transportation	1	0	0	0	0	0	0	0	1
Concessionaries for Public Service	0	0	0	0	0	0	0	0	0
Textiles	3	0	2	0	0	0	0	0	0
Metallurgy	6	0	6	0	2	0	2	0	16
Other	0	0	0	0	0	0	0	0	0
Total (exports + imports)	14		14		15		8		41

Panel D: Hedge and Speculation – Capital Origin

Origin of Capital	Hedge	Reverse Speculation	Neutral Speculation
Private Domestic	44	13	22
State-owned	5	1	1
Multinational	4	2	1
Total	53	16	24

Table 3. Pearson Correlations

Pearson correlations for the regressors used in the logit estimations. The correlations in black and in parentheses are significant at 5%. The existence of external debt is equal to one when a firm possesses debt in dollars and zero otherwise; the participation of administrators in profits is equal to one when the administrators participate in profit and zero otherwise; tax is equal to one when a firm pays tax and zero otherwise; institutional investors show the number of institutional investors of the firm; preferential shares are the book value of the preferential shares of the firm.

		Existence of External Debt	Exportation/Gross Revenue	Importation/Gross Revenue	Circulating Asset/ Circulating Liability	Tax	Institutional Investors	Long Term Debt/Log (assets)	Immobilized/ Log(assets)	Log(assets)	Market Value/Book Value	Participation in Profits	Profitability	Total Debt in Dollars/Assets
Exportation/Gross Revenue	0,15													
Importation/Gross Revenue	-0,08	0,06												
Circulating Assest/Circulating Liability	-0,04	0,05	-0,01											
Tax	-0,05	0,07	0,01	0,01										
Institutional Investors	0,06	0,06	0,07	-0,01	0,07									
Long Term Debt/Log (assets)	-0,04	0,01	-0,01	-0,02	-0,11	-0,01								
Immobilized/Log(assets)	0,08	0,07	-0,01	-0,02	0,00	-0,01	0,28							
Log (ativos)	(0,34)	0,07	-0,07	-0,09	-0,01	0,04	(0,4)	(0,33)						
Market Value/Book Value	-0,01	0,08	0,08	0,07	0,12	0,01	-0,02	0,00	0,05					
Participation of Administrators in Profits	0,12	0,0	-0,02	-0,01	0,07	0,08	-0,05	-0,05	0,03	0,01				
Profitability	0,07	0,04	-0,02	-0,01	0,06	0,00	0,01	0,03	0,08	0,02	0,07			
Total Debt in Dollars / log(assets)	-0,03	0,11	-0,01	-0,01	0,06	0,40	-0,02	-0,01	0,06	-0,01	0,11	-0,01	-0,01	-0,02

Table 4. Logit Estimations: Firms with Currency Exposure

Logit regressions of firms probability to hedge and to speculate. The sample includes 343 corporations that we select from the financial statements of 2002 and that are subject to some type of risk related to currency exposure. These corporations either have export revenue in dollars, import expenses in dollars, debt in dollars, presented open positions in currency swaps or take part in industrial sectors that are most affected by the currency exposure. Operational currency exposure is the difference between revenue from exports and the sum of expenses from imports and debt in dollars. The corporations that hedge are those for which the product of its operational currency exposure by the net open position in currency swaps at the end of 2002 is less than zero. The firms speculate if the product of its operational currency exposures with the net open positions in swaps at the end of 2002 is greater than zero or if they possess net open positions in swaps, but do not possess operational currency exposure. The existence of external debt is equal to one when a firm possesses debt in dollar and zero otherwise; the participation of the administrators in profits is equal to one when the administrators participate in profits and zero otherwise; tax is equal to one when the corporation pays tax and zero otherwise; institutional investors shows the number of institutional investors of the firm; preferential shares are the book value of the firm's preferential shares; and multinational is equal to one when a firm is multinational and zero otherwise. We are also controlling for the indicative variables of the following industrial sectors: Food/Beverage, Chemical/Petroleum, Metallurgy, Transportation, Mining, Electro/Electronic, Textiles and Concessionaries for Public Service. The statistics of the tests for maximum likelihood tests the joint significance of the variables. The robust standard errors are calculated using Huber-White. Below the estimated coefficients and the χ^2, statistics, in parentheses, are the p-values.

Regressors	**Dependent Variable** **Hedge (A)**	**Speculation (B)**
Constant	-10.03 (0.0)	-1.01 (0.36)
Existence of External Debt	1.14 (0.03)	0.30 (0.47)
Log (Assets)	0.62 (0.01)	-0.087 (0.48)
Exports Revenues/Gross Revenues	-0.06 (0.10)	0.012 (0.0)
Imports Revenues/Gross Revenues	-0.05 (0.09)	0.03 (0.37)
Administrator Participation in Profits	-0.001 (0.10)	0.0 (0.17)
Compensation of Executives	-0.006 (0.06)	-0.0005 (0.80)
Tax	1.62 (0.19)	0.22 (0.73)
Long Term Debt/Log(Assets)	-0.002 (0.21)	0.0 (0.14)
Current Assets/Current Liabilities	0.008 (0.22)	-0.015 (0.45)
Fixed Assets/Log(Assets)	0.002 (0.86)	-0.0061 (0.57)
Market Value/Book Value	0.0 (0.11)	0.0 (0.0)
Preferential Shares /Log(Assets)	0.0002 (0.19)	0.024 (0.77)
Net Profit/ Total Equity	-0.05 (0.95)	-0.86 (0.52)
Multinational	0.0097 (0.03)	0.032 (0.23)
Institutional Investors	-0.001 (0.90)	-0.01 (0.57)
Dummies for Industries	controlled	controlled
Maximum Likelihood Ratio $\chi^2(22)$	58.80 (0.0)	53.57 (0.0)
Pseudo R^2	0.22	0.13

Table 5: Logit Estimations for Hedge and Reverse Speculation

Logit regressions of the firm's probability to hedge and probability of reverse speculation. Reverse speculation is defined as the positive product of the open position in currency swaps and the operational currency exposure, defined as the difference between export revenues and the sum of debt in dollars the import expenses. The corporations that hedge are those for which the product of their operational currency exposure by the net position in currency swaps was less than zero. The sample excludes the corporations that do neutral speculation. There are 323 firms with currency exposure, or rather, firms that have revenue in dollars, imports expenses in dollars, debt in dollars or participate in a tradable sector. The existence of external debt is equal to one when a firm possesses debt in dollar and zero otherwise; the participation of administrators in profits is equal to one when the administrators participate in profits and zero otherwise; tax is equal to one when the firm pays tax and zero otherwise; institutional investors shows the number of institutional investors of the firm; preferential shares are the book value of the firm's preferential shares; multinational is equal to one when a firm is multinational and zero otherwise. We are also controlling for the following industrial sectors: Food/Beverage, Chemical/Petroleum, Metallurgy, Transportation, Mining, Textiles, and Concessionaries for Public Service. The statistics of the tests for maximum verisimilitude and for the Lagrange multiplier test the combined significance of the dependent variables. The robust standard errors were calculated using Huber-White. Below the estimated coefficients and the χ^2 statistics, in parentheses, are the p-values.

Regressors	**Dependent Variable**	
	Hedge(A)	**Speculation(B)**
Constant	-2.45 (0.0)	-3.61 (0.0)
Existence of External Debt	0.98 (0.08)	1.24 (0.10)
Log (Assets)	0.13 (0.05)	0.94 (0.06)
Exports Revenues/Gross Revenues	0.29 (0.89)	0.85 (0.05)
Imports Revenues/Gross Revenues	-0.94 (0.54)	0.093 (0.54)
Administrator Participation in Profits	-0.99 (0.26)	0.027 (0.0)
Compensation of Executives	0.85 (0.07)	-0.01 (0.82)
Tax	-0.63 (0.37)	-0.32 (0.06)
Long Term Debt/Log(Assets)	0.41 (0.20)	-0.15 (0.34)
Current Assets/Current Liabilities	-0.01 (0.24)	-0.014 (0.24)
Fixed Assets/Log(Assets)	0.01 (0.0)	-0.15 (0.09)
Market Value/Book Value	0.57 (0.50)	0.056 (0.61)
Preferential Shares /Log(Assets)	-0.84 (0.69)	0.18 (0.07)
Net Profit/ Total Equity	0.02 (0.74)	-0.04 (0.0)
Multinational	0.38 (0.62)	0.47 (0.84)
Institutional Investors	0.45 (0.22)	0.90 (0.57)
Dummies for Industries	controlled	controlled
Maximum Likelihood Ratio χ^2(22)	28.74 (0.18)	43.01 (0.0)
Pseudo R^2	0.12	0.28

Table 6: Logit Estimations of Hedge and Speculation for Other Years: 1999, 2000 and 2001

Logit regression for hedge and speculation for the years from 1999 to 2001. We use the complete sample of 343 firms. This sample includes all of the corporations that we select from the financial statements at the end of these years and that present some form of currency exposure. Panel A shows the logit estimations for firms that hedge. A firm hedges if it possesses open positions in currency swaps and operational currency exposure, defined as the difference between export revenues and the sum of import expenses and debt in dollars, and if the product of this exposure and of the positions is less than zero. Pannel B shows the logit estimations for firms that speculate. A firm speculates if it possesses open positions in currency swaps and operational currency exposure, defined as the difference between export revenues and the sum of import expenses and debt in dollars, and if the product of this exposure and of the positions is greater than zero. The existence of external debt is equal to one when a firm possesses debt in dollars and zero otherwise; the participation of administrators in profits is equal to zero when administrators participate in profits and zero otherwise; tax is equal to one when a firm pays tax and zero otherwise; institutional investors shows the number of institutional investors of the firm; preferential shares are the book value of the firm's preferential shares; multinational is equal to one when a firm is multinational and zero otherwise. We are also controlling for the following industrial sectors: Food/Beverage, Chemical/Petroleum, Metallurgy, Transportation, Mining, Textiles and Concessionaries for Public Service. The robust standard errors were calculated using Huber-White. We present below the coefficients and the χ^2 statistics, in parentheses, the p-values.

Panel A: Hedge for the Years 1999, 2000 and 2001

Regressors	1999 (A)	2000 (B)	20001 (C)
Constant	-8.99 (0.01)	-4.69 (0.0)	-10.00 (0.0)
Existence of External Debt	0.58 (0.05)	1.57 (0.07)	1.43 (0.06)
Log (Assets)	0.65 (0.03)	0.14 (0.20)	0.54 (0.01)
Exports Revenues/Gross Revenues	-0.002 (0.24)	-0.20 (0.80)	-0.23 (0.27)
Imports Revenues/Gross Revenues	0.27 (0.88)	0.93 (0.94)	0.44 (0.21)
Administrator Participation in Profits	0.034 (0.13)	0.58 (0.21)	-1.29 (0.29)
Compensation of Executives	-0.058 (0.06)	0.0 (0.21)	-0.011 (0.08)
Tax	-0.25 (0.29)	-0.47 (0.09)	-0.26 (0.56)
Long Term Debt/Log(Assets)	-4.31 (0.11)	0.03 (0.52)	0.83 (0.91)
Current Assets/Current Liabilities	0.66 (0.71)	-0.001 (0.91)	0.49 (0.74)
Fixed Assets/Log(Assets)	-0.81 (0.58)	0.13 (0.87)	1.20 (0.41)
Market Value/Book Value	-1..11 (0.22)	-0.31 (0.46)	-0.04 (0.91)
Preferential Shares /log(Assets)	0.92 (0.83)	0.42 (0.32)	-0.94 (0.47)
Net Profit/ Total Equity	-0.001 (0.99)	-0.0013 (0.91)	-0.007 (0.59)
Multinational	0.72 (0.58)	0.073 (0.92)	2.70 (0.02)
Institutional Investors	0.01 (0.09)	-0.068 (0.87)	0.001 (0.22)
Dummies for Industries	controlled	controlled	controlled
Maximum Likelihood Ratio $\chi^2(22)$	-45.00 (0.24)	54.90 (0.01)	53.13 (0.0)
Pseudo R^2	0.24	0.21	0.26

Panel B: Speculation for the Years 1999, 2000 and 2001

Regressors	**1999** **(A)**	**2000** **(B)**	**20001** **(C)**
Constant	-4,03 (0,05)	-6,3 (0,05)	-1,32 (0,26)
Existence of External Debt	2,26 (0,0)	-0,43 (0,53)	-2,42 (0,0)
Log (Assets)	-1,80 (0,77)	9,50 (0,0)	-1,47 (0,85)
Exports Revenues/Gross Revenues	0,44 (0,93)	-11,79 (0,49)	-4,05 (0,65)
Imports Revenues/Gross Revenues	0,51 (0,21)	0,97 (0,11)	0,63 (0,15)
Administrator Participation in Profits	0,25 (0,28)	0,54 (0,13)	0,12 (0,53)
Compensation of Executives	0,0 (0,83)	0,0 (0,78)	0,0 (0,52)
Tax	-0,5 (0,19)	-0,17 (0,79)	-1,74 (0,0)
Long Term Debt/Log(Assets)	0,0 (0,88)	0,0 (0,66)	0,0 (0,71)
Current Assets/Current Liability	0,0 (0,86)	0,0 (0,84)	0,0 (0,74)
Fixed Assets/Log(Assets)	0,0 (0,57)	0,0 (0,66)	0,0 (0,88)
Market Value/Book Value	0,033 (0,99)	0,07 (0,42)	0,04 (0,62)
Preferential Shares /log(Assets)	0,0 (0,93)	0,0 (0,96)	0,0 (0,11)
Net Profit/ Total Equity	0,002 (0,99)	0,004 (0,99)	0,0 (0,99)
Multinational	-0,99 (0,47)	1,99 (0,08)	1,38 (0,30)
Institutional Investors	0,0 (0,77)	0,0 (0,99)	0,0 (0,98)
Dummies for Industries	controlled	controlled	controlled
Maximum Likelihood Ratio $\chi^2(22)$	50.80 (0.0)	43.13 (0.0)	27.55 (0.02)
Pseudo R^2	0.19	0.23	0.28

Table 7: Random Effect Panel Analysis for the Period 1999 to 2002: Firms with Currency Exposure

Pannel regressions of the probability of firms to hedge and the probability of the firm to speculate. The sample includes 343 corporations that we select from the financial statements from 1999 to 2002 and that are subject to some type of risk related to currency exposure. These firms have revenue in dollars, imports expenses in dollars, debt in dollars, present open positions in currency swaps or pertain to industrial sectors that are most affected by currency exposure. Operational currency exposure is the difference between exports revenues and the sum of import expenses and debt in dollars. We are only considering firms with net open positions in currency swaps purchased in dollars. The firms that hedge are the ones which the product of their operational currency exposure with their net open position in currency swaps at the end of 2002 is less than zero. The firms speculate if the product of their operational currency exposures with their net open positions in swaps at the end of each one of these years greater than zero or if they possess net open positions but do not possess operational currency exposure. The existence of external debt is equal to one when a firm possesses debt in dollars and zero otherwise; the participation of administrators in profits is equal to zero when administrators participate in profits and zero otherwise; tax is equal to one when a firm pays tax and zero otherwise; institutional investors shows the number of institutional investors of the firm; preferential shares are the book value of the firm's preferential shares; multinational is equal to one when a firm is multinational and zero otherwise. We are also controlling for the indicative variables of the following industrial sectors: Food/Beverage, Chemical/Petroleum, Metallurgy, Transportation, Mining, Electro/Electronic, Textile and Concessionaries of Public Service. This is a variable effect panel. The maximum likelihood statistic is presented. The robust standard errors are calculated using Huber-White. Below the estimated coefficients and the χ^2 statistics, in parentheses, are the p-values.

Regressors	**Dependent Variable** **Hedge (A)**	**Speculation (B)**
Constant	-16.64 (0.54)	-13.40 (0.18)
Existence of External Debt	0.87 (0.09)	0.35 (0.57)
Log (Assets)	1.48 (0.0)	2.36 (0.02)
Exports Revenues/Gross Revenues	-0.02 (0.34)	-0.007 (0.91)
Imports Revenues/Gross Revenues	-0.045 (0.69)	-0.0001 (0.65)
Administrator Participation in Profits	-0.18 (0.56)	0.17 (0.40)
Compensation of Administrators	0.0 (0.46)	0.0 (0.91)
Tax	0.07 (0.26)	0.0 (0.79)
Long Term Debt/Log(Assets)	-0.38 (0.87)	-0.4 (0.21)
Current Assets/Current Liabilities	0.58 (0.50)	0.31 (0.23)
Fixed Assets/Log(Assets)	1.48 (0.76)	0.31 (0.82)
Market Value/Book Value	0.01 (0.60)	-0.003 (0.11)
Preferential Shares /log(Assets)	0.13 (0.51)	0.05 (0.09)
Net Profit/ Total Equity	-0.098 (0.42)	-0.024 (0.01)
Institutional Investors	0.47 (0.82)	0.0046 (0.09)
D2002(ExportsRevenues/Gross Revenues)	-0.002 (0.34)	0.69 (0.09)
D2002	0.75 (0.05)	1.84 (0.0)
Dummies for Industries	controlled	controlled
Maximum Likelihood Ratio	-223.72	-118.03
$\chi^2(15)$	(0.03)	(0.0)

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