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THE MARKET OF FOREIGN EXCHANGE HEDGE IN BRAZIL: REACTIONS OF FINANCIAL INSTITUTIONS TO INTERVENTIONS OF THE CENTRAL BANK

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The Market of Foreign Exchange Hedge in Brazil: Reaction of Financial Institutions to Interventions of the Central Bank

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Abstract

Between 1999 and 2002, Brazil's Central Bank sold expressive amounts of dollar indexed debt and foreign exchange swaps. This paper shows that in periods of high volatility of the exchange rate, first semester of 1999 and second semester of 2002, the Central Bank of Brazil increased the foreign exchange hedge, but the financial institutions used this to reduce their foreign exchange exposure. In contrast, increases in foreign hedge during periods of low volatility of the exchange rate were transferred to the productive sector.

1. Introduction

One of the main functions of the central bank is to administer the foreign exchange reserves of the country, intervening in the foreign exchange market when the foreign exchange policy needs. In such circumstances the classic instrument is to sell or buy foreign exchange in the spot market. In the last decades, however, interventions through foreign exchange derivatives, in particular, the selling of public bonds indexed by the exchange rate have become common in emerging markets, like Brazil or Mexico, among others.

Mishkin (2001) and Blejer and Shumaker (1997) give explanations for the increasing participation of central banks in the foreign exchange derivative markets. For these authors such derivatives imply a short position in dollars for the central bank and a long position in dollars for the private sector. These derivatives are basically purchased by financial institutions that use them as guarantees to offer protection against foreign exchange devaluation (hedge) to the productive sector. Without the supply of these foreign exchange derivatives the market of foreign exchange hedge would crash in periods of foreign exchange crisis and the productive sector of the country would be subject to a high volatility of the exchange rate, that, in the best case, would increase the cost of capital of the firms, and, in the worst case, would generate a cycle of destructive bankruptcy. [1]

The arguments of Mishkin (2001) e Blejer e Schumaker (1997) suggest that the financial institutions are only transferring risk. However, the financial institutions do not work necessarily with matched operations between assets and liabilities. This is clear if we consider maturity or currency. It is thus possible that the financial institutions decide to sell foreign exchange hedge without another transaction that aims in eliminating or minimizing the risk involved in selling the hedge.

Under this perspective, it is not obvious that an increase in the supply of hedge of the central bank will be transferred to the productive sector. As a matter of fact, in times of high foreign exchange risk, an increase in the supply of the hedge can be completely absorbed by the financial institutions, making the interventions of the central bank unable to affect the productive sector, contrary to the arguments of Mishkin (2001) e Blejer e Schumaker (1997). Therefore, the impact of the interventions of the central bank in the foreign exchange hedge market is still an open question.

In this paper, we will seek to answer this question using an original database with 74,000 contracts of foreign exchange swaps that where written between 1,318 firms and 43 financial institutions from 1999 to 2003. This database was built from confidential information of the financial institutions following a request from Brazil′s Central Bank. The foreign exchange swap is by far the most important foreign exchange derivative used by corporations in Brazil, as available data from the Exchange of Futures and Other Derivatives in Brazil- *Bolsa de Mercadorias e Futuro-BM&F*- and the Clearing of Private Bonds of the Financial Institutions - *Central de Custódia de Títulos Privados - CETIP* - make clear. Therefore, this database is the most representative of the demand of foreign exchange derivatives in Brazil, allowing that we document the reaction of the financial institutions with respect to interventions of the Central Bank of Brazil, as far as their foreign exchange exposure and of their clients is concerned.

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[1] To understand the reasons why domestic agents of emerging markets are indebted in foreign exchange see : Olivier (2002), Dooley (1999), Haussman e Eicheengreene (1999) e Haussman e Eicheengreene (2003)

We will consider two hypotheses. One is that in times of foreign exchange crisis, increases in the supply of foreign exchange hedge from the central bank will be absorbed by the financial institutions to decrease their foreign exchange exposure generated before the foreign exchange crisis, when the financial institutions supplied hedge to the productive sector in excess to the supply of the central bank. The alternative hypothesis is that part of that supply of hedge is transferred to the productive sector, following the arguments of Mishkin (2001) and Blejer and Shumaker (1997).

We will show that the interventions of the Central Bank of Brazil in the hedge market and the reaction of the financial institutions to these interventions vary with the volatility of the foreign exchange rate. In periods of high volatility, as, for example during the first semester of 1999, when the foreign exchange regime was modified, and in the second semester of 2002, when the election for Presidency was held, the Central Bank of Brazil increased considerably its supply of foreign exchange derivative, but this increase was absorbed by the financial institution to decrease their foreign exchange exposure. In contrast, part of the supply of foreign exchange hedge from the Central Bank of Brazil was transferred to the economy in the period between foreign exchange crises.

To be more specific, the average number of interventions of the Central Bank in the foreign exchange market increased from an average of 23 per semester in periods of low volatility of the foreign exchange rate to (July 1999 to April 2002) to an average of 36 per semester in the periods of high volatility of the exchange rate (first semester of 1999 and second semester of 2002). The increase in the frequency of the interventions was accompanied by a substantial increase in their magnitudes, that went from an average of US$ 5,33 millions in the period of low volatility to an average of US$ 30,73 millions in the period of high volatility, that is an increase of 576%.

In contrast, the daily average of the percentage of long positions in dollars of foreign exchange swaps of the financial institutions in relation to short positions in dollars of foreign exchange swaps increased from 18% in periods of low volatility of the foreign exchange rate to 29% in the periods of high volatility. This is, in the period of high volatility of the exchange rate, the increase in the foreign exchange hedge due to the Central Bank of Brazil was absorbed by the financial institutions to reduce their short positions in dollars created in periods before the crisis.

This behavior of the financial institutions is also observed when we analyze the impact of the supply of foreign exchange hedge controlling for the first difference of the foreign exchange coupon, first difference of the stock market general index, *IBOVESPA*, and first difference of the rate of certificate of deposits between financial institutions (*Certificado de Depósitos Interfinanceitros - CDI*). In addition, our regressions show that the pattern of reaction of the financial institutions are the same, independent of the origin of their capital (domestic or foreign), of their size (total assets), of the their participation in the spot foreign exchange market (dealers or not) and of the type of institutions that are their main clients (tradable or non-tradable)

The fundamental conclusion of the paper is that, in times of foreign exchange crisis, the financial institutions absorb the supply of foreign exchange hedge from the Central Bank of Brazil. These institutions take advantage of these interventions to reduce their foreign exchange exposure, but they do not seem capable to reduce the impact of the exchange rate crises over the productive sector.

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The rest of the paper is organized as follows. Section 2 describes the data, analyzing them in an univariate manner. Section 3 shows the empirical analysis considering the aggregate data of the stock of swaps foreign exchange. Section 4 analysis empirically the data considering groups of institutions and section 5 presents the conclusions of the paper.

2. Data Sample

In this paper, we want to estimate the impact over the private market of foreign exchange hedge of changes in the supply of financial assets of the Central Bank of Brazil indexed to the dollar. Our sample period starts with the change in the foreign exchange regime that took place in January 1999 and ends in December 2002. Between January 1999 and December 2002, the country suffered two serious foreign exchange crisis (first semester of 1999 and second semester of 2002) that, as expected, are associated with a high volatility of the foreign exchange rate: the average of the standard deviation in the foreign exchange crises is 5,0%, while between July 1999 and April 2002 is 1,8%.

In our analysis, therefore, we will divide our sample period in three periods. The two periods corresponding to the foreign exchange crisis (first semester of 1999 and second semester of 2002) and the period of no foreign exchange crises from July 1999 to April 2002.

Between 1999 and 2002, the Central Bank of Brazil supplied the market with two financial assets indexed to the dollar: public indexed bonds and swap contracts. The public indexed bonds were the Notes of the Central Bank Series E, (*Notas do Banco Central - Série E) NBC-E* and Notes of the National Treasury-Series D (*Notas do Tesouro Nacional - Série D), NTN-D*. Both bonds pay a fixed interest rate summed with the depreciation of the dollar. The most important difference between these bonds and the swap contracts is that the former have no principal, giving only the buyers of the swap contracts the difference between the foreign exchange depreciation and the rate of certificate of deposits between financial institutions, *CDI* (which is a floating interest rate in reais).

Between January 1999 and April 2002, *NBC-E* and *NTN-D* were the main instruments that the Central Bank of Brazil used to supply the market with foreign exchange hedge. Such dominance stopped existing in may 2002, when the Central Bank of Brazil started selling Financial Letters of the Central Bank (*Letras Financeiras do Tesouro), LFT,* together with foreign exchange swap contracts, a combinations that kept the Central Bank of Brazil long in a floating rate, *CDI*, and short in the depreciation of the nominal exchange rate.

It follows, then, that between 1999 and 2002, the stock of foreign exchange hedge supplied by the Central Bank was given by the sum of *NBC-E* and *NTN-D* in the market and by the stock in the market of foreign exchange hedge. The data concerning this stock was obtained in the Department of Open Market Operations of the Central Bank. Graph 1 shows the evolution of this stock in dollars through January 1999 to December 2002.[2]

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[2] The original series of NTN-D and NBC-E and foreign exchange swaps were informed by the Central Bank in reais. We used the nominal exchange rate of the day before to transform them in dollars

Graph 1

Market Stock of Foreign Exchange Hedge
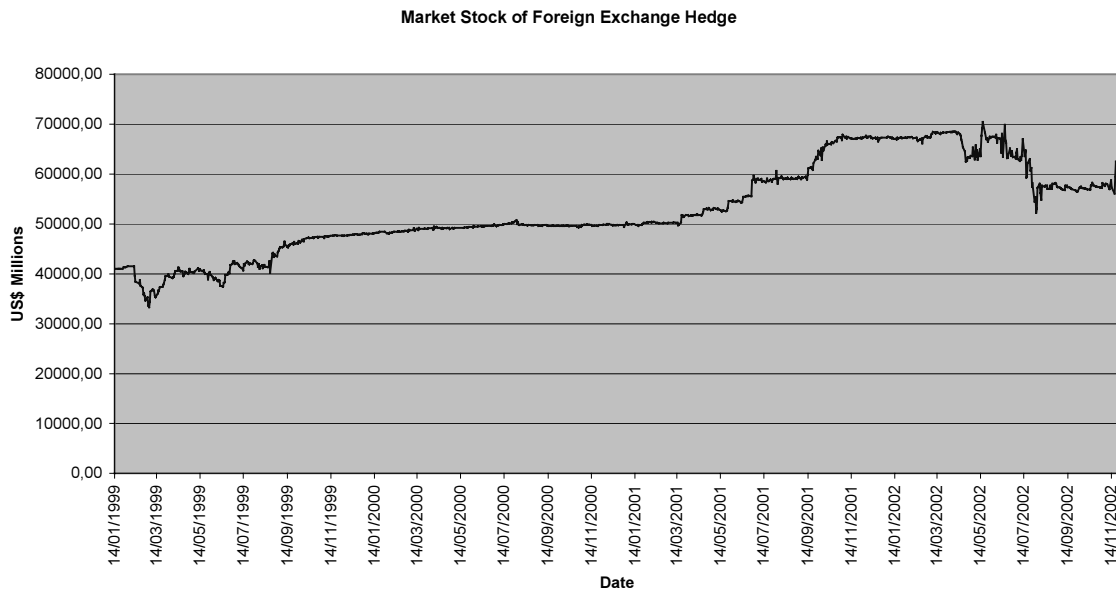
After describing the instruments the Central Bank of Brazil used to supply foreign exchange hedge (public indexed bonds and foreign exchange swaps) our next task is to describe how the changes in the supply of hedge of the Central Bank of Brazil took place. For this, we created a series of interventions in the foreign exchange hedge, using the first difference of foreign exchange hedge in the market (public indexed bonds and foreign exchange swaps). We consider that the Central Bank of Brazil intervened in a date t when the value of this series in t was greater in modulus than the average plus two standard deviations of whole series, from January 1999 to December 2002. The information concerning interventions of the Central Bank in the hedge market is presented in Table 1 for several periods that we considered.[3]

We recorded 241 interventions in the whole period, 147 of which were positive interventions, this is, where the Central Bank increased the stock in the market of foreign exchange derivatives and 94 where the Central Bank reduced this stock. In all periods considered, the daily average of interventions is positive. In fact, the supply of foreign exchange swaps in the foreign exchange crisis of the second semester of 2002 increases considerably the daily average, that change from US$ 4.58 millions (not reported in the table), between January 1999 and April 2002, to US$ 55.23 millions.

Our next task is to describe the market of foreign exchange hedge between firms and financial institutions. In a very simple way, we can describe this market as being the one of foreign exchange derivatives that are sold to the corporations by the financial institutions. These derivatives are contracts that the financial institutions agree with monetary transfers that depend on the nominal exchange rate. For example, the dollar future contract sold from an institution to a firm gives the company the right to buy dollars

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[3] We observed that the results of our empirical analysis that is going to presented later in the paper are similar if we consider one or three standard deviations instead of two standard deviations

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at a pre-determinate rate. The future gains of the future contract, therefore, increase with the depreciation of the nominal exchange rate, being thus a foreign exchange hedge.

Future contracts of foreign exchange are not the only instruments of hedge available for the financial institutions. They can also transact, for example foreign exchange options, foreign exchange forwards and foreign exchange swaps. All these transactions are necessarily recorded in the BM&F or in CETIP. At the latter are basically recorded the foreign exchange swaps, which are operations off-exchange, between two companies or between one financial institutions and a company.

According to information of BM&F, future of dollars are only liquid for maturities of 30 or less days and their daily open stock was always inferior to 3% of the daily stock of foreign exchange swaps between companies and financial institutions. Foreign exchange options are even less liquid. It follows then that in the recent period the market of foreign exchange swaps was the most representative of the market of hedge between companies and financial institutions.

In this paper, a database of foreign exchange swaps between financial institutions and companies was built with confidential data that was requested by the Central Bank of Brazil to 43 financial institutions that operate in the market. There are 74,000 contracts of foreign exchange swaps that correspond to 98% of the total volume of foreign exchange swaps between firms and financial institutions, in the period from January 1999 to December 2002.[4]

Table 2 shows the stock of foreign exchange swaps of the financial institutions. The series of the sum of short and long positions in dollars shows an increase from US$ 5.69 billions in the first semester of 1999 to US$ 21.4 billions in the second semester of 2002. Table 2 shows that the average of the net positions (short minus long positions in dollars) was always positive, this is, indicating that foreign exchange depreciations impose losses to the Central Bank of Brazil and gains to the financial institutions in the counterpart of these contracts. They vary from US$ 3.13 billions in the first semester of 1999 to US$ 12.30 billions in the second semester of 2002.

3. The Interventions of the Central Bank of Brazil in the Foreign Exchange Derivatives Market

As explained in section 2, the Central Bank of Brazil intervenes in the market of foreign exchange hedge by selling foreign exchange swaps or public bonds indexed by the exchange rate. The agents that purchase directly these instruments are financial institutions that after purchasing them have the option to transfer the foreign exchange protections to the productive sector by means of foreign exchange swap contracts.

We have then two distinct hypotheses about the reaction of the financial institutions to the interventions of the Central Bank in the foreign exchange market. For Mishkin (2001) and Blejer and Shumaker (1997) an increase in the supply of hedge by the Central Bank of Brazil is transferred from financial institutions to the firms. In the alternative hypothesis an increase in the supply of foreign exchange hedge by the Central Bank of

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[4] The Central Bank asked information from 50 financial institutions at first. Some of these institutions were acquired by others of the group of 50, between 1999 and 2003. The institutions that bought the others took the responsibility to inform about the contracts of foreign exchange swaps of the financial institutions that were acquired. This explains why the number of institutions that responded was 43 and not 50. The remaining two percent of the contracts were closed by institutions that had technical difficulties in responding to the request of the Central Bank

Brazil is not necessarily transferred by the financial institutions. These can maintain the hedge to reduce its foreign exchange exposure.

To test these two hypotheses we will use the first difference of stock of net positions of foreign exchange swaps (short positions minus long positions in dollars) as a dependent variable. First of all, in a regression of ordinary least squares that considers the stock of foreign exchange swaps between firms and financial institutions independent from the interventions of the Central Bank. After estimating this basic regression, we estimate a VAR to take account of a possible simultaneity of the decision of the Central Bank to intervene and of the financial institutions to supply hedge to the corporations.

3.1 The Basic Regression

In the first approach to evaluate the interaction of the reaction of the financial institutions in the foreign exchange swap market and the interventions of the Central Bank in the derivatives market we estimate the coefficients of regression (1) below using ordinary least squares.

Δ (net aggregate stock - short minus long positions in dollars) of foreign exchange swaps between financial institutions and firms = $C_0 + C_1$ (interventions of the Central Bank in the foreign exchange derivative market)+ $C_2 \Delta$ (foreign exchange coupon) + $C_3 \Delta$(stock market general index, *IBOVESPA*,) + $C_4 \Delta$ (rate of certificate of deposits between financial institutions, CDI) + ε (1)

Our main concern is in the sign of the coefficient C_1 of the intervention of the Central Bank in the derivatives market. Our null hypothesis is that if the Central Bank increases (decreases) the supply of hedge then the financial institutions will increase (decrease) their stock of net positions (short minus long positions in dollars) of foreign exchange *swaps* with the firms. That is, in this hypothesis the coefficient C_1 is greater than zero.

In the alternative hypothesis, an increase in the supply of foreign exchange hedge of the Central Bank of Brazil is completely used by the financial institutions. They use it to reduce their foreign exchange exposure. That is, in the alternative hypothesis the coefficient C_1 is zero. The other independent variables of equation (1) influence the expectation of the flow of foreign exchange capital to the economy. This is a key variable that is taken in consideration to evaluate the foreign exchange risk of emerging markets like Brazil, for instance. Such expectation affects the propensity of financial institutions to put in their portfolios assets that are related to foreign exchange risk, which is relevant in the alternative hypothesis. For example, an increase in the rate of certificate of deposits between financial institutions (CDI) or in the interest rates that prevails in foreign exchange derivatives market (foreign exchange coupon) attracts foreign capital, reducing the pressures against foreign exchange depreciation. In this case, we expect that the financial institutions will have a greater tendency to supply credit against foreign exchange depreciation, without the need for the institution to use the hedge supplied by the Central Bank of Brazil. In an analogous way, the IBOVESPA index captures changes in the expectations of the agents, that for one side can signal a decrease in the foreign exchange risk and, on the other side, can imply an increase in the volume of imports that force a depreciation of the nominal exchange rate. Therefore, these two conflicting effects do not allow us to affirm in a priori basis, which will be the sign of the IBOVESPA coefficient.

The results of the estimation of equation (1) are presented in Table 3. All standard errors are robust to heterocedasticity and autocorrelation (Newey West standard errors).

Table 3 shows an asymmetric behavior of the impact of the interventions of the Central Bank of Brazil in the derivatives market. These interventions do not impact the stock of net positions (short minus long positions in dollars) of the swaps contracts of the financial institutions with firms in the first semester of 1999 and on the second semester of 2002, when Brazil suffered two foreign exchange crises. As a matter of fact, in the first semester of 1999 as well as in the second semester of 2002, not only the coefficients of the interventions of the Central Bank of Brazil but also the coefficients of other independent variables (first difference of CDI, first difference of the foreign exchange coupon, and the first difference of the IBOVESPA) were not significant. The F statistic did not reject the hypothesis that all variables were statistically equal to zero, despite the fact that the Ramsey test did not reject the specification of the model.

In contrast, Table 3 shows that an increase in the supply of foreign exchange hedge of the Central Bank of Brazil increases the net aggregate stock in the market of foreign exchange swaps written between financial institutions and firms (short positions minus long positions in dollars) in the period between foreign exchange crises (from July 1999 to April 2002). In this period, an increase in the supply of foreign exchange hedge by the Central Bank of Brazil increases the net aggregate stock of foreign exchange swaps (p-value of 0.05), but this increase (0.44 is the coefficient) is statistically lower than 1 (p-value of 0.05). Even in periods of low volatility of the nominal exchange rate the financial institutions use part of the increase of the supply of hedge to the Central Bank of Brazil to reduce their foreign exchange exposure. Finally, as well as in periods of crises, the other independent variables are not statistically significant, despite the fact that the Ramsey test does not reject the specification of the model. Only when we consider the whole sample, the other independent variables (first difference of the CDI, first difference of the foreign exchange coupon and the first difference of the IBOVESPA) become significant at the 5% level.

Summing it up, the results of the estimation of equation (1) are evidence that in periods between foreign exchange crises the interventions of the Central Bank of Brazil reach the productive sector. This does not happen in the periods of foreign exchange crises, when despite the fact that the volume of interventions increased, the financial institutions did not increase their short positions of the foreign exchange hedge with firms. That is, in these periods the financial institutions use the increase of the supply of hedge to decrease their foreign exchange exposure.

However, the interventions of the Central Bank of Brazil in the foreign exchange derivative market in periods of crises in the foreign exchange market may have been useful to reduce the systemic risk of the financial system which as Caballero (2001), Caballero and Krishnamurth (2001) and Caballero (2003) point out is a reason to justify such interventions. These interventions may have served also to smooth the dynamics of the nominal exchange rate, which is another reason for justifying them as Calvo (1997) and Calvo and Reinhart (2000) indicate.

3.2 Simultaneous Equations

To take in consideration the possible simultaneity of the decision of interventions of the Central Bank of Brazil and of the supply of foreign exchange swaps of financial institutions to firms we estimate a VAR. This VAR is built with the series of interventions

of the Central Bank of Brazil, the series of the first difference of the net aggregate stock of foreign exchange swaps (short positions minus long positions in dollars), the first difference of the rate of certificate of deposit between financial institutions, CDI, the first difference of the IBOVESPA, and the first difference of the foreign exchange coupon. For each period, we analyzed if these series were stationary, using the tests of Perron and augmented Dick-Fuller. We verified that all series were stationary in all periods. We also looked at the Granger causality between these series so as to define the order of the series that appear in the VAR. Finally, we found the number of lags in the VAR according to the criteria's of Akaike and Schwarz.[5]

We found the impulse response functions (2, 5 and 10 days) of the first difference of the net aggregate stock of foreign exchange swaps (short minus long positions in dollars) to innovations equal to one standard deviations of the interventions of the Central Bank of Brazil. The impulse response function of the VAR in Table 4 confirms the results of the ordinary least squares estimation in the preceding section. Once again, the financial institutions did not transfer to the productive sector the interventions of the Central Bank of Brazil in the periods of the foreign exchange crises. For example, Table 1 shows that in the foreign exchange crisis of the first semester of 1999, one standard deviation of the Central Bank's intervention corresponds to US\$ 42.00 millions. For this innovation, the impulse response accumulated in two days is an increase of US\$ 34.90 millions in the net aggregate position (short minus long) of the financial institutions. This increase is not statistically significant (p-value 0.20)

The VAR shows that the financial institutions transfer the interventions only in the periods between crises (periods of low volatility of the nominal exchange rate). But they do that in a proportion inferior to the interventions of the Central Bank. That is, in periods between crises, an intervention of the Central Bank increases the foreign exchange hedge in US\$ 60.73 millions (one standard deviation of the intervention of the Central Bank). This implies that an accumulated increase in the first difference of the net aggregate stock in two days is US\$ 44.35 millions, an increase statistically different from zero (p-value of 0.10)

4. Analysis of the Reaction of Groups of Financial Institutions to Interventions of the Central Bank

The preceding section showed an asymmetry of the response of the aggregate supply of foreign exchange swaps of 43 financial institutions in our sample. In this section we will investigate if such responses depend on the origin of capital of the institutions (domestic or foreign), on the size of the institutions (volume of assets), on their participation in the foreign exchange spot market (dealers or non-dealers) and on the sector of their preferred clients (tradable or non-tradable).

We start showing the evolution over time of the net stock positions of foreign exchange swaps (short minus long positions in dollars) of several group of institutions. Table 5 shows that except for the institutions classified by type of preferred clients the series are very much correlated to the series of the aggregate net stock of foreign exchange swaps. For the total sample period the greatest correlation is with the series of net stock of foreign institutions (0,99) while the lowest correlation is with the series of the financial institutions whose preferred clients are from the tradable sector (0,46). These high

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[5] Haldrup and Lildholdt (2002) show that the risks involved in testing if the series is I(1), by the tests augmented Dick-Fuller and Perron, before testing if the series is I(2), are relatively limited

correlations give a first indication that the reaction of the financial institutions to the interventions of the Central Bank was uniform and similar to the aggregate one.

To ratify this first evidence, we will repeat our basic regression of the previous section for each group. This regression explains the first difference between the net stock positions of foreign exchange swaps (short minus long positions in dollars) of each group as a function of the interventions of the Central Bank of Brazil, of the first difference of the foreign exchange coupon, of the first difference of the IBOVESPA and of the first difference of the rate of certificate of deposits between financial institutions, CDI. Once again, we use in the regressions the Newey and West standard errors that are robust to heterocedasticity and autocorrelation of the residuals.

We start with the capital origin, observing that the foreign institutions are predominant (24 of 43). Mishkin (1997) arguments that the foreign institutions operate in several countries, being more diversified than domestic institutions. As such they benefit from this greater diversification to reduce their foreign exchange exposure. This advantage may imply that the financial institutions transfer a greater percentage of the supply of hedge of the central bank to the productive sector. On the other hand, the stockowners of these institutions in the home country are preoccupied with the capacity of the financial institutions located in the emerging markets to generate revenues in dollars. This may make them more conservative than the domestic institutions as far as short positions in dollars is concerned. Therefore, these two conflicting effects related to the incentives of foreign financial institutions to transfer the hedge of the Central Bank to the productive sector do not let us suspect a priori how they will react to the interventions of the Central Bank.

Table 6 shows that the interventions of the Central Bank of Brazil do not impact the net stock positions (short minus long positions in dollars) of the financial institutions. Both in the first semester of 1999 and in the second semester of 2002, not only, the coefficient of the interventions but also the coefficients of the other variables (first difference of the rate of certificate of deposits between financial institutions, CDI, the first difference of the IBOVESPA, and the first difference of the foreign exchange coupon) are significant. The F statistic does not reject the hypothesis that the independent variables are all statistically equal to zero, despite the fact that the Ramsey test does not reject the specification of the model.

At the same time, Table 6 shows that an increase in the supply of hedge of the Central Bank of Brazil increases the net stock (short position minus long position in dollars) of foreign exchange swaps of the financial institutions in the period between crises (from July 1999 to April 2002). In this period, an increase in the supply of foreign exchange hedge from the Central Bank of Brazil increases the net stock position of foreign exchange swaps of the financial institutions (coefficient 0.30 and p-value 0,03). Therefore these institutions do not transfer the hedge from the Central Bank of Brazil to the firms in these periods. Finally, the other independent variables are not statistically significant, despite the fact that the Ramsey test does not reject the specification of the model. [6]

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[6] The Wald Test related to the hypothesis of the coefficient of the intervention to be equal to one was not done for this group neither for the others that follow. The reason being that it only makes sense in the aggregate, when we are interested to know if the total volume of intervention of the Central Bank is transferred to the productive sector through the financial institutions

Other institutions that are strong candidates to react in a different way from the aggregate are big institutions. Big institutions are, normally, capable of absorbing greater losses in their foreign exchange swaps operations. This may imply a greater capacity to supply foreign exchange swaps to firms without the need to demand the foreign exchange derivatives of the Central Bank of Brazil. So as to define the group of big financial institutions we chose the fiscal year of 2002 and select 11 among the group of the 25 financial institutions with bigger volume of assets.

Table 7 shows that the group of big financial institutions did not react to the interventions of the Central Bank of Brazil in the crises periods. The coefficient of the Central Bank of Brazil interventions is not statistically significant (p-value of 0.82 in the first semester and 0.60 in the second semester of 2002). On the other hand, these institutions transfer part of the supply of hedge of the Central Bank of Brazil in the period between crises (coefficient 0.31 and p-value 0.09). In all periods, the F statistic does not reject the hypothesis that all independent variables are statistically significant and equal to zero, despite the fact that the Ramsey test does not reject the specification of the model.

In what follows, we study the behavior of financial institutions that distinguish themselves by the firms that are on the counterpart of the foreign exchange swaps contracts. For that sake, we separate in two groups: institutions whose clients are mainly of the non-tradable sector and in which clients are mainly of the tradable sector. The criterion to define preference of clients was the percentage of written contracts of one of these types from January 1999 to December 2002. If this percentage is greater or equal to 65% than there is a preferred group of clients for this institution. In the group of institutions whose preferred clients come from the tradable sector we identified 4 financial institutions, while in the group of clients of the non-tradable sector we identify 14 financial institutions.

In periods of foreign exchange crises, there is a natural increase in the demand for foreign exchange hedge, which can possibly justify the fact those financial institutions that wrote more contracts with clients of this sector react in a distinct manner from other institutions to the interventions of the Central Bank.

Table 8 shows the results of the estimation of equation (1) for financial institutions with clients predominantly of the tradable sector and of non-tradable sector. Panel A of Table 8 shows that the first group did not react to the interventions in periods of foreign exchange crises (p-value of 0.68 and 0.36 respectively for the first semester of 1999 and second semester of 2002), while they transfer part of the supply of hedge of the Central Bank between foreign exchange crises (coefficient of 0.05 and p-value of 0.02). Panel B of Table 8 shows that the financial institutions with concentration of clients in the non-tradable sector decrease their net stock positions (short minus long positions in dollars) in the first foreign exchange crisis (coefficient of -0.91 and p-value of 0.01) and do not react in the second foreign exchange crisis of the second semester of 2002 (coefficient of intervention -0.024 and p-value pf 0.43).

Like the other groups presented before-groups classified by capital origin and size-these financial institutions transfer the supply of hedge from the Central Bank of Brazil in the crises periods (p-value of 0.02 for the group of institutions with preferred clients in the tradable sector and p-value of 0.09 for the group of clients) in the non-tradable sector. In all periods for these two groups the coefficients of the first difference of the other independent variables (first difference of the rate of certificate of deposit between financial institutions, CDI, first difference of the foreign exchange coupon and first difference of the IBOVESPA) are not statistically significant. The F statistic does not reject the hypothesis

that the independent variables are all statistically significant and different from zero, despite the fact that the Ramsey test does not reject the specification of the model.

Finally, one other characteristic that could result in a distinct behavior from the aggregate related to the interventions of the Central Bank is the participation of a financial institution in the spot foreign exchange market. Institutions that are dealers in this market may have a better understanding of the dynamics of the nominal exchange rate. This may possibly affect their decision to supply foreign exchange hedge to corporations. To study this possibility, we chose 15 financial institutions in our sample that were dealers in the spot market in the year 2002.

Table 9 shows once again that this group behaves in a very similar way to all others as far a reaction to the intervention of the Central Bank of Brazil is concerned. That is, they do not react in periods of foreign exchange crises (p-value of 0.54 in the first semester of 1999 and 0.75 in the second semester of 2002) and it transfers the supply of hedge between crises (coefficient of 0.10 and p-value of 0.04). The F statistic does not reject that all variables are statistically equal to zero, although the Ramsey Test, once again, does not reject the specification of the model in all periods.

As we can see by the above analyses, for the periods of foreign exchange crises all groups of financial institutions do not react to the interventions of the Central Bank of Brazil or as in the only case of financial institutions whose clients come predominantly from non-tradable sectors decrease their positions in the foreign exchange swaps in response to interventions of the Central Bank of Brazil.

The results are similar if we estimate a VAR to consider the simultaneous decision of the Central Bank of Brazil and of the group of institutions. We do not show the results, because of space considerations, but they confirm in general all the preceding ones related to the ordinary least squares estimation. That is the reaction of the group of institutions was similar to the aggregate in the periods of foreign exchange crises and in between these crises

5. Conclusion

This paper shows that the reaction of the financial institutions to interventions of the Central Bank of Brazil in the foreign exchange market varies with the volatility of the nominal exchange hedge. In periods of high volatility of the nominal exchange rate (periods of foreign exchange crisis) the institutions demanded the foreign exchange derivatives but did not transfer them to the corporations. This transfer did however occur in periods between crises but even then it is not a complete transfer. This means that the financial institutions absorb part of the hedge of the Central Bank of Brazil to reduce their foreign exchange exposure.

This behavior does not change with the origin of the capital of the financial institutions (foreign or domestic), with their type of participation in the spot market (dealers or non dealers) or with the volume of their assets (big or little institutions) or with the concentration of clients in the counterpart of the swap contracts, be them part of the tradable or non-tradable sectors.

The main conclusion of the paper is that, contrary to the arguments, of Mishkin (2001) and Blejer and Shumaker (1997) an increase in the supply of hedge of the Central Bank of Brazil does not reach the productive sector in periods of foreign exchange crisis. Arguments in favor of the Central Bank of Brazil supplying hedge in these periods must be

based on benefits related to the reduction of the foreign exchange exposure of the financial system. Future work should go further in this direction.

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Table 1. Interventions of the Central Bank of Brazil in the Foreign Exchange Market

This table presents the number of interventions of the Central Bank of Brazil in the foreign exchange market between 1999 and 2002, as well as the average value of interventions and the standard deviations (in parenthesis). The dates of interventions are identified as the ones in which the first difference of the stock of foreign exchange hedge (swaps and public bonds indexed by the dollar) in the market is greater in modulus than the average of the series (considering the whole sample) plus two standard deviations. The series of stock of foreign exchange hedge in the market is the sum of the stock of public bonds indexed by the dollar in the market and the stock of foreign exchange swaps in the market. The volume of intervention is the first difference of the series of the stock of foreign exchange hedge in the market at the date when the intervention occurred. When the Central Bank of Brazil does not intervene we consider the intervention to be zero. The periods of foreign exchange crisis are the first semester of 1999 and the second semester of 2002. The period in between crises goes from July 1999 to April 2002.

	Foreign Exchange Crises		No Crises	Whole Sample
	1999/1	2002/2	07/1999 a 04/2002	01/1999 a 12/2002
Total Number of Interventions of the Central Bank	16	52	173	241
Total Number of Interventions that Decreased the Supply of Hedge	6	17	71	94
Total number of Interventions that Increased the Supply of Hedge	10	35	102	147
Average Value of Interventions (US$ millions)	6.34 (42.00)	55.23 (545.59)	5.33 (60.73)	12.84 (225.85)

Table 2. Aggregate Stock of Foreign Exchange Swaps of Financial Institutions

Our sample consists of 43 financial institutions with open foreign exchange swap contracts from 1999 to 2002. This table presents the daily average and in parenthesis the standard deviation of the series of the total aggregate stock (short plus long positions in dollars) and of the net aggregate stock (short minus long positions in dollars) of foreign exchange swaps. We also show for each period the daily average of the quotient of long positions to short positions in dollars. The foreign exchange crises are the first semester of 1999 and the second semester of 2002. The other periods are the years 1999, 2000, 2001, 2002 and the whole period without any foreign exchange crises, from July 1999 to April 2002.

	Foreign Exchange Crises		Whole Sample				
	1999/1	2002/2	1999	2000	2001	2002	07/1999 a 04/2002
Short Positions plus Long Positions in Dollars (US$ billions)	5.69 (1.66)	21.4 (3.68)	12.10 (8.32)	21.30 (1.41)	25.00 (1.26)	23.60 (3.73)	17.92 (4.99)
Short Positions minus Long Positions in Dollars (US$ billions)	3.13 (0.90)	12.30 (2.48)	7.24 (6.91)	15.11 (2.97)	17.88 (2.27)	15.92 (3.27)	12.20 (5.97)
Long Positions /Short Positions	0.29	0.27	0.24	0.17	0.16	0.23	0.19

Table 3. Reaction of the First Difference of the Net Aggregate Stock (Short Minus Long Positions in Dollars) of the Foreign Exchange Swaps of Financial Institutions to the Interventions of the Central Bank of Brazil

The dependent variable is the first difference of aggregate net stock (short minus long positions in dollars) of foreign exchange swaps of the financial institutions. The independent variables are the interventions of the Central Bank of Brazil, the first difference of the foreign exchange coupon, the first difference of the IBOVESPA and the first difference of the rate of certificate of deposits between financial institutions, CDI. Below the estimated coefficients, in parenthesis are the p-values obtained using the Newey and West standard errors that control for possible heterocedasticity and autocorrelation of the residuals. The data is daily and is divided in 4 periods: two periods are foreign exchange crises, the first semester of 1999 and the second semester of 2002, the period of no crises from July 1999 to April 2002 and the whole sample.

Dependent Variable: First Difference of the Net Aggregate Stock (Short Minus Long Positions in Dollars) of Foreign Exchange Swaps				
	Foreign exchange crises		No crises	Whole sample
	1999/1	**2002/2**	**07/1999 a 04/2002**	**1/1999 a 12/2002**
Constant	76.23 (0.30)	-19.41 (0.56)	11.77 (0.62)	12.63 (0.52)
Interventions of the Central Bank in the Derivatives Market	-1.40 (0.46)	-0.89 (0.53)	0.44 (0.05)	-0.05 (0.64)
First Difference of the Foreign Exchange Coupon	5.55 (0.42)	3.96 (0.12)	2.37 (0.63)	3.88 (0.05)
First Difference of the IBOVESPA	-0.37 (0.28)	-0.001 (0.5)	0.02 (0.65)	-0.0004 (0.07)
First Difference of the Rate of Certificate of Deposits Between financial Institutions, CDI	60.30 (0.0)	-75.62 (0.94)	-19.30 (0.06)	34.30 (0.01)
R^2	0.02 0.63	0.06 0.46	0.03 1.48	0.05 0.45
F Statistic	0.63 (0.63)	0.46 (0.76)	1.48 (0.20)	0.45 (0.71)
Reset Test	2.09 (0.15)	0.01 (0.91)	0.005 (0.94)	0.97 (0.32)
Wald Test Coefficient of Interventions of the Central Bank in the Derivatives Market=1 $\chi^2(1)$			3.75 (0.05)	
Observations	120	150	700	970

Table 4. Reaction of the First Difference of the Net Aggregate Stock (Short Minus Long Positions in Dollars) of Foreign Exchange Swaps to Interventions of the Central Bank of Brazil, using a VAR Methodology

This table presents the results of impulse response functions of a VAR with the following series: the first difference of the net aggregate stock of foreign exchange swaps (short minus long positions in dollars), of the first difference of the foreign exchange coupon, of the series of intervention of the Central Bank of Brazil in the foreign exchange market, of the first difference of the IBOVESPA, and of the first difference of the rate of certificate of deposits between financial institutions, CDI. We show the accumulated impulse response for two days, for five days, and for ten days of the first difference of the net aggregate stock of foreign exchange swaps in response to one standard deviation of the series of interventions of the Central Bank. The one standard deviation innovations are described in the third line of the table. From the fourth to the sixth line are the impulse response functions: for each line there is first the impulse response, then, in parenthesis, its standard deviation and in brackets the respective p-value. The data is daily and is divided in 4 periods: two periods are foreign exchange crisis, the first semester of 1999 and the second semester of 2002, the period of no crises that is from July 1999 to April 2002 and the whole sample.

	Foreign exchange crises		No Crises	Whole sample
	1999/1	**2002/2**	**07/1999 a 04/2002**	**1/1999 a /122002**
Standard deviations of the Interventions of the Central Bank (US$ Millions)	42.00	55.59	60.73	225.85
Impulse Response Accumulated in Two Days (US$ Millions)	34.90 (40.07) [0.20]	0.9 (26.04) [0.99]	44.35 (36.00) [0.10]	-32.20 (56.00) [0.35]
Accumulated Impulse Response for Five Days (US$ Millions)	31.16 (39.07) [0.22]	-5.47 (25.06) [0.80]	39.50 (37.50) [0.15]	-0.61 (30.07) [0.99]
Accumulated Impulse Response Function for ten days (US$ Millions)	-109.05 (130.04) [0.23]	-35.31 (160.07) [0.85]	39.4 (36.00) [0.13]	32.00 (33.04) [0.15]
R2	0.22	0.03	0.02	0.03
Akaike	48.63	57.09	48.63	54.70
Schwarz	48.82	57.69	48.82	54.86
Observations	120	150	700	970

Table 5. Net Stock of Foreign Exchange Swaps (Short Positions Minus Long Positions in Dollars) by Group of Financial Institutions

This table shows the daily average and standard deviation (in parenthesis) of the net aggregate stock of foreign exchange swaps (short minus long positions in dollars) of several groups of financial institutions as well the correlation between this stock and the net aggregate stock. In the first line are the groups of institutions and in parenthesis the number of institutions in each group. The institutions are classified in accordance with the origin of capital (foreigners and domestic), participation in the spot foreign exchange market (dealers or non-dealers), size (big institutions if amongst the 25 biggest ones in assets in the year 2002) and the type of clients in the counterparts of the foreign exchange derivatives contracts, (tradable or non tradable, if 65% or more of the contracts were written with clients of the tradable or non tradable sectors). The data is daily and is divided in 4 periods: two periods are foreign exchange crises, the first semester of 1999 and the second semester of 2002, the period of no crises from July 1999 to April 2002 and the whole sample.

	Foreigners		Dealers		Big Institutions		Tradable		Non Tradable	
Number of Financial Institutions	24		14		11		4		14	
Period	Short minus long (US$Bi)	Correlation	Short minus long (US$Bi)	Correlation	Short minus long (US$Bi)	Correlation	Short minus long (US$Bi)	Correlation	Short minus long (US$Bi)	Correlation
1999/1	2.32 (0.67)	0.97	1.02 (0.30)	0.96	3.21 (0.94)	0.91	0.39 (0.22)	0.12	0.62 (0.39)	0.06
2002/2	10.30 (0.66)	0.94	3.07 (0.46)	0.92	10.40 (1.18)	0.99	0.74 (0.13)	0.76	3.56 (0.62)	-0.68
07/1999 A 12/2002	8.77 (2.43)	0.96	3.31 (0.86)	0.94	8.15 (2.32)	0.99	0.88 (0.28)	0.69	3.14 (1.01)	0.45
Whole Sample	8.23 (3.03)	0.99	3.05 (1.06)	0.92	8.02 (2.73)	0.98	0.77 (0.36)	0.78	2.96 (1.20)	0.46

Table 6. Reaction of the First Difference of the Net Aggregate Stock of the Foreign Exchange Swaps (Short Minus Long Positions in Dollars) of Foreign Financial Institutions to the Interventions of the Central Bank of Brazil

The dependent variable is the first difference of the net stock of foreign exchange swaps (short minus long positions in dollars) of the foreign financial institutions. The independent variables are the interventions of the Central Bank of Brazil, the first difference of the foreign exchange coupon, the first difference of the IBOVESPA and the first difference of the rate of certificate of deposits between financial institutions, CDI. Below the estimated coefficients, in parenthesis are the p-values obtained using the Newey and West standard errors that control for possible heterocedasticity and autocorrelation of the residuals. The data is daily and is divided in 4 periods: two periods are foreign exchange crises, the first semester of 1999 and the second semester of 2002, the period of no crises from July 1999 to April 2002 and the whole sample.

Dependent Variable: First Difference of the Net Stock of Foreign Exchange Swaps (Short minus Long Positions in Dollars) of Foreign Financial Institutions				
	Foreign exchange crises		No Crises	Whole Sample
	1999/1	**2002/2**	**07/1999 a 04/2002**	**1/1999 a 12/2002**
Constant	32.48 (0.47)	-23.12 (0.47)	88.55 (0.56)	92.96 (0.57)
Interventions of the Central Bank in the Derivatives Market	-0.74 (0.53)	-0.032 (0.56)	0.30 (0.03)	-0.027 (0.60)
First Difference of the Certificate of Deposits Between Financial Institutions, CDI	32.22 (0.11)	2.49 (0.78)	-18.10 (0.58)	16.90 (0.20)
First Difference of the IBOVESPA	-0.0001 (0.52)	-0.085 (0.37)	0.032 (0.45)	0.0075 (0.84)
First Difference of the Foreign Exchange Coupon	2.27 (0.59)	1.75 (0.15)	2.30 (0.42)	2.08 (0.11)
R^2	0.23	0.06	0.03	0.01
F Statistic	0.52 (0.71)	0.95 (0.43)	0.83 (0.50)	1.48 (0.21)
Reset Test	2.09 (0.16)	2.69 (0.11)	0.19 (0.66)	0.04 (0.84)
Observations	120	150	700	970

Table 7. Reaction of the First Difference of the Net Aggregate Stock (Short Minus Long Positions in Dollars) of the Foreign Exchange Swaps of Financial Institutions to the Interventions of the Central Bank of Brazil

The dependent variable is the first difference of the net stock of foreign exchange swaps (short minus long positions in dollars) of the big institutions. These are defined as the ones amongst the group of 25 financial institutions with the largest assets in the year 2002. The independent variables are the interventions of the Central Bank of Brazil, the first difference of the foreign exchange coupon, the first difference of the IBOVESPA and the first difference of the rate of certificate of deposits between financial institutions, CDI. Below the estimated coefficients, in parenthesis, are the p-values obtained using the Newey and West standard errors that control for possible heterocedasticity and autocorrelation of the residuals. The data is daily and is divided in 4 periods: two periods are foreign exchange crises, the first semester of 1999 and the second semester of 2002, the period of no crises from July 1999 to April 2002 and the whole sample.

Dependent Variable: First Difference of the Net Stock of Foreign Exchange Swaps (Short minus Long Positions in Dollars) of Big Financial Institutions				
	Foreign exchange crises		No Crises	Whole sample
	1999/1	**2002/2**	**07/1999 a 04/2002**	**1/1999 a 12/2002**
Constant	31.23 (0.66)	-73.21 (0.76)	82.25 (0.62)	89.24 (0.55)
Interventions of the Central Bank in the Derivatives Market	-0.44 (0.82)	-0.055 (0.60)	0.31 (0.09)	-0.028 (0.74)
First Difference of the Certificate of Deposits Between Financial institutions, CDI	4.21 (0.55)	2.68 (0.08)	1.71 (0.61)	2.99 (0.08)
First Difference of the IBOVESPA	49.00 (0.10)	-0.29 (0.97)	-17.00 (0.61)	30.00 (0.15)
First Difference of the Foreign Exchange Coupon	-0.19 (0.57)	-0.081 (0.43)	0.019 (0.70)	-0.0091 (0.84)
R^2	0.20	0.05	0.02	0.05
F Statistic	0.61 (0.65)	1.44 (0.22)	0.76 (0.46)	1.80 (0.12)
Reset Test	1.60 (0.20)	0.02 (0.90	0.011 (0.91)	0.51 (0.47)
Observations	120	150	700	970

Table 8. Reaction of the First Difference of the Net Aggregate Stock of the Foreign Exchange Swaps (Short Minus Long Positions in Dollars) of Financial Institutions with Clients of Tradable Sectors and Clients of the of Non-Tradable Sectors to Interventions of the Central Bank

In Panel A the dependent variable is the first difference of the net stock of foreign exchange swaps (short minus long positions in dollars) of the financial institutions that wrote more contracts with firms of the tradable sector. In Panel B the dependent variable is the first difference of the net stock of foreign exchange swaps (short minus long positions in dollars) of the financial institutions that wrote more contracts with corporations of the non tradable sector. The financial institutions were classified as one of these two types if the number of contracts written with clients of these sectors was greater or equal to 65%. The independent variables are the interventions of the Central Bank of Brazil, the first difference of the foreign exchange coupon, the first difference of the IBOVESPA and the first difference of the rate of certificate of deposits between financial institutions, CDI. Below the estimated coefficients, in parenthesis, are the p-values obtained using the Newey and West standard errors that control for possible heterocedasticity and autocorrelation of the residuals. The data is daily and is divided in 4 periods: two periods are foreign exchange crises, the first semester of 1999 and the second semester of 2002, the period of no crises from July 1999 to April 2002 and the whole sample.

Panel A Clients of Tradable Sectors

Dependent Variable: First Difference of the Net Stock of Foreign Exchange Swaps (Short minus Long Positions in Dollars) of Institutions of the Tradable Sectors				
	Foreign exchange crises		No Crises	Whole sample
	1999/1	**2002/2**	**07/1999 a 04/2002**	**1/1999 a 12/2002**
Constant	-0.12 (0.32)	-0.0014 (0.70)	-11.38 (0.73)	-0.56 (0.83)
Interventions of the Central Bank in the Derivatives Market	0.00018 (0.68)	-0.00074 (0.36)	0.055 (0.02)	0.0 (0.94)
First Difference of the Certificate of Deposits Between Financial Institutions, CDI	-0.024 (0.35)	0.35 (0.0)	-0.15 (0.97)	0.18 (0.35)
First Difference of the IBOVESPA	-0.98 (0.36)	-0.38 (0.43)	-9.52 (0.34)	-0.70 (0.34)
First Difference of the Foreign Exchange Coupon	0.000055 (0.33)	-0.00023 (0.81)	0.0064 (0.46)	0.0048 (0.56)
R2	0.57	0.08	0.05	0.05
F Statistic	0.43 (0.77)	2.34 (0.06)	0.37 (0.82)	0.21 (0.93)
Reset Test	0.05 (0.82)	1.82 (0.17)	0.004 (0.94)	0.004 (0.94)
Observations	120	150	700	970

Panel B - Clients of Non-Tradable Sectors

Dependent Variable: First Difference of the Net Stock of Foreign Exchange Swaps (Short minus Long Positions in Dollars) of Non Tradable Sector				
	Foreign exchange crises		No Crises	Whole sample
	1999/1	**2002/2**	**07/1999 a 04/2002**	**1/1999 a 12/2002**
Constant	18.10 (0.09)	-10.90 (0.25)	46.90 (0.41)	4.44 (0.34)
Interventions of the Central Bank in the Derivatives Market	-0.91 (0.01)	-0.024 (0.43)	0.08 (0.09)	-0.0023 (0.35)
First Difference of the Certificate of Deposits Between Financial Institutions, CDI	-0.41 (0.47)	0.82 (0.13)	0.71 (0.46)	0.61 (0.18)
First Difference of the IBOVESPA	5.35 (0.25)	-1.39 (0.69)	7.44 (0.44)	4.65 (0.22)
First Difference of the Foreign Exchange Coupon	-0.047 (0.50)	-0.018 (0.90)	0.0039 (0.81)	0.000435 (0.97)
R^2	0.31	0.04	0.02	0.02
F Statistic	1.47 (0.22)	1.10 (0.35)	0.49 (0.74)	0.75 (0.55)
Reset Test	0.15 (0.69)	1.53 (0.21)	0.21 (0.64)	2.57 (0.11)
Observations	120	150	700	970

Table 9. Reaction of the First Difference of the Net Aggregate Stock (Short Minus Long Positions in Dollars) of the Foreign Exchange Swaps of Financial Institutions to the Interventions of the Central Bank of Brazil

The dependent variable is the first difference of the net stock of foreign exchange swaps (short minus long positions) of the financial institutions. The independent variables are the interventions of the Central Bank of Brazil, the first difference of the foreign exchange coupon, the first difference of the IBOVESPA and the first difference of the rate of certificate of deposits between financial institutions, CDI. Below the estimated coefficients, in parenthesis are the p-values obtained using the Newey and West standard errors that control for possible heterocedasticity and autocorrelation of the residuals. The data is daily and is divided in 4 periods: two periods are foreign exchange crises, the first semester of 1999 and the second semester of 2002, the period of no crises from July 1999 to April 2002 and the whole sample.

Dependent Variable: First Difference of the Net Stock of Foreign Exchange Swaps (Short minus Long Positions in Dollars) of Institutions that are Dealers in the Spot Foreign Exchange Market				
	Foreign exchange crises		No crises	Whole sample
	1999/1	**2002/2**	**07/1999 a 04/2002**	**1/1999 a 12/2002**
Constant	15.20 (0.43)	-18.04 (0.12)	25.71 (0.67)	20.00 (0.77)
Interventions of the Central Bank in the Derivatives Market	-0.31 (0.54)	-0.0073 (0.75)	0.10 (0.04)	-0.008 (0.74)
First Difference of the Certificate of Deposits Between Financial Institutions, CDI	1.04 (0.55)	0.21 (0.62)	0.96 (0.41)	0.73 (0.18)
First Difference of the IBOVESPA	12.70 (0.14)	-1.68 (0.96)	-9.26 (0.55)	6.67 (0.26)
First Difference of the Foreign Exchange Coupon	-0.081 (0.41)	-0.0039 (0.38)	0.023 (0.18)	0.010 (0.26)
R2	0.24	0.09	0.03	0.05
F Statistic	0.47 (0.75)	0.26 (0.90)	0.91 (0.45)	1.22 (0.29)
Reset Test	2.54 (0.11)	1.53 (0.22)	0.09 (0.75)	0.25 (0.61)
Observations	120	150	700	970