

# ***Capital Flight or Volatile Financial Flows: which one is the best indicator to measure Brazilian External Vulnerability?***

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**Single Paper – AHE Annual Conference 2009**

## **Abstract**

As an attempt to analyze the Brazilian external vulnerability, this paper aims to measure the Brazilian capital flows volatility and to apply different measures of capital flight. The main objective is to compare the volatility and capital flight measures in order to evaluate which indicator best reveals the resources reversal potential for the Brazilian economy and thus which one is more appropriate to capture the external vulnerability present in this country. We have observed that external events, out of domestic authority control, became capital flows much volatile and influenced the Brazilian economic performance because of intensive capital flight. The empirical results highlight that there is a close relationship between the two indicators examined. While the financial flows volatility may capture moments when Brazil is facing a period of inflows of international resources and the transition to sharp reversals and large negative transfers, capital flight may indicate the sensitivity of capital flows toward Brazil due to unstable factors and external shocks. In this sense, the capital flight as that one occurred in 2008 can be caused by high capital flows volatility.

**Key words:** External Vulnerability, financial flows, capital flight, instability.

**JEL Classification:** F32, F36, G11, G15

## **1 – Introduction**

Capital flows volatility and capital flight in an economy are affected by the loss of confidence in the global economy. It is the international liquidity movement that determines the international capital flows movements, particularly in developing countries. More specifically, it is the dynamics of the international financial markets that determines the capital flows to the periphery economies, and the dynamics of this market in the central countries determines the volume of these flows (Prates, 2005).

Thus, in the Brazilian economy case, which shows a balance of payments dominated by highly flexible and speculative financial flows, the capital flight causes a macroeconomic instability that is difficult to revert<sup>3</sup>. The capital flies from Brazil when there is a sudden change in the international investor's expectations, causing a loss of resources in the domestic economy and consequently causing serious implications to the economic performance in the long run.

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<sup>3</sup> Corrêa & Almeida Filho (2003) developed the idea of a “macroeconomic trap” and the reversion costs created by the intensification of the financial openness in Brazil.

Based on the verified possibility of an abrupt reversion of resources and, thus, in an attempt to analyze the external vulnerability in Brazil, this paper aims to measure the capital flows volatility in the Brazilian balance of payments and to apply different measures of capital flight, frequently used by the international literature but not yet fully explored in the national literature. The main objective is to compare the volatility and the capital flight measures in order to evaluate which indicator best reveals the reversal potential for the Brazilian economy. Consequently, the purpose is to verify which indicator (the volatility measure or capital flight measure) is the best to characterize the external vulnerability in this economy, in a moment of rising instability in the international financial system. The underlying argument is that this vulnerability is caused by the financial and rate exchange liberalization process, intensified since the last decade in Brazil.

More specifically, the present paper has two objectives. First, it aims to measure the volatility of each sub-account of the Financial Account, detecting which flows have more influence on the vulnerability of this account, verifying if these flows are strongly dominated by expectation and speculative movements formed on external markets. Second, it aims to apply different measures of capital flight to find out which one is the best for the Brazilian case. Based on these two applications it will be possible to observe the behavior of the financial flows directed to the Brazilian economy, as well as the volume of the capital flight and its impacts on the external vulnerability.

The remainder of this paper is divided in more three parts. The second one is dedicated to the analysis of the volatility in the Financial account of the Brazilian balance of payments, using a Generalized Autoregressive Conditional Heteroskedastic Model (GARCH); the third part is dedicated to the application of different measures of capital flights; and the last one is reserved to a few preliminary conclusions, with a conclusive analysis of the impact of two empirical exercises, not only on the external vulnerability of Brazil, but on this country's economic performance.

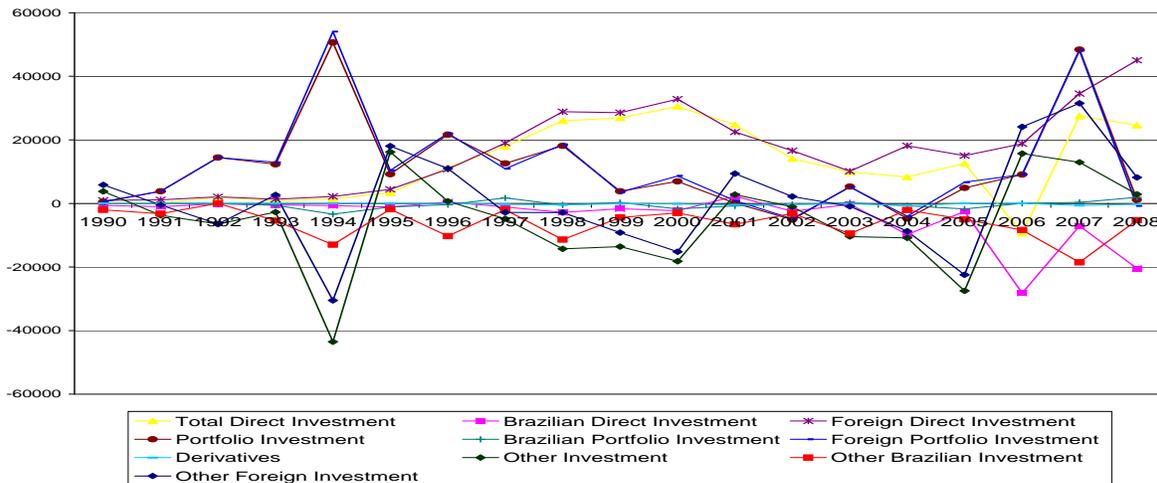
## **2 – Capital Flight volatility: an analysis through GARCH model**

### **2.1 – ARCH/GARCH models and the treatment of the data**

When we observe the Financial Account in the Brazilian balance of payments and its sub-accounts we can see clearly, through a graphic and a data descriptive analysis (Graph 1) that the capital movements are highly volatile, because it shows abrupt movements. Furthermore, it can be observed a strong movement of capital flight in moments of financial crisis, like the most recent one, occurred in 2008. Therefore, in this paper we consider that the capital flows towards the Brazilian economy are highly instable because they are quickly reverted at any change in the expectations. Thus, the objective of this part of the paper is to measure the volatility of each of these flows.

The standard way (and also the simplest one) to measure volatility is through standard-deviation, variation coefficient and variance. Despite its frequent use, the knowledge of the historical value has limitations, because the variance in the  $t$  period can be conditioned to past information. In other words, in periods of great uncertainty the conditional variance can show strong alterations for short periods of time. That is, the limitation of these descriptive indicators is that they cannot evaluate the instantaneous volatility in the series at specific moments of its trajectory.

**Graph 1 – Financial Sub-accounts of the Brazilian balance of payments - 1990 to 2008 (U\$ Millions)**



Source: Central Bank of Brazil

In this way, a more sophisticated approach used to treat auto correlated volatility is the ARCH (autoregressive conditional heteroskedasticity) model. For this paper we chose the GARCH model because it is more precise to estimate the series volatility than the ARCH model.

The ARCH model was introduced by Engle (1982). It consists in a non-linear model, considering its variance equation, since it is a non-linear function based on past information. This is an appropriated model to represent variance changes for time series with periods of great volatility alternated with periods of relative tranquility.

However, the GARCH model – a natural extension from ARCH – is more widely adopted and generates more inclusive correlation standards. This model, proposed by Bollerslev (1986), is an attempt to express, in a more parsimonious way, the path dependency of the conditional variance. In this extension the conditional variance not only depends on the lag of squared return as in the ARCH model but depends also on the past values of the conditional variance itself. Thus, it is through GARCH model that we will base our volatility measure to the international capital flows oriented towards Brazilian economy.

In a general way, the Brazilian Financial Account series show the necessary properties to use GARCH models<sup>4</sup>, which are: non autocorrelation in level (white noise); time variant variance (clustered volatility); and distributions with kurtosis excess (fat tailed).

The data from movements of Brazilian capital flows are part of the National Account System, particularly the Financial Account which was created to capture the flows that most affect the volatility in this account. Such data are presented in time series and involve resources measured in US\$ millions, displayed by Central Bank of Brazil.

The Financial Account registers flows from transactions with financial assets and liabilities between residents and non-residents. Basically, this account is divided in four groups: 1) Direct Investment; 2) Portfolio Investment; 3) Derivatives; e 4) Other Investments. Each of these flows is again divided in further sub-accounts to show specific details. Unfolding the accounts until three hierarchic levels totalize 25 series. The details and openness levels of these accounts are shown in the Annex I.

This paper uses monthly data set and the time cuts were made in two periods: first between January 1995 and December 1998, and then between January 1999 and August 2008. This choice of time periods is explained by the following facts: the first period is characterized by managed exchange rate and in the second one the exchange rate started to float, implicating in a change on volume and composition of the international capital flows towards the Brazilian economy. We must point out that periods of greater volatility coincide with moments of international crisis and internal or external unfavorable environments, such as: Mexican Crisis (1995); Asian Crisis (1997); Russian moratorium (1998); Brazilian Crisis (1999); NASDAQ crash (2000); negative shocks from the Argentinean Crisis and the Brazilian Energy Crisis (2001), confidence crisis in 2002 (elections in Brazil); political crisis in Brazil (2005), and world financial crisis (2008).

From these data we analyzed the statistical behavior of each series in the Financial Account of the Brazilian balance of payments through average, variance, skewness and kurtosis coefficients, and Jarque Bera statistics. It was observed from these descriptive statistics that these series do not show a Normal Distribution. The values of the skewness and kurtosis coefficients are far from those seen in a Normal Distribution (skewness = 0; kurtosis = 3). The non-normality is confirmed by the Jarque Bera statistic that rejects the null hypothesis of normality in every case. Furthermore, it must be pointed out that the averages, medians, and standard deviations in each series show different levels, indicating heterogeneity in these accounts. It corroborates our purpose in verifying the most volatile series.

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<sup>4</sup> For stylized facts of the GARCH model, see Vargas & Martínez (2006).

Another characteristic observed was the residuals behavior of the linear regression in the autoregressive series. We verified that the residuals of the linear regressions show abrupt oscillations and not a constant average what lead us to believe that  $t-1$  period residuals have influence on the residuals values of period  $t$ . Therefore, it is identified the heteroskedasticity problem of the Brazilian financial account, violating the premise that variance is constant over time, which is exactly one of the hypothesis that sustains the parameters robustness of Least Squares estimation method. In this way, we motivated ourselves to use the GARCH model to measure the financial account volatility. The intention is to measure volatility in each sub-account to analyze the instability in the capital flow series and point out the most volatile financial sub-accounts. The underlying hypothesis is that the more volatile financial accounts are the ones with a speculative feature and short term biased.

Following, it focuses on the use of stationary series through a ADF (Augmented Dickey-Fuller) test. When this unit root test is applied on the first period of analysis, almost every series is found stationary in level. That is, using the calculated values the null hypothesis of unit root presence to all series is rejected, showing that the Financial Account series here analyzed are  $I(0)$ . For the second period of analysis, again it was observed that series are stationary in level, with one exception: Brazilian Companies Equities with the third openness level in the sub account Foreign Portfolio Investment series. In this case, since this series is stationary in first difference, it corresponds to a integrated series of first order,  $I(1)$ .

After this descriptive analysis, we move to the methodological procedures to estimate the GARCH model to each series, using the following steps: identification, through an ARMA model estimation, in order to remove serial correlation; application of GARCH model to the square residuals of ARMA model, through the study of partial autocorrelation function; study of identified GARCH model residuals properties; and, finally, prediction of the GARCH conditional variance (volatility) of the adopted series model.

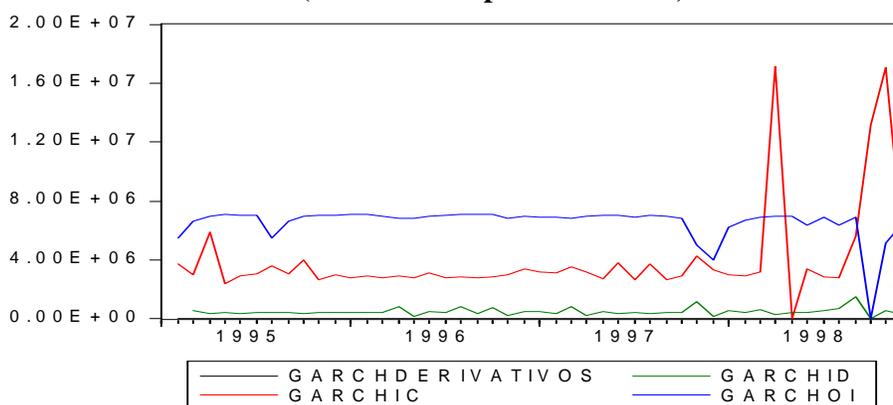
## **2.2 – Analysis of results**

We followed the steps described in the item above to find the volatility values to each Financial Account series. The first step, identification, was the most arduous one. According to Morettin & Tolo (2004), the identification of a GARCH model order to be adjusted to a real series is usually difficult. It is recommended to use a low order model, like (1,1), (1,2) ou (2,1), and then choose a model based on criteria like AIC or SIC information, skewness and kurtosis values or log likelihood.

Once the model has been identified, a GARCH model is constructed to each series, according to the Financial Account openness level (identified on Annex I). It was estimated twenty five conditional variances (volatilities).

It was obtained a result for the ARMA model to each account and another one for the GARCH model, with its respective estimated equations of conditional variance to each of the two periods of analysis. From this GARCH model it was extracted, thus, the conditional variance. This result is the volatility indicator aimed in this research. It must be pointed out that the volatility values found to each series are very high ones (numbers of six and seven digits<sup>5</sup>), since the volatility generated from this model is a crescent quadratic function of the past values of the series, as we pointed out before.

**Graph 2 – Financial Account series volatility - 1995: 01 to 1998:12  
(first level of openness of BoP)**



Source: own elaboration based on Central Bank of Brazil data.

Looking at Graph 2, it is verified that at first level of openness, in the first period of analysis (1995 to 1998), the accounts with greater volatility levels were the Portfolio Investment (PI) and Other Investments (OI) series, as we expected<sup>6</sup>. We observed here a huge difference between these two series of conditional variance (PI and OI) in relation to Direct Investment and Derivatives accounts. Moreover, this last account shows very low levels of volatility.

It is also necessary to highlight the volatility peaks during moments of instability in the international scenario, like in the beginning of 1995 (Mexican Crisis), during 1997 (Asian Crisis) and the high peaks in 1998 (Russian Crisis).

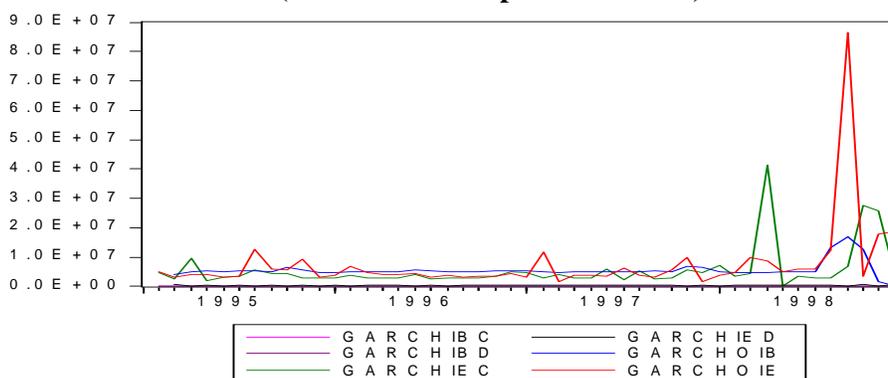
<sup>5</sup> We will verify in the following graphs that volatility values, displayed on the coordinate axis, are shown with exponential references (E + 07 or E + 06, representing 07 or 06 digits, respectively).

<sup>6</sup> The Portfolio Investment group registers assets and liabilities flows, constituted by equity securities emissions, commonly negotiated in secondary market papers. Other Investment group registers loans and financing (to monetary authorities and other sectors); commercial credits and other liabilities; and “money and deposits” flow. Thus, these accounts are highly speculative biased.

Furthermore, it is observed that Portfolio investments and Other Investments series showed opposite movements. While the first raised volatility the second reduced its volatility in moments of contagion effects related to crisis. It is explained by the occurrence of huge capital inflows and outflows through Portfolio Investment account, while Other Investments account was more characterized by capital flight movements.

At second level of openness, within these two former most volatile accounts, Foreign Portfolio Investments (FPI) and Other Foreign Investments (OFI) are the most noticeable ones. In Graph 3 it can be clear that these accounts (FPI and OFI) are raising the volatility levels of Portfolio Investments (PI) and Other Investments (OI) series. Again, are seen highlighted peaks in 1997 and 1998, moments in which Brazil started to feel the impacts of international financial crisis.

**Graph 3 – Financial Account series volatility - 1995: 01 to 1998:12  
(Second level of openness of BoP)**



Source: own elaboration based on Central Bank of Brazil data.

Therefore, the excessive resources inflow brought great risks to Brazilian economy. Not surprisingly, in 1997 (Asian Crisis) Brazil suffered a resources reversal and, consequently, moments of instability in the financial flows. However, in 1998 already Brazil faced again a great foreign capital inflow. In the next moment, it suffered the impacts of events in Russia, when in August and September of that year a huge capital flight was observed. Actually, great volatility episodes occurred during most part of the first period (1995 to 1998). According to Palma (2006, p. 729):

“(..) 1998 posted both the all-time record for net inflows (first quarter), and for net outflows (third quarter)! This exemplifies the difficulties confronted by economic authorities in the implementation of their macro-policies when they voluntarily operate with a liberalized capital account in a world of highly volatile flows, a high degree of ‘contagion’, and asymmetric information.”

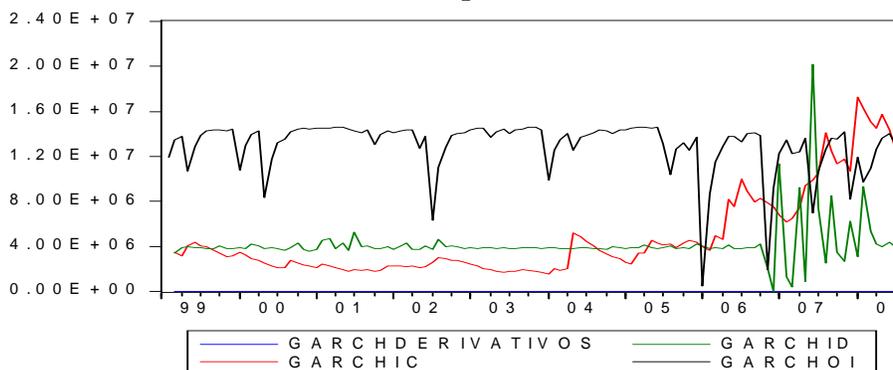
In this sense, what can be concluded from these results is that, although the average volume of capital flight does not seem to be so huge when compared to other developing economies, the peak of capital flight was reached during a period in which the Brazilian economy was already

integrated to the world economy. It was a result of institutional changes, more specifically of the capital account liberalization process<sup>7</sup>.

Beyond the volatility analysis, we are also concerned with the sub-account weight in the total Financial Account. This is important, because it is not enough that the sub-account is too volatile. To make sure that it means a good indicator to the potential macroeconomic instability it is necessary to know if this account has significant relative participation in the Brazilian balance of payments. Thus, we analyzed, from the values found in Annex II tables, the relative participation<sup>8</sup> of each sub-account in the Financial Account of directly superior hierarchic level. For example, we are concerned to know which sub-account has more weight within the Portfolio Investments account: foreign or Brazilian Portfolio Investments.

From the Table II.1 we can see that the accounts with more average weight in the total Financial Account for the first period of analysis were exactly Portfolio Investments and Other Investments series. That is why we will focus our analysis in the sub-accounts of these two accounts, since these are the ones that most contributed to the Portfolio Investments and Other Investments levels. That is, the focus underlying in this paper are on the flows with greater relative participation and with greater volatility values, which are: Foreign Portfolio Investments and Other Foreign Investments sub-accounts.

**Graph 4 – Financial Account series volatility - 1999: Q1 to 2008: Q2 (first level of openness of BoP)**



Source: own elaboration based on Central Bank of Brazil data.

Moving onto the analysis of the second period, we verified that the high volatility persists (Graph 4). The dynamics of flows is still strongly influenced by speculative movements, following the international liquidity logic. Although the volatility levels are smaller when compared to the first period, important movements of volatility still occur. Now the volatility impacts from the

<sup>7</sup> This argument follows the conclusion of the work of Eryar (2005), that applies the residual method to measure capital flight in Brazil.

<sup>8</sup> To calculate the average relative participation (to each period of analysis) it was used the module of each Financial Sub-Account value, since the weight of each of these in the Financial Account would not be possible if the account contributed negatively in the Total Financial Account.

capital flow are more strongly adjusted through exchange rates and the interest rates movements becomes smaller, as well as its levels. Furthermore, the Trade Balance starts to improve, progressively generating positive results in Current Account.

On the Financial Account side, following the trend of the dynamics of flows towards peripheral countries, a fall on the participation of Portfolio Investments can be seen; a small supply of bank loans and a greater participation of Direct Investment, surpassing the relative participation of Portfolio Investments. In the same way, the Portfolio Investments volatility is smaller in this second phase and the Direct Investment flow volatility exceeds the volatility of the first ones. Next, we will treat this volatility rise. First we will characterize the Portfolio flow movements.

After a period of high instability related to the interregnum 1999-2002, it is noticed that from the end of 2003 occurs a return of Portfolio Investments flow and even of bank loans<sup>9</sup>. The period between 2003 and 2005 is related to a international liquidity expansion scenario, noticing that between these years the results of Trade Balance and Current Account becomes very favorable, occurring a substantive improvement on the external accounts.

From that moment the market has started to consider that Brazil was less vulnerable, since the country improved its capacity to pay external creditors and investors. This scenario indicates a fall of the external vulnerability according to the traditional external debts indicators (Tabela 1). The total external debt has fallen from 41,8% of the GDP in 2002 to 14,9% in 2007 and the reserves correspond to 3,5 times the debt service, among other external debt indicators performances. Thus, it was formed, under the market logic, the idea that Brazil is less vulnerable to international crisis, after a series of crisis in the 1990's. What we want to point out is that, although the external debt indicators and the results of Current Account have improved, this is a false thesis. The underlying argument here is that vulnerability simply was not manifested during this period, but it never ceased to exist.

**Table 1 – External debt indicators (2000 to 2007)**

<b>Indicator/Year</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>
Debt service/Exports (%)	88,6	84,9	82,7	72,5	53,7	55,8	41,4	32,3
Debt service/GDP (%)	7,6	8,9	9,9	9,6	7,8	7,5	5,3	4
Interest rates/Exports (%) - annual	29	28	23,6	19,4	14,8	12,2	10,8	9,5
Total external debt/GDP (%)	33,6	37,9	41,8	38,8	30,3	19,2	16,2	14,9
Total public sector external debt/total external debt (%)	48,5	51,5	59,4	63,1	65,7	59,2	51,7	44,4
Net total external debt/GDP (%)	26,5	29,4	32,7	27,3	20,4	11,5	7	-0,8
Reserves (liquidity)/Total debt (%)	15,2	17,1	18	22,9	26,3	31,7	49,8	93,2
Total external debt/Exports - Ratio	3,9	3,6	3,5	2,9	2,1	1,4	1,3	1,2
Net total external debt/Exports - Ratio	3,1	2,8	2,7	2,1	1,4	0,9	0,5	-0,1
Reserves (liquidity)/Debt service - Ratio	0,7	0,7	0,8	0,9	1	0,8	1,5	3,5

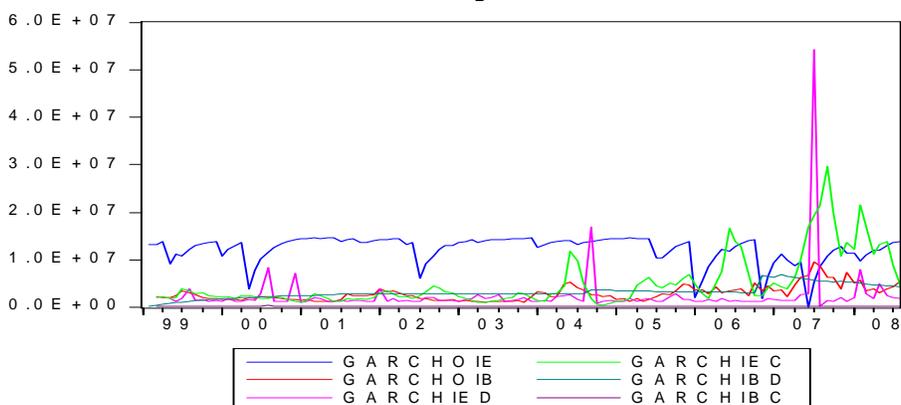
*Source:* Central Bank of Brazil

<sup>9</sup> It is necessary to say that the net results of the Portfolio Investments Account are of very low magnitude and, sometimes negative, considering payment of debts or even paper re-buy involving pre-payment of debts.

In this sense, the external vulnerability we want to point out does not follow the traditional interpretation related to the domestic capacity to financing the external accounts. We are referring here to Brazil's capacity to protect from external shocks what involves instruments of economic policies used by domestic authority as a response to the shocks and the costs of confronting these shocks.

We argue, therefore, that external account vulnerability persists (or even intensifies<sup>10</sup>) in the second period. What we want to point out is that the high weight of flexible capital flow on Brazilian balance of payments still remains, and these flows are conditioned by liquidity movements determined in the international capital markets. Since they are highly speculative at any expectation changes, the flows keep showing movement of reversal and, consequently, showing strong volatility also on the second period. We can see on Graph 5 that Foreign Portfolio Investment instability rose strongly in this second phase.

**Graph 5 - Financial Account series volatility - 1999: Q1 to 2008: Q2  
(second level of openness of BoP)**



Source: own elaboration based on Central Bank of Brazil data.

Related to these movements, we point out that domestic interest rates are still influenced by capital flows dynamics, even after the adoption of floating exchange rate in January 1999. Furthermore, the quick wave of capital inflows tends to overestimate exchange rates. It is a stimulus to turn debts denominated in domestic currency into foreign currency ones. The domestic obligations require a lower interest rate, but the foreign currency obligations require a higher exchange rate. Consequently, an “interest rate trap” is created. That is, the volatility of these financial flows generates macroeconomic effects even in non critical moments being, thus, unreachable for the internal control.

<sup>10</sup>This is proven by the impact of the most recent financial crisis, which directly affected capital flow towards Brazil, causing a huge capital flight in 2008 last trimester.

Specifically, the high volatility of Direct Investments during second period (July 2007), seen on Graph 4, is due to the fact that Foreign direct Investment inflow has reached a historical record in 2007, particularly in June (Graph 5, in pink). According to UNCTAD's paper (2008), Foreign Direct Investment flow has been growing regularly in the last 30 years, with a few declines in the beginning of the 1980's, 1990's, and 2000's. This growth, occurred in all regions, is particularly due to the raise of corporation profits all over the world, and is also a result from the higher stock prices that raised the value of fusions and acquisitions beyond the domestic frontiers.

By its turn, the Other Brazilian Investments account high volatility in June 2007 was impelled by a huge outflow, and then by a huge inflow, of "money and deposits" flow. This sub-account aggregates movements of deposits of Brazilian banks and shows movements similar to those observed in foreign investor applications in Equities Securities<sup>11</sup>. These were the flows that had most influence on the Financial Account volatility in this period, as will be seen when the financial sub-account are further disaggregated.

It must be pointed out that, from 2003 onward, international financial markets are on a phase of higher liquidity, when compared to 1999-2002 period. This relative tranquility on financial markets can be explained by the rise and stability of Prime interest rate (USA) in 2004.

Even more important are the recent episodes of crisis, like the Subprime market crisis in USA in 2007, showing that volatility of capital flow towards Brazilian economy becomes even higher. In the beginning of 2008 we can see that a capital flight had already occurred in Brazil (mainly via Portfolio Investments and Other Investments), as a consequence to this crisis. By the end of that year, capital flight through Foreign Portfolio Investments and Other Foreign Investments was even more intense, showing that external vulnerability was already in place. Therefore, the most volatile accounts (that generate strong capital flight) are exactly the ones that show a higher speculative bias.

Moving the accounts to the third openness level we can verify that sub-accounts volatility are very strong in this hierarchic level, causing a constant instability on the flows. Looking at Graphs 6 and 7 we can see that important volatility movements occurs even when there are no restraints to international liquidity, or even when it becomes more abundant in moments of relative tranquility.

The most volatile sub-accounts in the first period were those related to "money and deposits", from Other Brazilian Investments account and those referring to Loans and Financing, from Other Foreign Investments account (Graph 6). Once again, the most volatile sub-accounts are the ones that have more significant part on the higher hierarchic level accounts, as we can see on

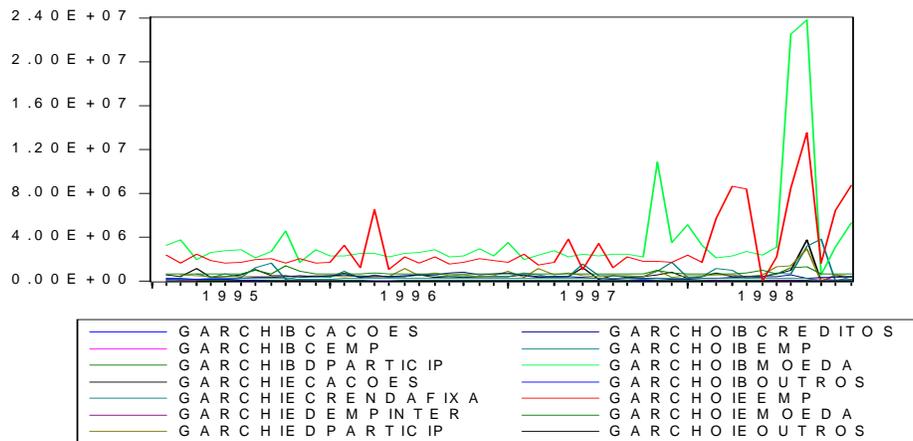
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<sup>11</sup> Other investments related to foreigners refers to inflows and outflows related to CC5 account, that counts foreign resources inflow to apply indirectly in Brazilian Debt Securities, since direct application in Equities Securities had strong restrictions to foreign investors (Sicsú, 2006).

Table II.3 in Annex II. The “money and deposits” account represents more than 61% and 73% of Other Brazilian Investments account in the first and second period, respectively, and this sub-account has a greater relative participation on the Other Investments account, evidencing how important this Other Brazilian Investments greater part is on the total Financial Account. “Money and deposits” flow refers movements of Brazilian citizen’s deposits kept abroad, thus, being highly flexible and speculative flows, which depends on the market “appetite”.

In regard to Loans and Financing sub-account, it can be seen on Graph 6 that there are important movements of volatility during stability periods, such as in the beginning of 1995 (Mexican Crisis), during 1997 (Asian Crisis), and in 1998 (Russian Crisis). These movements are due to negative net flows (capital flight) of bank loans, resulting from a smaller supply and from voluntary reduction of debts during moments of uncertainty.

**Graph 6 - Financial Account series volatility - 1990: Q1 to 1998: Q4  
(third level of openness of BoP)**



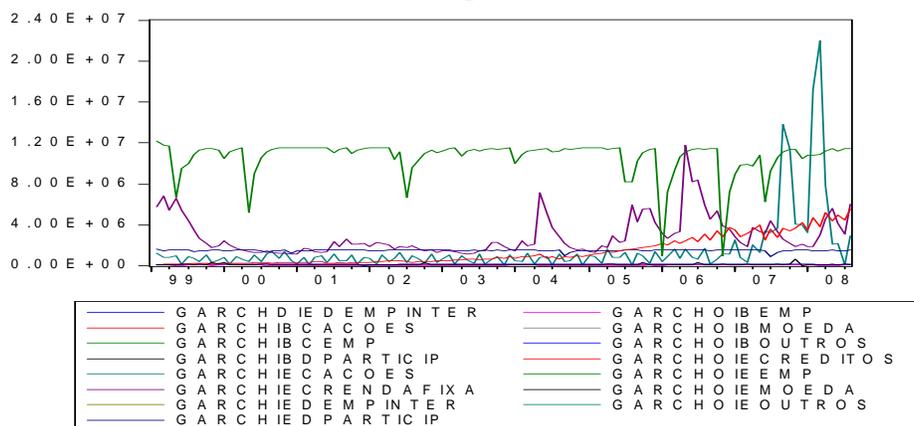
Source: own elaboration based on Central Bank of Brazil data

Obviously, there are reversals in these flows during periods of crisis and, therefore, this sub-account volatility is higher than other application types within Foreign Portfolio Investments series, which did not have any of its sub-accounts distinguished.

In the second period, Debt Securities flow high volatilities also distinguish themselves on the Foreign Portfolio Investments account. The explanation to this volatility movement can be related to the risk involving Debt Securities acquisitions. In moments of crisis international investors overestimate these risks and, thus, reversal of these flows occurs in these periods. Consequently, this sub-account volatility is higher than other flows within Foreign Portfolio Investments.

By the end of second period, Other Liabilities flow was distinguished within Other Foreign Investments sub-account, which can be explained by international market instability due to Subprime market crisis in USA.

**Graph 7 - Financial Account series volatility - 1999: Q1 to 2008: Q2  
(third level of openness of BoP)**



Source: own elaboration based on Central Bank of Brazil data.

Finally, we point out the Brazilian Company Equities sub-account high volatility by the end of second period, as we can see by the blue curve on Graph 7. It is due to a huge volume of foreign investments on Brazilian Equities in the beginning of 2008. This sub-account registers non-residents acquisitions of equities. In Brazil was observed a huge volume of foreign investments in Brazilian Equities in the beginning of that year, Petrobrás and Vale do Rio Doce's Equities being the most distinguished ones.

Thus, it can be observed that the most volatile sub-accounts, even when accounts are opened to the third level, are exactly the ones with greater speculative character and short term bias. Consequently, since they are guided by speculative elements and dependents on the international investor's mood, financial resources flow towards Brazilian economy are susceptible to reversal in moments of crisis and of international liquidity restraint, thus, being unreachable to Brazil's internal control.

### 3 – Capital flight

The demystification of the idea that capital account liberalization is necessarily beneficial to economic growth and to income distribution can be done through a capital flight analysis in developing economies. Here we will analyze this phenomenon on the Brazilian economy case. The purpose is to aggregate empirical arguments to the capital flight volatility analysis: which financial

flow movements play an important part as a potential of macroeconomic instability indicator and, keeping the focus of this paper, of Brazilian external vulnerability.

A capital flight generates impact on exchange rate volatility, economic growth, and income inequality. Thus, we want to prove that this phenomenon, resulting from the financial liberalization process, is not beneficial to Brazil's economy. The main objective here is to compare the conclusions of the study made above (about volatility) to the conclusions that can be taken from estimations of Brazil's capital flight.

To accomplish this we will apply different measures of capital flight commonly used by the international literature, but little explored on Brazilian literature. From the application of these measures we want to conclude which can be used as a proxy to Brazil's capital flight.

Capital flight is not a directly observable phenomenon, although it is largely frequent in developing economies. Consequently, estimations of capital flight have huge variations. First, before moving to the exposition of our application and analysis, it must be said that we are defining capital flight<sup>12</sup> as an unregistered net outflow of capital, moving out from developing economies with capital scarcity, like Brazil's economy. Thus, capital flight refers to outflow of abnormal or illegal capital. It must be pointed out that this capital outflow usually occurs due to speculation movements. In this sense, capital flight is related to uncertainty and to the risk of keeping certain domestic assets, that is, capital "flies" trying to avoid huge wealth losses.

Not less important, it must be said that capital flight estimations differs from each country. Also there can be deviations depending on the data base, since each institution adopts different measures to the same indicator. Therefore, it is necessary to take sufficient care when we are comparing results from different estimations. Anyway, we tried to adopt the same variables used in works about capital flight estimations that were quoted here.

### **3.1 – Residual method**

We will start with the residual method, for this is the most widely used by literature related to this subject. The data periodicity to all capital flight methods is trimestral, due to the IMF data base availability, which will be used to calculate these estimations. The time cut will start on 1990's first trimester to 2007's third trimester (most recent data available).

The residual method measures capital flight indirectly, through the residuals between officially registered resources and the funds use, that is, these are outflows of non-registered capital, or "abnormal" ones. Thus, this measure compares the source of capital inflow (net growth of external debt and net inflow of foreign investment) to the use of these inflows (Current account

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<sup>12</sup> It is necessary to say that there is no consensus on the definition of capital flight among the scholars. Here we will use one of the most common definitions.

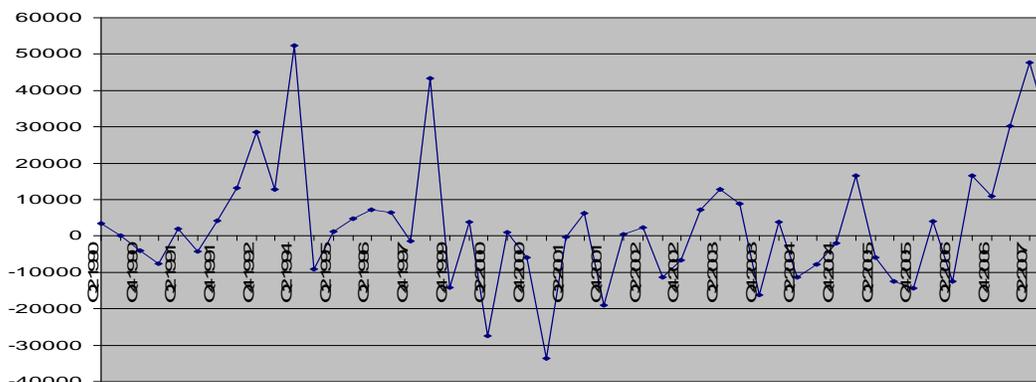
deficit and international reserves variation). Capital flight can, therefore, be calculated by residual method by:  $KFWB = CDET + NFI - CAD - CRES$ .

Each component of this equation is explained in the following. First, CDET refers to external debt variation, so that  $CDET = \text{external debt}_{\text{period } t} - \text{external debt}_{\text{período } t - 1}$ . In this calculation was used net external debt (both public and private) registered on Central Bank of Brazil. It is different, therefore, from gross external debt that includes nonregistered public and private debt. This choice follows some works on capital flights (Claessens e Naudé, 1993; Chang, Claessens e Cumby, 1997; Hermes, Lensink e Murinde, 2002; Kaufmann, 2004; Beja, Jr, 2005) pointing out that non-registered private debt refers to contingents liabilities and, thus, would be a good measure to use in residual method. For that we use the sum of “external debt by sector – private” (series number 3568 from Central Bank of Brazil) and “external debt by sector – public” series (series number 3570 from Central Bank of Brazil).

Second, NFI refers to net Foreign Investments, where:  $NFI = \text{Foreign Direct Investment} + \text{Portfolio Investment} + \text{Other Investments}$ . In this case were used International Monetary Fund (IMF) series, since this institution releases the net results of Foreign Direct Investment, Portfolio Investment, and the result of the account “Other Investment assets”, needed for this calculation.

Third, CAD refers to current account deficit, to which is used:  $CAS = \text{negative of net current account}$ . Finally, CRES refers to international reserves variation<sup>13</sup>. To this variable was used the IMF series “RESERVE ASSETS”, which is constituted by Monetary Gold, Special Drawing Rights, Reserve Position in the Fund and Other Claims.

**Graph 8 – Capital flight using residual method (US\$ millions)**



Source: own elaboration base don IMF data.

A lot of works on capital flight adopts, therefore, these variables. However, there are little variations between them, like, for example, Claessens & Naudé (1993) that, contrasting with many

<sup>13</sup> The accumulation of international reserves follows the reverse notation. A negative variation means a accumulation of international reserves or a capital inflow, and a positive variation means a reduction in international reserves or capital outflow.

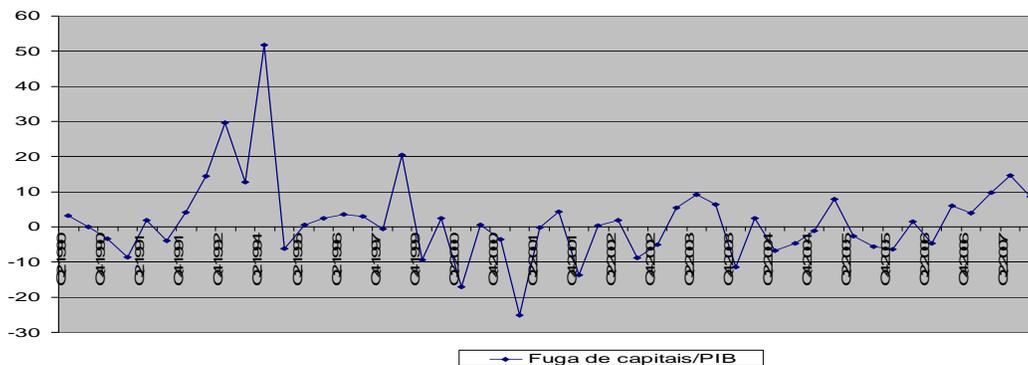
other works, consider net acquisitions of Equities Securities in their Foreign Direct Investment measure. Here we chose the variables described above. A positive value for this measure means an outflow of non-registered capital (capital flight) and a negative value means an inflow of non-registered capital (reverse capital flight). From the application of this measure is extracted, thus, the result displayed on Graph 8.

It can be observed that capital flight peaks coincide with moments of international financial crisis or with some exogenous event, out of domestic control. These peaks were observed on 1994's 2<sup>nd</sup> trimester, 1998's 4<sup>th</sup> trimester, and 2007's 2<sup>nd</sup> trimester.

The first peak is related to a huge record on Foreign Portfolio Investment, which had no counterpart from Current Account and international reserves variation. This occurrence is due to payments and amortizations from several sources in 1994, specially the refinanced amortization of direct loans. This amortization is a result of the external debt renegotiation process, during Brady Plan, and was registered in "long term bonus" sub-account, which belongs to Foreign Portfolio Investment.

Thus, external debt renegotiation worked as capital flight, according to the residual method application, in 1994's 2<sup>nd</sup> trimester. Furthermore, it must be pointed out that a huge variation of papers registered in the Foreign Portfolio Investments account, related to Brazilian debts renegotiation, did not result on a negative variation of Brazilian external debt<sup>14</sup>, what could reduce the capital flight.

**Graph 9 – Capital flight as % of GDP<sup>15</sup>**



Source: own elaboration base don IMF data.

<sup>14</sup> Terra (1999) shows that possibility of external debt re-buy, in this case, has worsened pendent debt instead of relieving it.

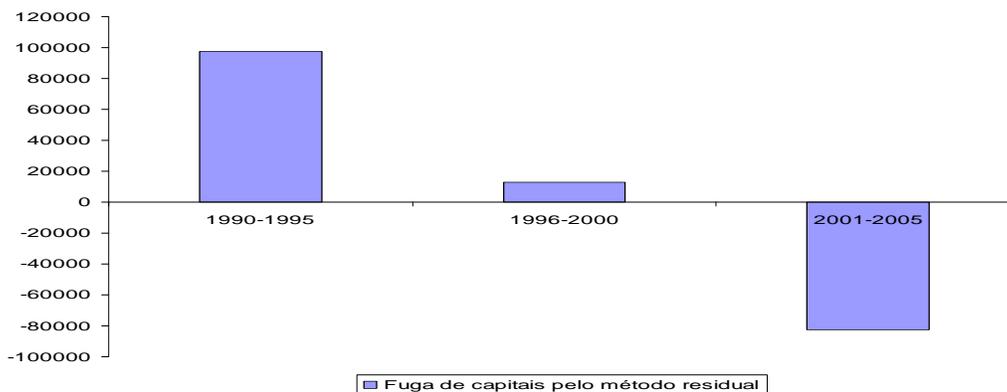
<sup>15</sup> To this calculation as used the following GDP series: 4385 – monthly GDP - in US\$ millions - US\$ millions, from Central Bank of Brazil.

The second capital flight peak refers to impacts of Russian crisis in 1998, which affected more strongly the Brazilian economy when compared to those of the Asian crisis the year before. The third peak, occurred in 2007, was caused by a huge international reserves variation in Brazil, due to very high liquidity in international market, thus, being atypical when compared to the two other peaks. The strong capital flight is related to a huge capital inflow followed by a strong retraction as also as the non-registering of these capital in the Current Account balance and in the international reserves balance of Central Bank of Brazil's account record.

To complement our analysis, we also observed the capital flight weight on economic activity. Looking at Graph 9, we can see that during moments of crisis capital flight reaches a very significant percentage of GDP, as occurred in 1994 and 1998. Capital flight was extremely important, when it exceeded 50% of Brazil's economic activity, due to a huge foreign capital inflow, not reflected in the international reserves variation. Therefore, although between 1990 and 1994 Brazil had attracted foreign capital through privatization and financial deregulation, this capital inflow (seen as a reverse capital flight) was followed by a huge contraction in 1994's 2<sup>nd</sup> trimester.

It is also important to point out that the year of 1997, branded by the Asian crisis, did not stand out here due to the unavailability of external debt data for that year. That is why the capital flight calculation by residual method was not possible for some trimesters.

**Graph 10 – Capital flight using residual method – accumulated by period (US\$ millions)**



Source: own elaboration base don IMF data.

To support our empirical argument that capital flight is a good indicator to external vulnerability analysis in Brazil, we also observed the accumulated amount of capital flight in three different periods. We can see in Graph 10 that capital flight is very high during periods of crisis<sup>16</sup>.

<sup>16</sup> We suspect that capital flight accumulated between 1996-2000 has a smaller volume than the one accumulated between 1990-1995 due to omissions of a few trimesters in important years of financial crisis, like 1997, by lack of available data, as we pointed out.

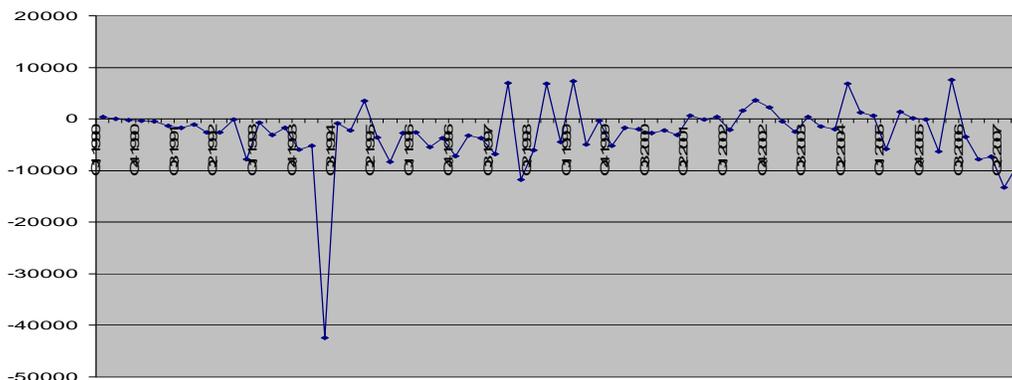
Meanwhile, during periods of favorable international liquidity a reverse capital flight is observed. It occurred between 2001 and 2005 because we can see a huge accumulation of international reserves due to the liquidity international cycle in this period as also as a strong financial inflow through registered Foreign Investment.

### 3.2 – Hot Money method<sup>17</sup>

Capital flight measure by Hot Money method was originally developed by Cuddington (1986). This method measures capital flight through short term capital outflow. In this case, capital flight would be found by the sum (of the negative) of short term private capital flows (SK) and (of the negative) of errors and omissions (EO), obtained from balance of payments (BoP). Thus, this method also distinguishes between normal and abnormal capital outflow, and the last ones are shown by net errors and omissions. However, by emphasizing only short term flows, hot money method takes an additional assumption about the normal character of medium and long term flows.

The measure to show the short term flows are diverse but it is usually given by the sum of other assets (SK<sub>1</sub>) and Portfolio Investments (PORT), including other bonds and corporate equities. Thus, we have:  $KF_H = -SK - EO$ , being  $SK = SK_1 + PORT$ . Where SK<sub>1</sub> = other assets from other investments; PORT = net Portfolio Investments; EO = net errors and omissions. In this case, capital flight is displayed with a negative value, and a positive one means a reverse capital flight.

**Graph 11 – Capital flight using Hot Money method (US\$ millions)**



Source: own elaboration base don IMF data.

<sup>17</sup> We omitted here the Dooley method analysis of capital flight, which is based upon total amount of outflows minus total registered foreign assets, that is, it measures capital flight through non-registered capital flow. This measure cannot be applied to Brazil's economy, for we could not obtain the necessary data to the necessary adjustments to capital outflows (through non-registered declarations), as Dooley's definition, for two reasons. First, in this case, following the literature on capital flight it would be necessary to use external debt as it is released by World Bank, which is not available in trimesters, nor is the period analyzed here. Second, the values of Brazil's Balance of Payments are also unavailable.

Again, it can be seen on Graph 11 that the greatest capital flights coincide with periods of international instability and financial crisis, as in 1994 and 1998. The moment of strongest capital flight, again in 1994, was due to the strong register on Portfolio Investments, related to Brazilian debt renegotiation during Brady Plan, as was shown on the residual method application (item 3.1). That is, capital flight movements are easily observed when there are unstabilizing factors or external shocks.

Compared to residual method, in Hot Money method capital flight is more moderate, that is, has lower volumes in almost all the period of analysis. Furthermore, this method restricts capital flight to short term flows only. This prejudicial to our analysis, since some long term flows also have a high reversal potential, because they are sold in asset secondary markets. Thus, we consider that capital flight in Brazil is better contemplated through residual method.

### 3.3 – Misinvoicing trade method

The misinvoicing trade method indicates that export under-invoicing and import over-invoicing can hide capital flight. Variations on the statistics of the country and its trade partners can help to identify it. Thus, importers are involved in capital flight through the register of a higher value of imported goods, and exporters through the register of a lower value of exported goods. Therefore, this measure is based upon the assumption that domestic traders forge trade documents when there is a motivation to keep foreign capital.

To deal with imports registered by Brazil and imports registered by the world (Brazil's exports), both are adjusted from a CIF (costs, insurance, freight) basis to a FOB (free-on-board) basis. This implies that imports, usually expressed in CIF basis, are adjusted lowly by the CIF/FOB ratio, specific to the country, so that exports and imports can be compared on a consistent FOB basis. Thus, we have:

$$\text{Export misinvoicing} = (X_w / \text{CIFFOB factor}) - X_c$$

$$\text{Import misinvoicing} = (M_c / \text{CIFFOB factor}) - M_w$$

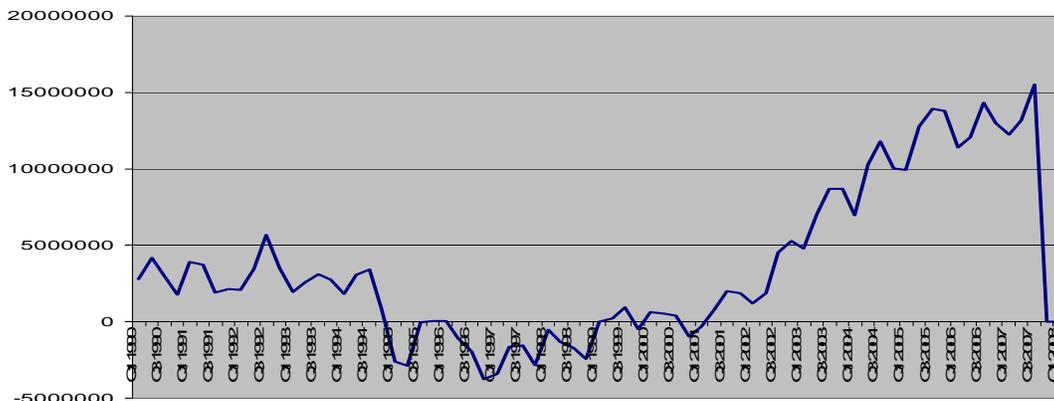
Where:  $X_w$  = Brazil's imports registered by the world on CIF basis;  $X_c$  = Exports registered by Brazil on FOB basis;  $M_c$  = Imports registered by Brazil on CIF basis;  $M_w$  = Exports to Brazil registered by the world on FOB basis; CIFFOB factor = CIF / FOB.

Given that both under-invoicing exports and over-invoicing imports increase capital flight, the two measures above must be add to the calculation of the net effect of non-invoiced trade on capital flight. In this case, a positive value means capital flight (over-invoicing imports or under-

invoicing exports) and a negative value means reverse capital flight (under-invoicing imports and over-invoicing exports).

We can see on Graph 12 that capital flight through misinvoicing trade has shown higher levels from 2001 on. It could be the reflex of Brazil's performance on Balance of Payments. During the financial crisis period in the 1990's, the Brazilian Balance of Payments displayed high deficits, recovering in 2001, when passed from a US\$ 2262 millions deficit to a US\$ 3307 millions surplus.

**Graph 12 – Capital flight using Misinvoicing trade method (US\$ millions)**



Source: own elaboration base don IMF data.

Thus, the application of this measure has generated different results from the former measures, so that it does not contemplate financial flows volatile movements and, consequently, capital flight in this case is not a good indicator of financial instability. International literature on application of capital flight measures points out that capital flight through misinvoicing trade do not consists only on capital flights. For example, Schneider (2003) points out that systematic capital outflow under this item are due to tax and quota evasions by importers. Thus, the underlying factors to this discrepancy can be complex and could constitute illegal practice, like underground trade, factors that are beyond our analysis of the capital flight.

A few works adopt this measure (capital flight through non-invoiced trade) only as correction factor, to adjust capital flight calculated from some others methods described. Here, we judge that capital flight measure by residual method already contemplates the external vulnerability of Brazil's economy that we intended to show. So, we neglect capital flight trough international trade. It means that capital flight by residual method efficiently contemplated the potential of reversal of international resources in moments of unstabilizing factors, which affects international liquidity.

#### **4 – Preliminary conclusions**

This article's objective was to analyze financial flow volatility of Balance of Payments and capital flight in Brazil, as measures of potential financial instability and, consequently, external vulnerability in this economy. We observed, through two empirical exercises, that exogenous event, out of domestic authority's control, have made capital flow highly volatile, affecting Brazil's economic performance.

This can be clearly seen from the impact of the present international financial crisis over domestic economy. Once the crisis was triggered, capital flows in Brazil were reverted from inflows to outflows, generating impacts on the Income and Employment levels, already in the beginning of 2008. The total flow of foreign capital was negative that year, which did not occur since 2002. In other words, while international liquidity cycle remained favorable, between 2002 and 2007, capital flows were strongly directed towards Brazil. In face of crisis, not even the Trade Balance was able to compensate the speculative capital flight.

This capital flow volatile movement has extreme relevance to the comprehension of the dynamics of Brazil's economy, since it affects domestic variables, such as Interest and Exchange rates. The Exchange rate becomes overestimated when facing the huge inflow of international resources and suffers from overshooting in moments of capital flight. The Interest rate remains in a high level, which is functional to control inflationary impacts from exchange variations and keep on attracting foreign capital. However, not even the higher Interest rates are able to hold back the Dollar flight in an environment of rising financial instability.

Furthermore, capital flow volatility also affects public debt due to exchange volatility (caused by Monetary Authority intervention); or due to the high level of Interest rates (which affect debt rolling over); or due to the consequences of changes in debt profile after capital flight shocks that caused growth of debt securities, sometimes indexed to exchange rates and sometimes to interest rates.

Thus, in a context of uncertainty and of institutions absence to coordinate liquidity supply at the worldwide level, the horizons to international capital flows become shorter. Consequently, its profiles become even more speculative. In this way, the capital flow volatility works as an indicator to Brazil's external vulnerability.

The capital flows that showed higher volatility, through GARCH model, were exactly the ones of greater reversal potential when facing changes in market expectations, which is: Foreign Portfolio Investments and Other Foreign Investments flows. Therefore, the volatility of these flows is directly related to the country's external vulnerability, since it shows the instability of international resources and its flexible movements. Brazil, because it depends on these financial

flows, and due to the frequent increase in its external liabilities, finds itself away from international events, even when a favorable situation reflects positively on the Current Account (what was observed from 2003 onward).

The changes in structures of international capital flow and of domestic economy were important to analyze capital flight in Brazil. The loss of confidence in global economy generates capital flight, as we can see by the applied measures. Capital flight can indicate the potential of resources reversal and, in this sense, can be considered another good indicator to Brazil's external vulnerability. However, we must ask if capital flights are resulting from macroeconomic instability, consequence of the financial liberalization process. Thus, it also would be important to analyze the causality relation between macroeconomic instability and capital flight in Brazil. Anyway, we can conclude preliminarily that structural changes in Brazil's economy, resulting from capital account liberalization, were suffered by strong capital flights.

It also can be concluded that, among the different methods to measure capital flight, the most robust was the residual method. Through this method it was possible to overcome the distinction between normal and "abnormal" capital flight, since its focus on the amount of non-registered capital outflow resulting from structural macroeconomic problems in Brazil, instead of dealing with specific motives of certain individuals (investors) or of certain countries to capital flight, as other capital flight methods do. Furthermore, through this method it is also possible to avoid the limitation to the analysis of short term capital outflow, to which the Hot Money method is subject. This is important because the long term capital outflow contributes even more to the depreciation of the necessary resources to domestic economy's growth. Thus, capital flight through residual method works as a proxy to this phenomenon in Brazil.

When analyzing the relation between these two indicators (of volatility and of capital flight), we can say that, while financial flow volatility can indicate moments in which Brazil turns from receptor to emitter of international resources, capital flight can indicate the sensibility of capital flow towards Brazil when facing unstabilizing factors and external shocks. The first indicator shows the flow's behavior (if they are inflows or outflows) and the second indicator captures the degree of outflows. They are, thus, inter-related indicators.

In this sense, a strong capital flight (as the one that occurred last year) can be the effect of Balance of Payments characterized by a great part of volatile capital flow. Therefore, we managed to show that capital flow volatility generates highly negative impacts on external vulnerability, since it turns the country dependant on the international liquidity cycles, while capital flight raises the country's external vulnerability by generating impact on international trade and Current Account balance, as well as on external debt. Thus, financial flow volatility and capital flight can be considered complementary indicators to the external vulnerability analysis.

Finally, it should be said that if financial flows volatility and capital flight are considered fundamental problems, specially in moments of generation of foreign reserves (in order to correct external liabilities in this economy), then, some policy to revert capital flight must be considered, as well as coordination with other policies that change the direction of accumulation to the productive sphere, generating jobs and economic growth.

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## ANNEX

### ANNEX I – Financial Account series index

Accounts	Level of openness	Accounts	Level of openness
1. Direct Investment	First level	3. Derivatives	First level
1.1 Brazilian Direct Investment	Second level	4. Other Investment	First level
1.1.1 Equity capital	Third level	4.1 Other Brazilian Investment	Second level
1.1.2 Claims on affiliated enterprises	Third level	4.1.1 Loans and finance – short term and long term	Third level
1.2 Foreign Direct Investment	Second level	4.1.2 Money and deposits	Third level
1.2.1 Equity capital	Third level	4.1.3 Other assets – short term and long term	Third level
1.2.2 Claims on affiliated enterprises	Third level	4.2 Other Foreign Investment	Second level
2. Portfolio Investment	First level	4.2.1 Suppliers' trade credit – short term and long term	Third level
2.1 Portfolio Brazilian Investment	Second level	4.2.2 Loans and finance – short term and long term	Third level
2.1.1 Foreign company equity	Third level	4.2.3 Money and deposits	Third level
2.1.2 Short term and long term debt securities	Third level	4.2.4 Other assets LP and CP (liquid)	Third level
2.2 Foreign Portfolio Investment	Second level		
2.2.1 Brazilian company equity	Third level		
2.1.2 Short term and long term debt securities	Third level		

### ANNEX II – Average relative participation and Standard Deviation of Financial Account series

**Table II.1 – Average participation of Financial Account series – first level**

	First period: 1995:01 - 1998:12	Second period: 1999:01 - 2008:08
Direct Investment	0,2436	0,3214
Portfolio Investment	0,3977	0,3026
Derivatives	0,0042	0,0099
Other Investment	0,3545	0,3661

**Table II.2 - Average participation of Financial Account series – second level**

	First period: 1995:01 - 1998:12	Second period: 1999:01 - 2008:08
Brazilian Direct Investment	0,1309	0,2144
Foreign Direct Investment	0,8690	0,7856
Portfolio Brazilian Investment	0,0997	0,1610
Foreign Portfolio Investment	0,9002	0,8390
Other Brazilian Investment	0,3840	0,4393
Other Foreign Investment	0,6159	0,5607

**Table II.3 - Average participation of Financial Account series – third level**

	First period: 1995:01 - 1998:12	Second period: 1999:01 - 2008:08
IBD – Equity capital	1,0000	0,71353
IBD– Claims on affiliated enterprises	0,0000	0,28647
IED – Claims on affiliated enterprises	0,1232	0,79518
IED – Equity capital	0,8768	0,20481
IBC – Foreign company equity	0,3067	0,38459
IBC – Debt securities	0,6933	0,61540
IEC – Brazilian company equities	0,4612	0,34252
IEC – Debt securities	0,5388	0,65747
OIB – Loans and Financing	0,1326	0,18029
OIB – Money and Deposits	0,6132	0,73109
OIB – Other assets	0,2541	0,08861
OIE – Loans and Financing	0,2980	0,36312
OIE – Money and Deposits	0,4080	0,52497
OIE – Trade credits	0,2940	0,11190
OIE – Other liabilities	0,0182	0,00347