Capital Controls: Empirical Analysis of Effectiveness of the IOF in Brazil

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Abstract: This paper aims to empirically investigate the effectiveness of capital controls imposed by the Brazilian monetary authorities. It presents the theoretical debates about the theory of capital controls, reviews the history of capital account liberalization and international funds’ flows into Brazil and presents an empirical analysis of the effectiveness of the Tax on Financial Transactions as short-term capital control. The paper concludes that the restrictions made on capital flows were ineffective for failing to reduce the profits from arbitrage operations on interest differential between emerging and developed countries.

Keywords: Capital controls, capital flows, IOF

1. Introduction

Over the last decades the dynamism of the international financial market has increased next to its coverage. The financial liberalization, which began in the last decade of the twentieth century and intensified in the early twenty-first, has allowed funds to circulate very easily among the opportunities of income and assets around the world and given this increasing ease migration of capital, the moods and expectations of some of the most influential fund managers and portfolios of the four main financial centres can move billions of dollars into or out of a nation in just a few hours. In Brazil, the most striking result of the capital account liberalization context was the large speculative inflows that led to overvaluation of the real. Seeking good returns, provided by high domestic interest rates, short-term capital flows came into Brazil generating oversupply of U.S. dollars, which, with floating exchange rate regime led to appreciation of the Brazilian currency.

Given the appreciation of the Real, the Brazilian government began to implement measures to restrict short-term capital in order to mitigate the effects that an overvalued exchange rate can result, such as difficulties in the industry and balance of payment issues. The government's main measure in this direction was the implementation of capital controls by disincentives, through the Tax on financial transactions, the IOF. However, the flows continued to put downward pressure on the Real. In this context, the article aims at analysing the measures of Capital Controls and testing the actual effectiveness of the restrictive nature of the IOF on speculative capital. The analysis period was defined as from 1999, when begins, after speculative attacks, the Floating exchange regime in Brazil, until July 2012.

To achieve the proposed objectives, the paper is divided into five sections, besides this introduction. The second section is devoted to explain the capital controls theory of and the major debates on this topic. Sections 3 and 4 clarify historically the constant changes in the capital inflows in Brazil and the factors that influenced these movements. The following section shows the economic consequences of the financial flows focusing mainly on the overvaluation of the real and the damage to industry. The sixth

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section is an econometric analysis to test the effectiveness of controls over capital flows imposed by the Brazilian economy. And finally, the last section is a conclusion of the work.

2. Capital Control Theory and Debates

The international movements of resources have acquired in recent decades a dynamism never seen before. In a short time, by the mood of some of the most influential funds managers in the world, billions of dollars can be removed of national borders, but this dynamism has its consequences. To restrict the rapid movement of capitals, the governments have the option of imposing restrictions on the entry or exit of capital. Capital controls are the ways by which the free capital mobility is restricted, either through taxes or administrative barriers. According to Carvalho and Sicsú (2006) the capital control can be divided in two forms:

- Incentives and disincentives: as taxes on undesirable capital flows, as happened in Malaysia and also in Chile.
- Administrative controls or direct quantitative restrictions: restrictions on the entry or exit of capital even if the investor is willing to pay more to hold their positions.

Over the past years, the international institutions had different opinions on this topic, however, over the majority of the time, they discouraged the use of the capital controls. In this perspective this paper highlights two trends that debate on the issue, the orthodox economists who argue that the resources must circulate freely for their best use and the heterodox line that criticizes the capital account liberalization as it can bring damages on macroeconomic context. To explain the arguments of these two theories that section was divided into two subtopics, the first discusses the vision of liberal theories and the second shows the arguments of those who criticize the currency convertibility and stand for the adoption of capital controls.

2.1. Liberalizing Theory

The capital account liberalization, currency convertibility or the free movement of resources are defended by the orthodox line of thought. These expressions mean the ability of the entrance or exit of foreign or national resources without any barrier. The main argument of the traditional theory is that the benefits of liberalizing capital are the same as to liberalizing trades, that is, with capital controls the allocation of resources is inefficient and so misallocated. According to Orthodox thinkers, the developing countries have a higher marginal productivity of capital than the developed economies due to scarcity of capital. If there was a free flow of capital, savings in developing countries would increase bringing higher returns and thus contribute to increase economic growth, and therefore the social welfare (Fischer, 1998 and DORNBUSCH 1998 apud PAULA et al. 2009).

Emerging countries would gain by integrating their capital accounts with wider access to international financial markets, reducing funding costs and being able to allocate their domestic savings more efficiently, diversify, have greater access to technology (imported as foreign direct investment) and therefore its financial sector developed (Prasad et al., 2003 apud PAULA et al. 2009). The national corruption would also be reduced since foreign investors would be much more critical to the practice than the Brazilians, seen as passive to the matter, having a government more responsible to prevent capital outflows (CARVALHO and SICSÚ, 2006). Ariyoshi (2000), in a report of the International Monetary Fund – IMF – argues that the attempt to establish capital controls tends to be a way to fill in a gap created by the interest rate differential between nations. However, with this attempt, not only capital inflows would be contained, but would also generate capital flight. Therefore the cost of capital control would be given by this flee. But if the controls were effective, the flows would become less sensitive to changes in interest rates and, therefore, would be greater autonomy of national monetary policy.
Fischer, one of the greatest experts of the subject mentions that liberalization "is an inevitable step on the path of development, which cannot be avoided and should be embraced. After all, all advanced economies have open capital accounts." (Fischer, 1998 apud Carvalho and Sicsú, 2006, p. 170). Modenesi (2006) also points out that one of the main arguments against the implementation of capital control is that, as the financial system becomes more complex and structured, learn to swindle any kind of administrative or quantitative measures that compromises the flows. Thus, there is a possibility that investors would hold speculative capital flows masked as productive capital. Prasad et al (2003) divides the arguments into two groups, those that directly influence economic growth and those that do indirectly. The direct factors are: increases in domestic savings with more efficient allocation of global capital; the lower cost of capital due to better allocation; and the development of the financial system, driven by increased liquidity and also by capital inflows and foreign banks. The indirect costs are: the promotion by specialization, resulting from increased productivity due to better risk management; incentives for better policies, as investors can punish inefficient policies with an outflow of its resources. (Prasad et al 2003 cited PAULA et al. 2009).

2.2. Arguments Against Liberalization

The heterodox economics stream criticizes the liberalization of the capital account arguing that restrictions on the international flow of capital are beneficial for growth, autonomy and national welfare. This stream is generally composed of followers of Keynes and his theory. Keynes argued that financial liberalization did not allow the government to have sufficient autonomy to implement economic measures needed to solve national problems, which in its contemporaneity was mass unemployment. The author supports the capital control so the government had the autonomy, as follows:

"The freedom of capital is an essential part of the old system of laissez-faire which requires appropriate and desirable equalization of interest rates everywhere in the world, assumed (...), if the interest rate that promotes full employment in Britain is less than the appropriate rate for Australia, there is no reason why it should not be created a situation in which all British savings are invested in Australia, considering only the different risk estimates until the Australian equilibrium rate is reduced to the level of the British rate. In my view, the whole management of the domestic economy depends on freedom of having the appropriate interest rate without reference to the rates prevailing in the rest of the world. The capital controls is a corollary. (...) The Americans will know how to identify their own interest and accept this conception "(Keynes apud Modenesi and Modenesi, 2006, p. 68).

According to the Mundel-Fleming model, there's no way to conciliate the full mobility of capital, fixed exchange rates and the autonomy of economic policies. It happens to the fact that to have an economic policy autonomy, such as domestic interest above international levels to hold an inflation of demand, capital mobility would allow the entry of international resources in abundance, which would have to be sterilized by the national authority to maintain the fixed exchange rate. Attempting to excessive sterilization would be "like trying to empty the ocean with a glass of water." Therefore, the national authority would have to choose between letting the exchange rate float or abdicate their monetary policy. This result is known as the "impossible trinity" (Carvalho et al., 2007, p. 361).

Just like Keynes, Tobin also highlights the autonomy loss as a result of the short-term capital flow. However, he adds that the impossible trinity also leads to a problem even with a floating exchange rates regime. Tobin argues that, letting the exchange rate float would cause undesirable effects to the national economy, inhibiting government autonomy. The author shows that in an economy that has a floating exchange rate, doing an expansionary monetary policy to increase demand, product and employment, undervalues the exchange rates. However, according to the J-curve in the short run this policy tends initially to generate a reduction in net exports, reducing the product, leading agents to believe that the
policy was not big enough and that a further depreciation of the exchange rate would be coming. This expectation leads to a currency demand for speculation which depreciates the currency even further. The government knowing that this can happen, changes the interest rate, which causes disastrous consequences to the product and therefore to employment. Tobin also argues that countries should interfere in rate variations given the consequences it brings on the macro level (employment) and micro (industry competitiveness) (Oreiro, 2006).

Carvalho and Sicsú (2006) also argues that the floating exchange rate regime can be functional to adjust operational changes in the economy, however, this system is not able to replace capital controls. According to the authors, "it is difficult to see how a floating exchange rate system can survive in the absence of capital controls that overwhelm their ability to set prices efficiently" (Carvalho and Sicsú, 2006 p. 22). For Stiglitz and Rodrik, New-Keynesians, with the existence of asymmetric information, the efficient markets hypothesis is not valid. The authors argue that the markets for goods are different from the financial markets, and that the benefits of the integration of the first do not recur in the second because there is asymmetric information. The economists also expose the capital flows, being procyclicals, generates instability "exacerbating economic fluctuations, if not causing it, and exposing the country to the vicissitudes associated with changes in economic from abroad" (Paula et al., 2009, p.5).

Therefore, the main authors who oppose the idea of real currency convertibility are followers of Keynes, and argue that under free international capital flows the nation loses the autonomy of economic policies. To them, due to the uncertainties, there is no way to have efficient markets in the financial system and the integration can cause financial crises and increase external vulnerability, causing volatile and undesirable changes in the exchange rates, balance of payments deficits, and increases public debt and private.

3. Financial Liberalization

Until the late 1970s, the Latin America countries were financed by increasing debt due to the high liquidity of international credit arising from so-called "petrodollars". With the oil shock and the increasing international interest rate in 1979, indebted countries fell into a deep crisis. The external crisis of Latin American countries led to a deterioration of public accounts and the inflation’s acceleration since the devaluation of national exchanges caused by the government to increase the competitiveness of its exports. To solve the problems, especially in countries of Latin America, the World Bank economists proposed, in November 1989, a set of actions that would lead to the growth of developing countries. Among them were the liberalization of the capital account and the implementation of floating exchange rates regime (Paula et al. 2012).

3.1. Liberalization Process

The financial liberalization began in Brazil in the 1980s, however, until the end of the decade there was still capital controls justified by the scarcity of foreign exchange and financing difficulty. However, it was in the 1990s that the major steps towards the financial opening were given. Through Resolution N° 1,552 of December 22, 1988 ("to the financial institutions, tourist agencies and hosting tourist agencies is allowed to make foreign exchange transactions at exchanges freely agreed between the parties"), the National Monetary Council granted to the central Bank the power to extend such operations or restrict them, creating the so-called floating exchange rate market. This resolution was regulated in 1989 when two markets coexisted, the foreign exchange fixed rates market (commercial) and the floating exchange rate market (dollar-tourism), which allowed certain transactions related to tourism, abroad education, among other (Sicsú, 2006). In the new resolution were allowed to increase the limit of buying up to $ 4,000 for travel, $ 100 thousand to treatments outside the boarders and $ 500,000 for transfers abroad of inheritance equity. To Sicsú (2006), there were clear signs that this was just the beginning of a much broader process of liberalization.
Following the recommendation of the International Monetary Fund (IMF), several inflow barriers for foreign direct investment (FDI) capital were removed, and many national companies were privatized receiving international resources. In 1991, Annex IV, allowed foreign investors to trade Brazilian stocks and bonds. In 1994, to overcome the debt crisis of the Brady Plan turned foreign loans in government bonds. However, the most important tool to the liberalization was the CC5s accounts. (Paula et al. 2007) These accounts were designed to facilitate resources transactions for non-residents returning to their countries and had as limit the amount that it had entered the boarders. According to the Tribunal de Contas da União (TCU, Federal Court of Audit), the goal "was to improve accounting transparency of the resources movement of non-residents, as well as control the amount of capital that returns to the country of origin ..." (TCU, 2001 apud Sicsú, 2006, p. 227).

In 1992 the Central Bank of Brazil has issued two circulars that regulated the Resolution 1,946 of the National Monetary Council that reinvented the CC5. Through this resolution, any agents could move resources with the exterior through CC5 accounts of non-residents without any limit. "It was invented a category, at least curious, that can be called non-resident financial agent with permanent account in financial institution resident in the country." (Sicsú, 2006, p. 227). The laws facilitated the funds’ movement abroad. Any foreign financial institution legal entity, could receive deposits in Brazil and send them abroad. According Sicsú (2006), this was the stronger act of financial liberalization on the Brazilian economy.To sum up, the early 1990s represented to the Brazilian economy a capital account opening mainly via the CC5 disfigurement. It was clear that the national authorities acted in order to demonstrate that they would follow the advice of the developed countries and that the country was ready to receive international capital whatsoever.

3.2. “Plano Real” and Speculative Crisis

The 1980s was marked by several attempts to stabilize the prices in an economy that was extremely indexed. In 1994, a very structured plan - the PLANO REAL (REAL PLAN) - aimed to put an end to the general indexation through currency transition, achieved price stability. With the PLANO REAL, was established a new national currency and the exchange rate, held highly valued, was used as an anchor on prices. This mechanism worked gradually but constant. However, despite having had great success in fighting inflation, the plan generated two serious problems. The first was the external imbalance caused by the strong increase of imports over exports, which, despite of being one of the strategies to reduce inflation by creating a price competition, forced the current account deficits to be heavily financed by the capital account. And the second, a fiscal crisis caused by the high cost of external borrowing. To reduce the operating deficit the government intensified the privatization that generated revenues of around U.S. $ 35 billion among the areas of telecommunications, energy generation and distribution and minerals. Foreign direct investments attracted even more capital. Between 1996 and 1998, approximately U.S.$16.3 billion flowed into our accounts. The external debt between 1996 and 1998 increased from 179.9 billion to 235 billion, and domestic debt of the public sector grew from 237 billion in 1996 to 328 billion in 1998 (Toffoli, 2006).

With the financial crises resulting from speculative attacks in some emerging countries, the concern about the currency comes back. Any abrupt exit of capital that was not controlled by the government could depreciate the exchange rate damaging the anchors mechanism and also the balance of payments. With the Mexican crisis and the contagion effect of capital flows in the Brazilian financial system, there were massive capital flights, mainly short-term. The CC5 disfigured accounts were widely used for this purpose.

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2The abbreviation CC5 comes as a reference to 5th Circular Letter (in Portuguese Carta Circular n° 5) that in February 1965 regulates the law 4,131 of September 3, 1962, that created a rubric allowing the movement and transfers of funds from abroad and not -residents (Sicsú, 2006).
Since the Mexican crisis in 1994 and especially during the Asian crisis (1997) and Russian (1998) these accounts were the main way out of billions of dollars. The years 1997 and 1998 together added up to U.S. $46.020 Billion. In response to these outflows government increases the interest rate (Ferrari and Paula, 2006). It can be seen by Graph 1 that the tops of the interest rate (Selic) are formed exactly in capital outflows related to speculative attacks on emerging economies. The first at 1994 and then 1997 and 1998.

Graph 1: Brazilian interest rate (SELIC) – AUG/1994 to AUG/2005.

SOURCE: Own elaboration based on data from IPEADATA (2012)

With the Russian crisis in 1998, the Brazilian scenario showed that the economy could not stand another speculative attack against the Real and, from January 1999, after a devaluation of 10% in the exchange rates made by the government, international agents, fearing a greater devaluation, made another major reversal of capital flows to a level that the exchange rate could no longer be sustained. And so, the government released the fluctuation of exchange rates.

4. Capital Flows

In emerging countries, the 2000s differs from previous by the capital flows that were predominant. While in the 1990s the flows were mostly of foreign direct investment (medium to long term), the following decade was characterized by volatile short-term capital flow, the portfolio investments. From 2000, the financial markets have become more dynamics, hence, the short-term flows, portfolio investments and derivatives, start to have great importance in the biggest investment funds’ portfolios. This may explain mostly of the capital flows, managed by the expectation of the large funds’ profits. This chapter aims to explain the movements are characterized as capital of the decade and what are the main factors responsible for the same.

4.1. Capital Flows in the 2000s

The first decade of 2000 has been characterized by three distinct phases of international capital flows. In the first, between 2000 and 2004, the flows had little relevance as a result of negative expectations arising from crises in emerging countries at the end of the previous decade and also political factors from 2002. The second, between 2004 and mid-2008, was characterized by a good moment of the international economy that has attracted a lot of international resources to emerging countries, and that ends up as soon as the international financial crisis is triggered in the last quarter of 2008. The third starts with an abrupt
capital exit resulting from the financial crisis followed by an excess of liquidity in the international market because of countercyclical policies of the United States and Europe (PAULA; FERRARI FILHO; GARCIA, 2012). In graph 2, you can check the development of the financial account:

**GRAPH 2: FINANCIAL ACCOUNT EVOLUTION (US$ MI, 2000-2011).**

![Graph 2: Financial Account Evolution](image)

**SOURCE:** Own elaboration based on data from IPEADATA (2012)

From this graph it is possible to analyze in greater detail each of the steps mentioned above. The first phase, between 2000 and 2004, begins with shaken expectations about the Brazilian economy that had suffered speculative attacks on national currency in the previous year (1999), leading to the fall of the government exchange fixed rate regime, followed by the 2002 Argentina’s crisis. Adding to this fact, in 2002 the Brazil, during the elections for president, once again aroused the fear of large investors. Showing great concern about the election of Luís Inácio "Lula" da Silva as President at the end of the year, even before the new president takes the chair, the resources allocated to Brazil became scarce. It can be seen through the graph 2 that from 2000 the capital account takes a downward trend reaching negative values in 2004. In response to this dissatisfaction of the international investors, the Brazilian government raised the interest rates, which remained high until the end of the decade (despite a downward trend), and that turned to be one of the main causes of the problems related to the exchange rates that will be seen in the next sections.

The next phase, from 2004 to 2008, is characterized by the good moment of international economy. Due to the low interest rate in the United States, the expansionary monetary policy of the Federal Reserve and other factors such as higher commodities prices due to increased Chinese demand rising incomes in emerging countries and the reduction in international investors’ risk aversion, capital flows willing to invest in Brazil become abundant (PAULA; FERRARI FILHO; GOMES, 2012). It can be observed that the financial account, from 2005 to 2006, shows an upward trend mainly driven by the portfolio investments, which are by nature volatile, and foreign direct investments are relevant only in the following year.

During this phase of capital abundance, Brazil, like other emerging countries took the opportunity to build up a large stock of dollars. With a sufficient volume of reserves, the government could reduce its external vulnerability and fragility to the foreign capital movements. Beside this, buying foreign exchange reserves is a major instrument of exchange rate policy in emerging countries. With enough dollars the government can reduce the excessive volatility of the exchange rate and mitigate the exchange rate appreciation. This phase ends in 2008, with the bankruptcy of the bank Lehman Brothers, historical landmark of the housing bubble crisis in the United States of America. In this year, there is an exorbitant capital reversal composed almost exclusively by short-term volatile capital. Portfolio investments that reached in 2007 an amount of U.S. $ 48.390 billion, reduced in 2008 to $ 1.133 billion, a 97.66% decrease. This movement has
generated a lot of instability in the foreign exchange market, and led to a sudden massive depreciation. The third phase related to capital flows of the decade is characterized by the return of the funds. The factors behind capital inflows once again were: i) The countercyclical policies of the United States and Europe governments, in response to international crisis, the expansionary policies that ended up mostly in the financial market and increased global liquidity, ii) the fast recovery of emerging markets and iii) the quick recovery in commodity prices, produced mostly by emerging countries (PAULA; FERRARI SON; GOMES, 2012). We can observe, again at graph 2, that the flows were mainly portfolio investments, despite an increase in FDI. In 2011 and 2012, despite uncertainty about the Eurozone and the economy in some key European countries, flows continued to get into Brazil, mostly due to an increase in liquidity from developed countries with countercyclical policies.

In short we can conclude that we lived different times with capital flows. First there was shortage of capital due to internal and external crises and then great inflow of resources, interrupted by a sudden reversal of capital during international crises.

5. The Real Overvaluation

As observed in the previous section, since 2006 capital flows have intensified. This increasing capital inflow in Brazil after the early 2000s crisis recovery generated a higher demand for the domestic currency and therefore a dollar offer. This constant increase in dollar supply generated, since 2005, a tendency to the overvaluation of the currency, which can cause problems for the economy and its development. This section will discuss the determinants of the Real’s overvaluation and its consequences for the national economy and shows how the Brazilian government, as with the increase in international liquidity, used capital controls - specifically through the Tax on Financial Transactions (IOF, “ImpostosobreOperaçõesFinanceiras”) - to try to reduce the damage.

5.1. Causes and Consequences

Araújo et al. (2009) estimated an optimal long-term exchange rate and concluded that during the period between 1999 and 2009, the real was not overvalued only in moments of capitals sudden stop or negative expectations, as in the episode of the “Lula-Risk” and the global financial crisis. It is observed from graph 3 that, from 2005 there is a clear appreciation of the Brazilian currency against the dollar.

GRAPH 3: NOMINAL EXCHANGE RATE-R$ / U.S.$ - from 2000 to 07/2012

If we match the above graph and the graph 2, we observe a negative correlation between the financial account and the exchange rate. From 2005, when the international funds start getting in Brazil, begins a trend of currency appreciation. After the 2008 crisis, in 2009, there is a sudden top in exchange rates as
well as a bottom in the financial account. This leads us to believe that the main reason of the overvaluation of the real is the capital inflows in Brazil, both speculative and long-term. Since 2002, interest rate was raised to a level three times higher than in developing countries (25%), attracting speculative capitals to arbitrage operations, which, together with the increase in commodity prices, appreciated the real (Lacerda and Oliveira, 2010). These policies of high interest rates served as an instrument for the government, since the Real Plan, in which appreciating currency facilitates the entry of cheaper imported goods for the domestic market, creating competition with domestic products, and chase the fall of inflation set by inflation targeting regime, the RMI (Regime de Metas de Inflação).

During the first decade of the 2000s, the Brazilian economy was characterized by movements of "stop and go". The average real GDP was 3.4%, below the average of developing countries (6%) and global countries which grew 3.7% on average. According Nassif (2011) these results are attributed to the growth model based on foreign savings. This policy aimed to pursue only the inflation target rather than economic goals as long-term sustainable growth and structural change that would prevent premature deindustrialization. A study by economists William R. Cline and John Williamson shows that while the Real was 15% overvalued, other Asian countries have devalued their currencies. In the case of China, the Yuan was more than 40% depreciated. This leads to the result that, thinking only about the exchange aspect (discarding subsidy policies, promotion and tax burden) the Chinese product has a head start of 66% compared to Brazil (Lacerda and Oliveira, 2010). You can see some of the consequences of the overappreciation of the real in the Brazilian exports’ composition, observe in graph 5:

![Graph 5: Brazilian exports’ composition (%)](image)

SOURCE: Own elaboration based on data from IPEADATA (2012)

With the loss of the domestic industry competition in the international market, the opportunity cost of investing into the Brazilian industry becomes too high. According to the IBGE, productive investments in proportion to the Brazilian GDP reached on average 17% per-year between 2000 and 2007, while the average results in the BRIC countries was twice as big. This shows that the appreciation has had a negative impact on capital accumulation and growth in Brazil.

To sum up, the effects of the overappreciation of the real on the industry can be devastating. With the low competitiveness both internally when external industry seems to have the fate of all remaining constant, play a secondary role in Brazilian growth would be based then on exports of primary products. This context leads us to believe in the importance of capital controls to restrict the overappreciation of the national currency as a form of protection to all progress achieved by the process of import substitution from 1930 until the late 1970s. To sum up, the effects of the currency overappreciation on the industry can be devastating. With the low competitiveness, both internally and externally, the industry seems to have the fate of playing a secondary role in growth, hence be based on exports of primary products. This
context leads us to believe in the importance of capital controls to restrict the overappreciation as a form of protection to all progress achieved by the process of import substitution from 1930 until the late 1970s.

5.2. The “IOF” as Capital Controls

With the concern in avoiding the deterioration of the Brazilian industry, the government began, after the 2008 crisis, to implement some controls on certain capital flows. The IOF was the most commonly instrument used for this matter. To try to contain the appreciation of the real, the Brazilian government, in October 2009, used an IOF of 2% on exchange operations to attempt to discourage the carry-trade operations (getting returns from the interest rate differential between developed and emerging countries). A year later, this rate was doubled and extended to derivative transactions. In 2010, the government increased the tax on the margin requirement to operate foreign exchange derivatives from 0.38 to 6%. Only in 2011 with two regulatory measures, the first in January with the imposition of bank reserves on foreign exchange derivative transactions and the second in July when the government began to regulate derivative transactions with foreign currencies, the government had more coverage (PAULA; FERRARI FILHO; GOMES, 2012). The table below shows the main measures of capital controls taken since 2008:

**TABLE 1: CAPITAL CONTROLS (2009 - Mar, 2012)**

<table>
<thead>
<tr>
<th>DATE</th>
<th>POLICY</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2009</td>
<td>The Minister of Finance implemented a rate of 2% IOF tax for non-resident assets and fixed-income assets.</td>
</tr>
</tbody>
</table>
| October 2010| i) Increase in IOF from 2 to 4% for fixed-income assets and equity funds.  
           | ii) Increase of 6% IOF tax on fixed-income investment.  
           | ii) Limitations on the exchange of stock investments to fixed-income. |
| March 2011  | IOF of 6% on loans from foreigners (foreign banks and securitization) with maturity under one year |
| April 2011  | i) the rate of 6% IOF tax was extended to renewals of foreign loans with a maturity of less than one year  
           | ii) 6% IOF extended to the new loans or renewals with maturity up to two years. |
| December 2011| IOF to stocks and fixed income investment (related infrastructure projects) reduced to 0% |
| March 2012  | i) 6% IOF extended to new loans or renewals with maturity of up to three years.  
           | ii) Advance payments operations for exports with maturity exceeding one year prohibited.  
           | iii) 6% IOF extended to new loans or renewals with maturity of up to five years. |

SOURCE: Adapted from PAULA, FERRARI-FILHO and GOMES (2012)

Capital controls were not able to reverse the overvaluation of the exchange rate during the years 2010 and 2011. This takes place by the fact that the rates implemented by the government are not sufficient to remove the returns with the carry-trade operations. These operations, as noted above, have its profit based on the interest rate differential between developed and emerging countries. Between 2009 and March 2012, the lowest interest rate differential that was recorded was 8.59% in March 2003, when the risk-free interest of the United States was 0.16% per year and the Brazilian was 8.75%. The IOF tax rate, to be effective, would have to eliminate gains arising from the carry-trade, should be equal to or greater than the interest rate differential found in the country.

Despite having been reduced, the interest rate differential between Brazil and the risk-free interest still remain very large. While this happens, speculative capital will be attracted continuously and will be very difficult and expensive for the government to keep rates at acceptable levels for the industry development. To sum up, the trend of overvaluation of the real has changed the trend of production of
manufactured products in Brazilian exports giving rise to the production of commodities with low aggregate value. Capital controls implemented by the government to mitigate the tendency of the national currency, has not been effective due to the interest rate differentials, which remain high.

6. Econometric Model

The financial transaction tax - IOF - has been, in recent years, the main instrument of capital control used by the Brazilian authorities to restrict the entry of speculative capital. However, as seen in the previous chapter, they seem to have been ineffective for such a proposal. To investigate empirically the influence of the IOF on capital flows, a series analysis through econometric regression with Ordinary Least Squares (OLS) is conducted in this section.

6.1. Model Specification

To test the influence of IOF on capital flows were used two simple models in which only the dependent variable is changed. In Model I the dependent variable is the balance of Capital and Financial Account (in Portuguese, Saldo da Conta Capital e Financeira) and in the model II the dependent variables is the principal route taken by the speculative short-term capitals into the country, portfolio investments (Investimentos em Carteira). The explanatory variables are, for both models, the Covered Interest Parity and a proxy for capital controls, which is the IOF tax collection.

\[
\begin{align*}
\text{(I)} & \quad SCKF = \beta_0 + \beta_1 PJC + \beta_2 DIOF \\
\text{(II)} & \quad CART = \beta_0 + \beta_1 PJC + \beta_2 DIOF
\end{align*}
\]

where:

- SCKF = Capital and financial account balance (Monthly, end of period);
- CART = Portfolio Investments Balance (monthly, end of period);
- PJC = Covered Interest Parity (% per month);
- DIOF = IOF tax collection (differentiated) (monthly, end of period)

The data sources were IPEADDATA at a monthly frequency from January 1999 to July 2012, end of the period. The only data that had to be handled was the Covered Interest Parity. The index was assembled from the interest rate differential between Brazil and the U.S. interest that are considered risk free - federal funds rate (prime) - plus a proxy for country risk, the EMBI + BRAZIL and the past variation of the exchange rate to represent the expected rates. In the IOF’s collection index, that presented a definite trend and, as after analysis of the chart it seems stationary, was performed a variable difference using the statistical software Eviews 5, the DIOFF.

6.2. The Unit Root Testing

The unit root test is used to evaluate the stationarity of the variables in the model, in other words, if each has average and constant variance in the analyzed time period (Gujarati, 2006). The test used to identify if the variables of these models are stationary or not was the Dickey-Fuller (ADF). In the ADF test the null hypothesis (H0) is that the series has a unit root, i.e., is non-stationary. As you can see in Table 2, the null hypothesis is rejected for all variables (SCKF, CARTF, DIOFF, PJCF) at a significance level of 1%.

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3 The IOF is a federal tax that covers credit, exchange rates and insurances operations. Although the tax includes other types of financial transactions, it is used as a proxy for capital controls since the sudden capital inflows and outflows would generate large variations in the collection.

4 The Covered Interest Rate Parity is the relationship between the interest differential plus the risk of investing in the country and the expected depreciation of the exchange rate. (CARVALHO et. al. 2007).
From this test we concluded that the variables follow a stationary stochastic process such that the model does not incur the problem of spurious regression\(^5\).

### 6.3. Results and Robustness Tests

After checking the stationarity, the ordinary least squares regression models is able to rotate, test the significance and extract the results. The linear regression model is an econometric function in which the dependent variable is related to the explanatory variable which is added to the error term (\(u\)). The model that will be used has more than two variables, and therefore, it is a Model of Multiple Linear Regression. (Gujarati, 2006) To test the correlation of residues is made, firstly, the Durbin-Watson test. To correct the correlation that existed on the models in the first estimation, Gujarati (2006) suggests some lag in the variables. In model (I) the dependent variable was lagged in one period and DIOFF in 3. With such changes can be seen that there is no autocorrelation between the residuals. In model (II) only the dependent variable was lagged in two periods. The F tests show with 1% significance that it is possible to say that the model parameters together are not zero.

The variable PJC was significant at 1% for explaining both models. This variable, however, had an ambiguous result in the estimation of the model. A natural hypothesis of covered interest parity would be that with the increase in domestic interest rates the capital would be attracted and thus increase the capital account balance and the portfolio investments. However, the estimation shows that there is an inverse relationship between PJC and dependent variables. This can be explained, however, by changes in interest rates related to the situation of national indicators. With the national situation unfavorable to foreign investment, the central bank increases interest rates to attract capital, and in good conditions the authorities can reduce domestic interest rates and still attract capital. Look through the table 4 the results of models:

### TABLE 4: MODEL’S RESULTS

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(\beta_0)</th>
<th>(\beta_1(\text{PJC}))</th>
<th>(\beta_2(\text{DIOFF}))***</th>
<th>(R^2)</th>
<th>Adjusted-(R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I) SCKFF(-1)</td>
<td>2123.755*</td>
<td>-116.42*</td>
<td>4.6969**</td>
<td>0.4001</td>
<td>0.3885</td>
</tr>
<tr>
<td>(II) CARTF(-2)</td>
<td>1686.435*</td>
<td>-114.114*</td>
<td>3.534**</td>
<td>0.25369</td>
<td>0.23943</td>
</tr>
</tbody>
</table>

SOURCE: Own elaboration based on survey data.

Obs.: Standard-Deviation in parenthesis

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\(^5\) When the estimation from the OLS leads to results that there is significant statistical relationship between the variables when a priori, there should be no relationship. (Gujarati, 2006, p. 646)
*significant at 1%; **Significant at 5%; and ***lagged in 3 periods for the first model.

Regarding the explanatory variable DIOFF there is no surprises. The model results corroborate the analysis that the taxes were not enough to reduce short-term operations and show that there is a positive relationship between the collection from the tax on financial transactions and capital account balances and the portfolio investments. This is because such taxes cannot nullify the investment profits and so they keep coming even with the tax increase, hence, contribute to the increase in the collection of the tax. The $R^2$ of the final models was not really high. However, it is quite understandable because it is difficult to estimate all variables in international capital flows, just as agents' expectations and financial crises that generate sudden stop and contagion in developing countries.

To sum up, the results of the estimated models confirm the hypothesis that, so far, capital controls by disincentives were not effective and are not able to control the speculative inflow of capital that generated in recent years the Brazilian currency overvaluation. It is necessary, therefore, to increase the scope of the capital restrictions to retain speculation with carry-trade operations and provide more stability to the exchange rate and the in the Brazilian balance of payments.

7. Conclusions

In Brazil the process of capital account liberalization was very intense following the guidelines of the Washington Consensus in the early 1990s. The main instrument for that matter was the disfigurement of CC5, which showed to international investors that the capital would not have any kind of outflow restriction. However, that liberalization caused problems during the beginning of the Real Plan. The high financing level of the Brazilian economy through the capital account brought great instability and vulnerability, followed by speculative attacks until the fall of the exchange rate regime in 1999 and beyond. With the large speculative and productive inflows there was an exchange rate over-appreciation in Brazilian’s currency. This over-appreciation has shown serious consequences on the competitiveness of the industry that is becoming less competitive than other emerging economies. This loss of industrial competitiveness has made the list of exports in recent years changes. In 2009 the proportion of commodity exports in the GDP exceeded manufactured products, which exposes that Brazilian economy is returning to be focus in agricultural exportation.

The results of the econometric study confirmed the paper hypothesis that the IOF has not been effective in controlling the short-term capital flow. According to the model the IOF’s collections proxy showed a positive relationship with the account balances financial capital and portfolio investments, hence, it was concluded that even with the increases in taxes, the flows were not reduced. Accordingly to that, the conclusion of this paper is that, despite the importance of capital controls for emerging economies in Brazil, it did not had the necessary magnitude to discourage volatile investment flows. It is necessary, therefore, to increase the scope of restrictions on short-term international capital, so the Brazilian economy can grow sustainably in harmony with the strengthening of the industry and the technological development of the country.

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6 The $R^2$ is the coefficient of determination and attest how the explanatory variables can correctly estimate the dependent variable $Y$. (Gujarati, 2006)
References


