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The Brazilian experience in managing interest-exchange rate nexus

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Abstract

This paper addresses four main questions: firstly, it discusses some theoretical background related to the interest-exchange rate nexus; secondly, it makes an attempt to explain why the interest rate in Brazil is so high, examining briefly the main explanations for it; thirdly, it describes Brazil's foreign exchange markets, their size and hierarchy; and lastly, it explains the carry trade dynamics considering the institutionalism of the Brazilian foreign exchange market and also the government policies envisioned to curb it.

Keywords: foreign exchange, carry trade, derivatives, capital controls.

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1. Introduction

The interest-exchange rate nexus has been the paramount determinant of the course of the exchange rate in the contemporary Brazil, through the operation of carry trade which has different forms, but all related to the interest rate differential. To explain how this works in Brazil and how the government has been dealing with it through the exchange rate policy, this paper addresses four main questions: firstly, it discusses some theoretical background related to the interest-exchange rate nexus; secondly, it makes an attempt to explain why the interest rate in Brazil is so high, examining briefly the main explanations for it; thirdly, it describes Brazil's foreign exchange markets, their size and hierarchy; and lastly, it explains the carry trade dynamics in different foreign exchange markets and also the government policies envisioned to curb it. In the final remarks, some recommendations are suggested to improve the foreign exchange market regulation.

2. The interest-exchange rate nexus

The economic theory addresses the relationship between the interest rate and the exchange rate mainly through the Uncovered Interest Parity (UIP). The UIP is a logical consequence of the Mundell-Fleming model and its "impossible trinity". It postulates that similar assets in different currencies should have the same rate of return, taking into account the perfect capital mobility. Therefore, the interest rate differential between currencies is understood as a way to reward the investor for a future depreciation of the currency with higher interest rate, which is the equivalent of stating that the interest rate differentials reflect the depreciation expectations of the high-yield currencies against the low-yield currencies. Accordingly, the UIP postulates that the yield of an application in the domestic interest rates (i^d) is equal to an application in a foreign currency (i^x) plus the expected depreciation of the domestic currency against the foreign currency (Δe^*)[3]:

$$(1) \quad i^d = i^x + \Delta e^*$$

Yet, the validity of this equilibrium stated by the UIP is restricted to the economic textbooks and does not apply to the economic reality. A vast literature referred to as "forward premium puzzle literature" seeks to solve this theoretical problem and points out two main reasons why UIP does not hold: market imperfections and government interventions.

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[3] This equation is a simplification of the original formula: $(1+i^d) = (1+i^*)(e^e_{t+1}/e_s)$. By manipulating the equation $(1+i^d) = (1+i^*)(e^e_{t+1}/e_s)$, one arrives at the expression: $[(1+i^d)/(1+i^*)]-1 = [(e^e_{t+1}-e_s)/e_s)]$. Mathematically, it can be shown that $i^d - i^* \approx [(e^e_{t+1} - e_s)/e_s)]$, for small values of i. For details of the UIP equation, see Isard (2008).

Beyond this theoretical imbroglio, the important issue here is that the failure of the UIP gives rise to a speculative operation called carry trade. This operation can be seen as a bet against the UIP as soon as its gain depends on the following inequality:

$$(2) \quad i^d > i^x + \Delta e$$

That is to say, the carry trade operation has a positive gain when the domestic interest rate is greater than the foreign interest rate plus the effective exchange rate depreciation. Thus, this operation is motivated by the interest rate differentials but the final gain depends on the exchange rate variation between the two currencies of the strategy. Therefore, it is not an arbitrage transaction but a speculative operation since the exchange rate variation is not known *ex-ante*.

There are two categories of carry trade operation, as pointed out by Gagnon and Chaboud (2007): the "canonical carry trade" and the "derivatives carry trade". In the former case, the speculator incurs in a debt in the funding currency (which is associated with a low interest rate), and acquires an asset in the target currency (which is the one related to a high interest rate). However, in derivatives markets there is no need to incur debts and buy assets, the carry trade expresses itself as a bet which results in a short position in the funding currency and a long position in the target currency. The relevant issue is that the quotation differential between the spot and future exchange rate embeds the interest rate differential between the two currencies which makes the return of this operation very similar to the canonical carry trade. However, it is noteworthy that the canonical carry trade involves a financial flow while the derivative carry trade does not involve flows besides a margin call. This fact has important implications for exchange rate policies, since the derivatives carry trade is not directly affected by the capital controls.

Several studies highlighted the carry trade as a cause of the macroeconomic disequilibrium and the exchange rate distortion as explained in Flassbeck and La Marca (2007) and e United Nations Conference on Trade and Development (UNCTAD) (2007 and 2010). These studies point out the carry trade as a major cause of exchange rate misalignment, foreign exchange accumulation and the current account imbalances. In addition, this operation has been one of the main forces driving the Brazilian real appreciation, as shown in Rossi (2011). Hence, an important task of economic policy is to neutralize the carry trade. For this assignment there are two main policy directions:

1) Converge the interest rate to the international standard
2) Impose a comprehensive capital account and derivative market regulation

The first task is an extremely complicated one considering the motives of high interest rate in Brazil, which will be addressed in the next section, and moreover it is certainly not a short term task. While this task is not accomplished, it is absolutely essential to deal with the second kind of policy which refers to a capital account regulation and a derivative market regulation. This discussion is the main objective of this paper and will be addressed in Section 4.

3. The reasons behind unusual high interest rate in Brazil

As a backdrop, we should address the reasons behind the extreme high interest rate in Brazil. To do this, the three main theories concerning the issue should be taken into account: the fiscal dominance, inflation differential and exchange rate volatility.

With regard to the first question, i.e. the fiscal dominance, it is usually argued that the Brazilian high public debt or, more precisely, the significant relation between the net public debt and the GDP, explains the higher Brazilian interest rate. However, the data does not support this statement. In Figure 1, an almost perfect positive correlation is observed between the net debt interest payment as a percentage of GDP (an indirect measure of the interest rate) and the net debt as a percentage of GDP. Nevertheless, in the Figure 1 we can see two exceptions or outliers: Japan and Brazil. The former has a great net debt and a low interest payment and the latter, on the contrary, has a high interest payment in spite of having a low net debt.

The data of Figure 1 rule out the thesis of fiscal dominance. In addition, if we take the data for a period after the crisis, from the World Economic Outlook for example, the fallacy of the proposition is more evident, as the net debt has grown very rapidly in the developed countries and their interest rates have dropped. Again, the opposite trend is noticed in Brazil where the net debt has decreased and interest rate differential has become higher when compared with developed countries. Some argue that the fiscal dominance is related to the gross debt and not to the net debt. Again, the OECD data reveals that Brazil has a low level of gross public debt measured as a percentage of GDP, compared with the other countries of the sample. In the period 2004 to 2008, only Spain and Poland had a lower indicator. However, after the crisis all of those exceed Brazil's indicator.

Figure 1: Net debt and net debt interest payments of the public sector (average 2004-2008)
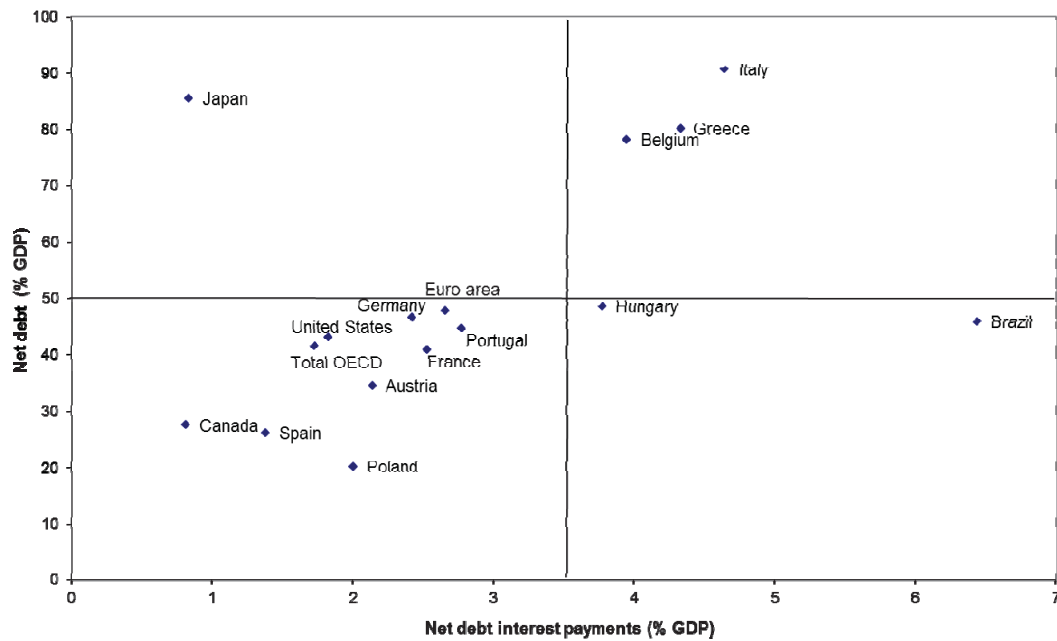
Source: Diagram prepared by the authors on the basis of OECD data.

The second thesis that attempts to explain the high interest rate level is related to the inflation rate and more precisely to the inflation rate differential. As Brazil has a high inflation rate, it should have a high nominal interest rate to compensate it. If we look at the data in Figure 2 we will find out that Brazil is again an outlier. For a long period, between 1999 and 2011 the country had an average inflation rate, similar to a large number of countries. However, its nominal interest rate has been higher, implying a larger real interest rate compared to the others.

Figure 2: Average inflation and average interest rate (1999-2011)
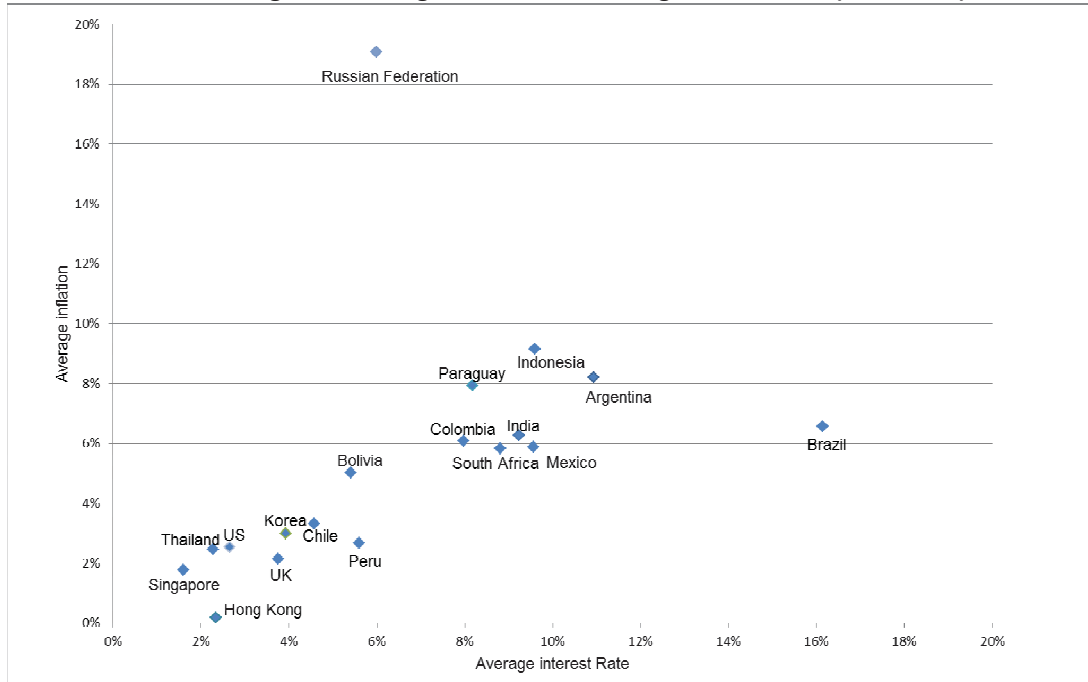
Source: Diagram prepared by the authors on the basis of the IFS-IMF data.

The third thesis posits that the interest rate in Brazil is high because of the great exchange rate volatility. As this volatility has been high, the international investors demand a premium which takes the form of an increase in the nominal interest rate to compensate for the risk of moving to an unstable currency. In the formal terms, in the UIP, $i^d = i^x + \Delta e^*$ the nominal interest rate (i^d) should be greater to compensate the expectations related to high exchange rate volatility (Δe^*).

Interestingly, the real life data in Figure 3 once again offers no support for this thesis. In the sample, there are different kinds of countries: developed (Australia, Korea, New Zealand) and underdeveloped (South Africa, Argentina), with the same profile of exchange rate volatility as Brazil but their interest rates are lower.

If there is not enough evidence to postulate that Brazil's high interest rate is linked to these three causes, then how can it be interpreted? The alternative thesis is that in Brazil the high interest rate is only explained by the political economy. As a matter of fact, it is the huge power of renters which explains it.

This superpower can be seen in many aspects of the economic functioning, but the most important is the central bank operation. Firstly, the framework of Inflation Target regime adopts a full price index rather than a core as a target and establishes a short term to fulfil it. In the same

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way, the central bank overreacts to any variation of inflation, regardless of its nature, if a demand or supply side shock.

Figure 3: Exchange rate volatility and average interest rate from 2006 to 2012
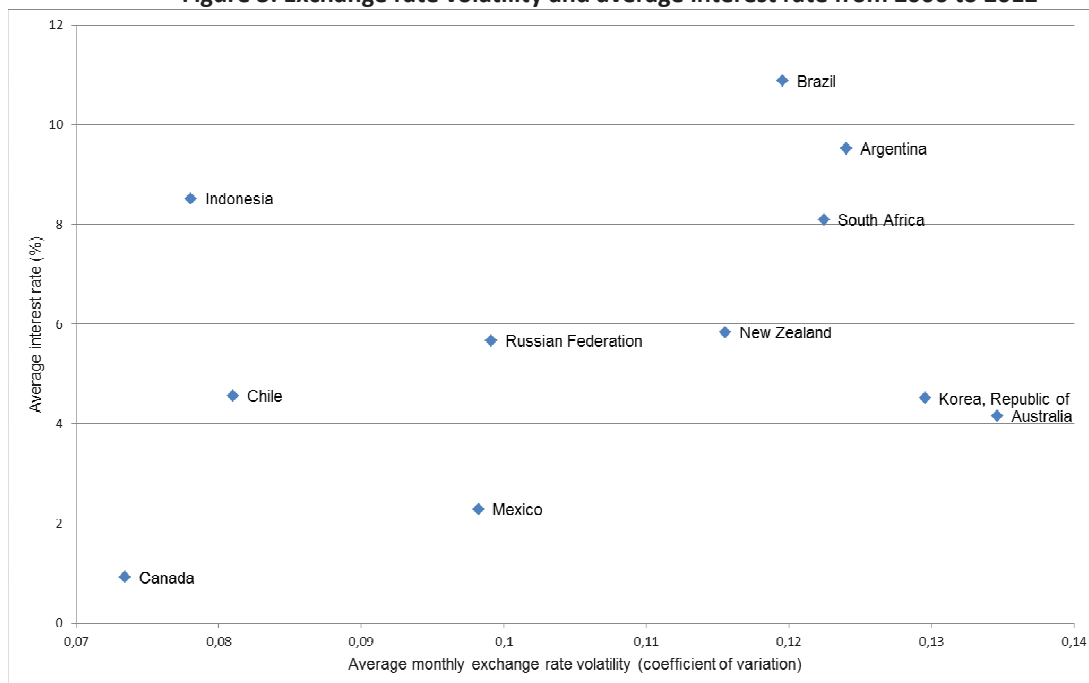
Source: Diagram prepared by the authors on the basis of the IFS-IMF data.

The reasons behind the above mentioned scenario is that the banks, big companies and the high income middle class are all net investors in public debt securities, which are mostly short term, and all of them are permanently interested in higher interest rates. This stance of investors and the absence of "bull' and "bear" positions, results into the fact that the majority of these public securities are indexed to the overnight interest rate without any *duration.*

4. Brazil's foreign exchange markets

4.1 A characterization

The exchange rate formation follows from the interaction between economic agents within an institutional framework that defines the foreign exchange market in each country. The Brazilian foreign exchange market has important specificities that should be considered when analyzing the carry trade and the exchange rate dynamics. Therefore, the purpose of this section is to characterize the institutional background of the Brazilian real´s foreign exchange market by considering four different and interconnected markets; the primary market, the interbank market, the derivative market and the offshore market.

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In Brazil, unlike other countries, almost every single foreign exchange transactions between residents and non-residents have to be formalized in foreign exchange contracts and carried out through the institutions authorized by the Central Bank to deal with the foreign currencies. The **primary market** is where those contracts take place. These operations include, for example, the sale of foreign currency revenues from exports, the purchase of foreign exchange for imports, the purchase and sale of foreign exchange for tourism or investments in Brazil and abroad.

The primary market operations are intermediated by the banks, since the primary agents are not allowed to trade currencies directly with each other. By supplying the demand for foreign currency and absorbing the excess of liquidity of primary agents, the banks accumulate spot positions in foreign currencies. This position can be "bought" when the accumulated purchases in foreign currency are higher than sales; "sold" when the total purchases are less than the total sales; and "flush" when there is equilibrium. It is noteworthy that the accumulation of foreign exchange positions in Brazil is a prerogative of banks.

The **interbank market**, or secondary market, described in detail in Garcia and Urban (2004), is where the exchange positions of the banks residents are leveled. That is to say, when a bank sells or buys currencies besides its appetite, it looks for another bank to adjust its foreign exchange position. Thus, the interbank market can be described as the *locus* of the stock of foreign exchange trading among institutions authorized by the Brazilian Central Bank to operate with foreign exchange.

An important issue is that the interbank operation is crucial in determining the exchange rate together with the primary market transactions. Considering only the primary and interbank markets of foreign exchange and discarding the Central Bank's intervention, the price of the exchange rate depends on two variables:

1) The net exchange flow from primary agents
2) The willingness of banks to maintain or change their foreign exchange position without altering the primary flow or eventually varying it by means of the interbank lines

When considering only the first variable, the exchange rate results from the interaction between supply and demand for foreign exchange arising from the commercial and the financial relations of the Brazilian economy to the outside world. However, considering the second variable,

the willingness of banks to vary their stock of foreign exchange is an important factor determining the exchange rate. There may be situations where the net inflow of U.S. dollars is positive and significant, but the Brazilian real depreciates since the banks want to increase the long position in dollars. That is to say, the banks offer better prices to deal dollars with primary agents, and therefore the Brazilian real depreciates. Likewise, the opposite situation occurs when there is no net inflow of foreign currency, but the banks want to get rid of long positions in U.S. dollars or increase their short position. In this case, following the same reasoning, the real exchange rate appreciates.

The relevant point- sometimes unidentified in the economic analysis-is that the dynamics of the exchange rate is not necessarily always determined by the flow of foreign exchange resulting from the primary market. Moreover, banks can induce the primary flow by manipulating the exchange rate price since they have access to international liquidity through interbank lines, which is a non-registered operation in the primary market.

The onshore **derivatives market** of foreign exchange has the important function of providing hedge for agents. For the banking sector, it allows the accumulation of spot positions without exposure to the currency fluctuations. Banks with short (long) dollar position in the spot market can hedge themselves by going long (short) in the future market and thus eliminating the risk of exchange rate changes.

There are two particular characteristics of the derivatives foreign exchange market in Brazil. The first is that, unlike other countries, contracts carried out in the over the counter (OTC) market must be registered in authorized institutions, such as Cetip and BM&F[4]. This reporting requirement is necessary in order to consider the derivative contract as legal and enforceable (Dodd & Griffith-Jones, 2007). The second characteristic is the size of the future market, which is disproportionately larger than the OTC market when compared to other countries. This market is distinguished by its transparency and the dissemination of electronic transactions.

In the Brazilian future market, hosted by BM&F, transactions are settled in Brazilian real and therefore there is no effective currency negotiation. Thus, the legislation that affects currency trading in the spot market does not apply to the future market. In the year 2000, non-residents were given permission to act in the future market and since then these agents have been very important in the future dollar trading volume. Between 2006 and 2011, foreigners along with domestic banks

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[4] Cetip is a clearinghouse for custody and settlement and BM&F is the Brazilian stock and futures exchange.

were the most active agents in the future market. According to Kaltenbrunner (2010), the activities of the foreign hedge funds have a central role in this market[5].

The link between the spot and the derivatives markets occurs by the arbitrage conducted by the banks[6]. The excessive supply of dollars in the future market leads the institutions to buy future dollars and sell spot dollars in the primary market or to the Central Bank. The result of this operation is an arbitrage gain with no currency risk and a price adjustment in both the spot and the future markets. It is worth noting that the operation of arbitrage strictly speaking does not constitute a carry trade. Theoretically, it takes place around the covered interest parity equation while the carry trade is a bet against the uncovered interest parity.

The **offshore market** consists of the trading of Brazilian real contracts between the non-residents in a foreign jurisdiction[7]. This market is conditioned by the inconvertibility of the Brazilian currency[8]. For this reason the Brazilian real contracts traded abroad are settled in foreign currency, and therefore there is no clearing in real outside Brazil. That is to say that the price discovery of the Brazilian spot exchange rate is exclusively an onshore phenomenon, unlike the central currencies of the international system. However, this does not exempt the offshore market from exerting an important influence upon the Brazilian exchange rate dynamic.

Offshore markets do not exist in isolation; there are institutions that operate in this market that maintain constant links with the onshore market. The influence of this market in the formation of the exchange rate depends on the balance of operations performed in that jurisdiction. As proposed by He and McCauley (2010), it is important to distinguish the symmetric or asymmetric nature of the use of a currency offshore. In the symmetric use there is an equivalent demand for short and long positions in a way that there is no pressure on the exchange rate onshore. Even so, in the asymmetric use of the currency, the offshore market tends to demand one end of the operation, short or long. In that case, the institutions that operate simultaneously in both markets adjust their

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[5]"A large share of those interviewed declared that foreign institutional investors, primarily hedge funds, have become the most important investor group in driving exchange-rate dynamics in the Brazilian market". (Kaltenbrunner, 2010: 313)

[6]These agents are responsible for arbitrage between these markets due to privileged access to the domestic and the international interbank interest rates, which are the lowest in the market.

[7]It is noteworthy that the concept of offshore market is not defined by geographical parameters. The residents operating abroad must comply with the requirements of Brazilian jurisdiction. Thus, an operation abroad between a resident and a non-resident should be considered an onshore operation.

[8]As in Carneiro (2008), the inconvertibility is considered as the non-performance of the functions of money in the international plan. In practice it refers to the absence of the Brazilian currency as a means of payment that settles contracts offshore.

positions in the onshore foreign exchange market, and thus transmit the buying or selling pressure to this market. In the Brazilian case, due to the interest rate differential, there is a unilateral demand for long positions in real in offshore market. Thus, the offshore institutions cover themselves in the onshore market, mainly in the future market, and therefore transmit a pressure for currency appreciation.

To illustrate this argument, one can think of an offshore bank that offers a client a contract of NDF (Non Deliverable Forward) in Brazilian real. Thereafter, the client assumes a long position in reals and a short position in dollars while the bank takes the opposite end. Thus, the client earns interest differential and the appreciation of the Brazilian currency while the bank pays the interest rate differential and the appreciation of the real. To hedge this transaction, the bank uses the onshore market and sells future dollars at BM&F. Accordingly, the predominance of agents willing to go long in Brazilian reals leads to adjustments of market positions that occurs in onshore market and transmits the pressure for the Brazilian real appreciation.

4.2 Size and Hierarchy

The Figure 4 gives a picture of the Brazilian foreign exchange markets in April 2010[9]. A first look at these statistics highlights a liquidity asymmetry between the derivatives and the spot markets: in April 2010, the turnover in BM&F futures was 440 US$ billions and the offshore market negotiated US$ 390 billion while the spot transactions in the primary market and interbank market were respectively US$ 79 and 71billion. In addition, the primary market was widely dominated by financial operations instead of commercial transactions in a proportion of 67% to 33%[10]. In general, one can say that to understand the exchange rate determination in Brazil, it is absolutely necessary to analyze the financial processes that occur in derivatives and spot markets.

When compared to other developing countries, the size of derivatives market in Brazil reveals to be prominent:

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[9]In April 2010 the last edition of the BIS triennial survey on foreign exchange was undertaken, with statistics on the offshore market. The *Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity* is coordinated by the BIS, and conducted every three years since 1989. In 2010, 54 central banks collected data with 1309 banks and other dealers. Data are collected throughout the month of April and reflect all transactions in that month. See BIS (2010) for more details about the research.

[10] One can say that a market analysis based on a month of the year statistics is not optimal, and those relationships indicated could be outliers. Indeed, nothing guarantees that the offshore market has this pattern of trading volume as determined by the BIS in April 2010. However, it is not the case for onshore e markets on which there is available data series.

The predominance of organized markets is also a characteristic of the Brazilian derivatives market onshore. According to Avdjiev *et al.* (2010), the Brazilian real was the second most traded currency in the organized derivatives market in 2010. In contrast, the financial volume of the foreign exchange derivatives traded on onshore OTC markets is small (US$ 18 billion in April 2010) when compared with other emerging markets[11].

Figure 4: Brazilian real foreign exchange market turnover in April 2010*
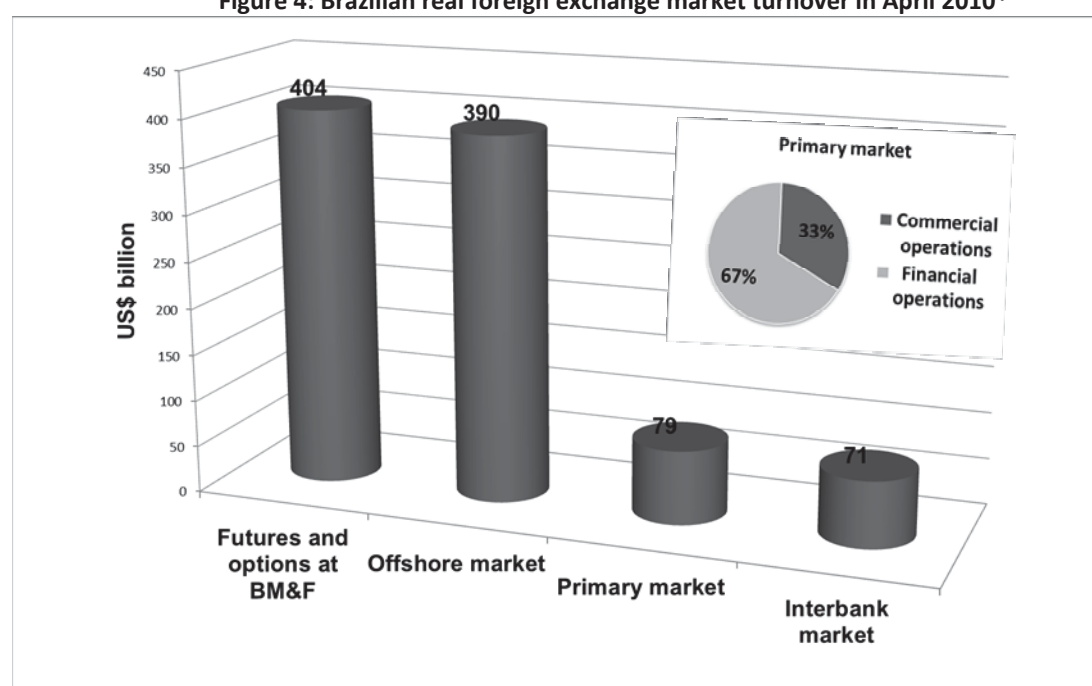
Source: Diagram prepared by the authors on the basis of the data from BIS, BM&F, Brazilian Central Bank and Cetip.
* For the interbank market the volume of the "clearing" at BM&F was considered and added to the interventions of the Central Bank amounting to US$ 3 billion. For this month there was no swap performed by the Central Bank.

When analyzing this huge asymmetry between spot and derivatives transactions, one should take into account that many of the offshore transactions are covered in the derivatives market onshore, which implies a double counting motivated by the action of financial intermediaries. In addition, it should be considered that derivatives are measured in notional values which take in account the leverage inherent in such operations. Even so, the important point to emphasize, as will

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[11]According to Cetip data

be shown ahead, is that exchange rate price is constantly determined at the most liquid market, as occurs with the price formation of any assets.

Figure 5 presents a stylized diagram showing the hierarchy between the different foreign exchange markets of the Brazilian real. The important point is that - due to the liquidity asymmetry - the future exchange rate has more influence in the spot exchange rate than the contrary. The first is determined by the interaction of the derivatives market onshore and offshore, while the price discovery of the spot exchange rate occurs by the interaction of primary flows and interbank market with or without the intervention of the central bank, but subordinated by the pressure carried out by the future exchange rate which is transmitted to the spot rate by the arbitrage made by banks. In the next section those four markets are analyzed separately with regards to the carry trade dynamics and the government policies and these points will be examined in depth.

Figure 5: Hierarchy in Brazilian foreign exchange markets
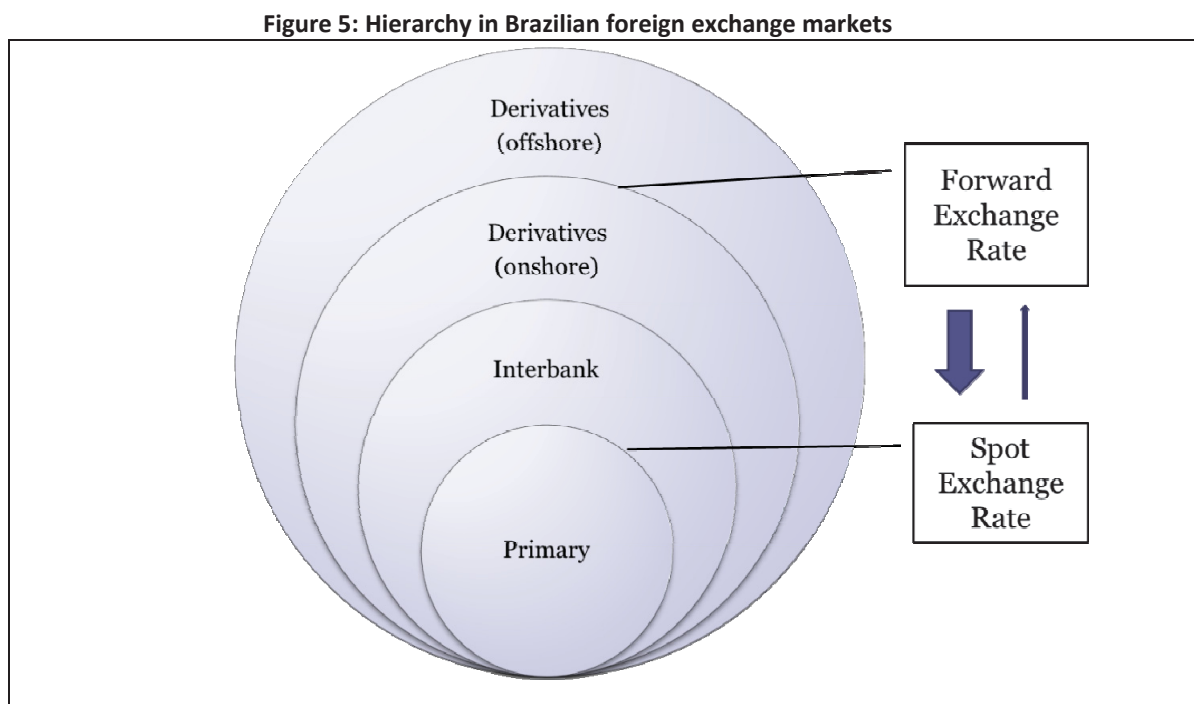
Source: Diagram prepared by the authors.

5. Carry trade dynamics and the government policies

As discussed in the last section, the primary market hosts the transactions between the residents and the non-residents. Those agents operate two categories of transactions in which the carry trade can be identified: financial and commercial. The classical form of carry trade, which we denominate "canonical carry trade", is operated through financial flows related to securities and

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loans. This was the first flow that the Brazilian government attempted to regulate. The first step in capital account regulation started in March 2008 when authorities instituted a 1.5% tax on foreign investments in fixed income. This kind of measure to counteract carry trade evolved, in April 2012, to a 6% tax on all kinds of foreign investments in securities, and in foreign loans up to 5 years of maturity.

The financial flows of equity and foreign direct investment (FDI) are two important loopholes in the Brazilian regulatory framework in such a way that they can hide disguised forms of carry trades. For the equity flows there is evidence of a sophisticated market instrument that allows the transformation of equities in the fixed income instruments. Regarding the FDI, the problem consists of the anticipation of the resources that are intended for the green-field investments.

Some flows classified as commercial also provide forms of carry trade as, for example, the anticipation of export value. There are two forms of anticipation of exports value: the ACC (Advances on Exchange Contracts) and the PA (Anticipated Payment of export[12]) as described in Rossi and Prates (2013). The first uses the domestic banking system as intermediary and the second is a direct credit relation with a foreign bank, and both of them are subject to the physical exportation of merchandises within a stated period. The purpose of these instruments is to provide funding for the production and the commercialization process of a given product. However, these resources can be deviated to fixed income application, characterizing a carry trade strategy. The mandatory exportation of merchandises gives rise to a secondary market of export invoices, where users of the commercial credit lines deal with producers with goods ready to be exported[13]. Aware of these issues, the Brazilian government recently restricted the PA instrument to a yearly operation, beyond which period the operation is considered a regular loan, and thus subject to taxation.

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[12] In portuguese: "Adiantamento de Contrato de Câmbio".
[13]This specific marketis usually calledthe "mercado de performances de exportação".

Table 1: Primary market - flows and regulation

Type of flow	Carry Trade dynamics	Regulation / Exchange rate policy
Financial flows • Debt: securities and loans	• Canonical carry trade	• 6% of IOF in all debt securities and in foreign loans of less than 5 years.
• Equity	• Disguised carry trade	• None
• Foreign Direct Investment (FDI)	• Disguised carry trade	• None
Trade flows • Anticipation of exports value	• Disguised carry trade	• Anticipation restricted to one year
• Secondary markets for export invoices	• Disguised carry trade	• None

Source: Prepared by the authors

As discussed in the last section, the banks have an active role in the foreign exchange market. With regard to the carry trade dynamics, the banks play a specific role by connecting the spot and derivatives market by arbitrage transaction and therefore transmitting the carry trade pressure from derivatives market to spot markets[14]. The price of a future exchange rate real/dollar is given by the covered interest parity developed in a pioneering work of Keynes (1924)[15]:

$$(3) \quad e^f = e^s (1+i^d) / (1+i^x)$$

Where (e^f) is the future exchange rate real per dollar, (e^s) is the spot exchange rate real per dollar and (i^d) and (i^x) are respectively the domestic interest rates and foreign interest rate. In periods of a large supply of dollars in futures markets, the appreciation of the future exchange rate turns this equation into an inequality. Therefore, banks operate as buyers of future dollars and simultaneously they use international interbank lines to borrow dollars abroad and sell them in the primary market or to the Central Bank. The result of this operation is an increase in the "sold" position of banks in spot market and a pressure to appreciate the real. On this subject, it is important to highlight that unlike other financial flows, the interbank lines are not subject to taxes, only to prudential regulation. These are the only foreign exchange transactions between the residents and the non-residents that do not require a foreign exchange contract.

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[14]As stated in Rossi (2011) there is a pattern of formation of positions in derivatives market where domestics banks are nearly always on the opposite side of foreign investors and institutional investors in dollar future contracts.
[15]Keynes´s attention was toward the rapid growth of foreign exchange derivatives markets after the First World War. His analysis was aimed at understanding this market and the price formation in the London future exchange.

Table 2: Interbank market – arbitrage and regulation

Type of flow/ Intervention	Carry trade dynamics	Regulation / Exchange rate policy
Interbank lines	Arbitrage	Prudential: reserve requirements (60%) in sold positions in spot market over US$ 1 bi.
Central Bank intervention	-	Spot purchases and sales

Source: Prepared by the authors.

The Central Bank intervention occurs in the interbank market by means of an auction of the sales and the purchase of dollar, and affects the exchange rate formation by changing the liquidity in this market. The Central Bank is therefore an important player with the capacity to affect price in the interbank market. Besides the non-existence of an explicit rule for those interventions, Figure 8 shows that in general the Central Bank has been acting in a way to neutralize the primary flow. Between January 2006 and February 2012, the Central Bank interventions in the foreign exchange market were almost corresponding to the primary flows in the same period[16]. Nevertheless, in the same period, the Brazilian currency experienced two cycles of appreciation separated by a strong depreciation at the end of 2008.

Figure 6: Primary flows and central bank interventions
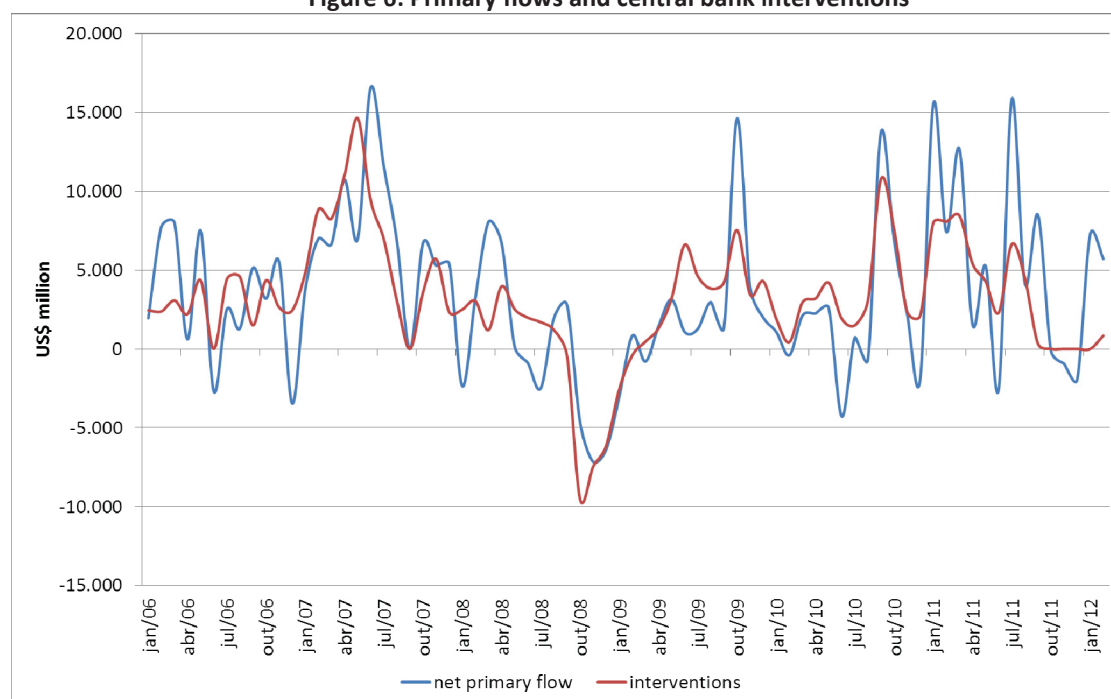
Source: Diagram prepared by the authors on the basis of the data from Brazilian Central Bank

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[16]Between January 2006 and February 2012 the liquid reserve accumulation resulting from Central Bank intervention was US$ 234 billion, while the liquid primary flows was US$ 255 billion.

These data raise an important issue which is: what mechanism explains the recent cycles of appreciation of the real? And the answer is certainly not the primary flow. Instead, the arbitrage-speculation relationship that occurs in interbank-derivative market seems to give a clearer answer to this question.

The derivative carry trade is a fundamental feature in Brazilian exchange rate dynamics. As we have seen in Section 1, the gain of the carry trade depends on a bet that the interest rate differential would be greater than the exchange rate depreciation. The specificity of the derivatives carry trade is that the future exchange of a given pair of currencies brings along the exchange rate differential. In the Brazilian future market, the carry trade assumes the form of a sale of future dollars. The return (Y) of the carry trade can be summarized as following:

$$(4) \quad Y = (e^f_t/e^s_{t+1})$$

Where (e^f_t) is the future exchange rate of real per dollar in period t, and (e^s_{t+1}) is the spot exchange rate of real per dollar at the end of the contract. As the price of future exchange rate follows the covered interest rate parity, as shown in the equation (3), it follows that:

$$(5) \quad Y = (e^s_t/e^s_{t+1})*(i^d - i^x)$$

This means that a positive return (Y > 0) will occur only if the interest rate differential is higher than the effective exchange rate depreciation:

$$(6)(i^d - i^x) > e^s_{t+1} / e^s_t$$

That is to say, when the spot and future markets are perfectly arbitrated, carry trade in future market tends to replicate the results of the *canonical* carry trade, operated in credit markets. In other words, the sale of future dollars is equivalent to incurring a debt in dollars and acquiring a fixed-income asset in Brazilian reals. Even so, it has a specific dynamics.

The appreciation tendencies in the future market arises from the imbalance between supply and demand for future dollars contracts. As in any market, excess supply tends to reduce the price of the contract, and in the foreign exchange market, appreciates the future exchange rate. Thus, a unidirectional speculation causes an excessive demand for long positions in reals, and is responsible

for the formation of trends in the future market. As a consequence it gives rise to an arbitrage where the arbitrators, mainly banks, normalize these price distortions vis-à-vis the spot market, buying the future dollars and selling the spot dollars, and therefore, transmitting the speculative pressure to the spot exchange rate.

Table 3: Onshore derivative market - carry trade and regulation

Type of operation / Intervention	Carry trade dynamics	Regulation / Exchange rate policy
Mainly future contracts	Derivative carry trade	- 6% (IOF) in required margin at BM&F - 1% tax on net positions of agents short/sold in dollar
Central Bank intervention	-	Reverse SWAP (buying dollar forward) SWAP (selling dollar forward)

Source: Prepared by the authors

With regard to the derivative market, the Brazilian government has been acting on two fronts of the exchange rate policy: the intervention front and the regulatory front. The instrument used by the Central Bank to intervene in the derivatives market is the auction of exchange rate swaps. As refereed by the Central Bank, the swap is equivalent of selling the future dollars while the so-called reverse swap is equivalent to the purchase of the future dollars[17]. In the case of a speculative demand for long positions in reals, the Central Bank can avoid the transmission of this pressure to the spot market by taking the opposite end, that is to say buying future dollars through a reverse swap operation.

The intervention policy can be seen as a way to dry the excessive liquidity. But the Brazilian government has been acting also with the purpose of avoiding this excessive liquidity in the derivatives market through taxation. The first measure, adopted since October 2010, is a 6% tax on the required margin for exchange derivatives contracts at BM&F[18]. In July 2011, the government expanded the possibilities of regulating the derivatives market; a provisory measure made it possible to tax the notional amounts of contracts, and to impose other conditions on the negotiation of exchange rate derivatives. In addition, a 1% tax on the notional value of transactions of agents that

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[17]As well as futures contracts, swaps also offer daily adjustments, but unlike the former, there is no central counterpart and contracts are customized with respect to maturity and lots. As an example, the Central Bank can perform a swap of $1 billion divided into three lots that expire on different dates.
[18]The margin required by BM&F varies around 8% to 15% of the notional value of the contract. It is important to note that this margin can be composed of federal government securities, shares and other assets.

have a net short position in dollars was implemented. There are two effects of the measure; the first has a regulatory nature since it allows the government to better monitor the derivative market and the exposure of its agents. The second effect of the measures is to discourage carry trade speculation by taxing the formation of short positions in dollars.

Finally, the offshore market, as seen in Section 4, is very important for the carry trade dynamics since it has the power to enhance the speculative pressure in the domestic derivative market. Although this market is beyond the jurisdiction of the Brazilian government regulation, the exchange rate policies designed for onshore market affects the profitability of carry trade offshore since this market is intrinsically connected to the onshore market through arbitrage channels.

Table 4: Offshore Derivative Market

Type of operation	Carry trade	Regulation / Exchange rate policy
Mainly Non Deliverable forwards (NDF) negotiated by non-residents	Derivative carry trade Assimetrical use of the Brazilian real offshore	None: beyond the jurisdiction.

Source: Prepared by the authors

6. Conclusions

In the recent past, the Brazilian Government has been trying hard to curb the real appreciation and its volatility with reasonable success. It could be argued that without this broad set of policy measures, the interest rate differential would bring the exchange rate to a greater appreciation. However, it is necessary to go deeper in the regulation to avoid further appreciation of the real in a context of liquidity excess and interest rate differential.

In this sense the government should take further steps in the exchange rate policy. The first set of measures could be related to the primary markets with a view to avoiding operations of disguised carry trade. For this it is necessary to improve monitoring and control of trade financing and FDI.

The second set of measures is related to the interbank market. It is necessary to reduce the power of the banks in the formation of spot exchange rate by limiting their role as market makers. More prudential regulation will be needed to restrict the net positions on foreign exchange. Their role as dealers should be magnified. In this field the Central Bank should be the main protagonist, acting as market maker and having an implicit target for the exchange rate.

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Last but not the least, the derivative markets should be reshaped by means of their gradual transference of liquidity to the spot market. This will imply penalizing the speculation operations through taxation and type and volume of margin requirement. At the same time it is imperious to distinguish them from the hedge ones which should have a differentiated regulation.

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