

Foreign exchange swaps: a near substitute for international reserves in peripheral countries? The case of Brazil

João Pedro Scalco Macalós^{*†‡}

October 14, 2017

Abstract

The Brazilian authorities announced in 2013 the biggest program of interventions in foreign exchange (FX) derivatives markets of the country's history. The extensive utilization of FX swaps contrasted with the virtual no utilization of international reserves to counteract the outflow of capital that marked this period. The distinctive aspect of these swaps is that they can affect FX markets without spending any foreign currency. We use GARCH models to assess the relation between the interventions with the FX swaps and the returns of the future BRL/USD exchange rate, presenting evidences that unexpected traditional FX swaps are negatively related with future BRL/USD exchange rate returns. Therefore, they are useful to curb excessive speculative movements in these markets. Moreover, the FX swaps were important to provide hedge before the 2015 exchange rate crisis. In addition, the FX swaps created incentives for commercial banks to bring foreign currency to the country, thereby limiting the pressure on BCB traditional instruments to curb depreciation. However, the costs of using these FX swaps were significant – especially in 2015 – and have important distributive effects. We conclude arguing that the FX swaps expands the room of maneuver of the BCB to intervene in FX markets.

Keywords: Foreign exchange swaps; central bank intervention; derivatives markets; GARCH models

Paper prepared for the 21st FMM Conference: “The crisis of globalization”.
Berlin, 09 Nov - 11 Nov 2017.

*PhD Candidate at Université Paris 13 Sorbonne Paris Cité

†Email address for correspondance: joaomacalos@gmail.com

‡I am very grateful to my supervisors Bruno Martarello de Conti, from University of Campinas (Unicamp) and Jonathan Marie, from Université Paris 13 for all the valuable comments for a previous version of this work. Of course, all the remaining mistakes and imperfections are of my entire responsibility.

1 Introduction

In mid 2013, the Brazilian authorities announced the biggest program of consistent intervention in foreign exchange derivatives that we have knowledge of. This program was known as the “daily feeding program”, since it scheduled daily auctions of foreign exchange swaps – considered as an equivalent to sales of future USD. This program lasted from 2013 to 2015 and in its peak the open position of the Brazilian Central Bank (BCB) in these contracts were equivalent to more than 7% of the Brazilian GDP. The size of these interventions with derivatives contrasts with the virtual no utilization of international reserves to counteract the pressures for the depreciation of the BRL. In fact, during the whole period of the “daily feeding program”, the BCB only sold foreign exchange reserves within agreements to repurchase them in the future, in a clear avoidance to utilize its international reserves – that amounts to around 360 billions USD since 2013. Our objective in this paper is to analyze why the BCB decided to intervene in derivative markets instead of utilizing its international reserves in the descendant phase of the global liquidity cycle, and to assess the efficacy of this strategy.

The work is structured in five sections, including this brief introduction. In the second section we present the structural asymmetries of the International Monetary and Financial System (IMFS) and its hierarchical character, in which only few currencies retain the status of money internationally; in the third section, we argue for the importance of foreign exchange rate policies in countries that issue peripheral currencies; in the fourth section we analyze the efficacy of the foreign exchange swaps interventions in the Brazilian economy, first by analyzing its impact on the returns of the future BRL/USD exchange rate and then by assessing its role in attracting capital to the country and offering hedge to market participants. This section is concluded with an assessment of the costs of the policy. Finally, we conclude the paper arguing that, despite the more constrained internal policy room of maneuver derived from the utilization of FX swaps, they enhanced the capacity of the BCB to undertake countercyclical foreign exchange rate policies.

2 Currency hierarchy and International Monetary and Financial System asymmetries

After the EMEs crises of the 1990s, some mainstream economists argued that some countries are unable to contract foreign debt in their own currencies due to structural features of global financial markets like transaction costs and positive externalities derived from the use of a small amount of currencies internationally. These inability affected the currency composition of their external debt and exposed these countries to currency mismatches, jeopardizing their capacity to undertake counter-cyclical policies (Hausmann and Panizza, 2011). While this approach advanced in highlighting the role of exogenous factors in the buildup of foreign exchange rate crises in peripheral countries, their focus on transaction costs and externalities are too narrow to understand the structural asymmetries in the IMFS. According to Prates and Cintra (2007), the IMFS is characterized by a “flexible, financial and fiduciary” U.S. dollar hegemony. It is flexible and fiduciary because it does not have fixed parity with any other commodity or currency; and it is financial because its role of international store of value is funded on the size

and importance of USD-based financial markets (Tavares and Melin, 1997). As a consequence, U.S. authorities have the privilege to define the basic interest rate of the system and to operate without significant external constraints (Serrano, 2002). This recognition is on the foundation of the currency hierarchy approach, that emphasizes the structurally asymmetric and hierarchical character of the IMFS (De Conti et al., 2014; Prates, 2005; Andrade and Prates, 2013; Carneiro, 2008; Fritz et al., 2014; Kaltenbrunner, 2015). A consequence of this hegemonic character of the USD is that it has virtually no liquidity premium, or no price risk, since it is the global *numéraire* (Carneiro, 2008). On the other hand, all other currencies are measured in comparison to the USD.

Liquidity, therefore, is central for the currency hierarchy approach. De Conti et al. (2014), defines liquidity as the capacity of an asset to be quickly transformed in means of payment without losses to its holder. In the national sphere, this role is fulfilled by the local official money, the mean of payment by definition. After money, there is an hierarchical sequence of IOUs – promises of payment in the future (Bell, 2001; Mehrling, 2013). According to them, there are different layers of money, the central bank being the provider of the most safest of them¹. This interpretation resembles the one by Minsky (1975, p. 74), who derives the “endogenous determination of the effective quantity of money” from the introduction of near monies. A higher utilization of these near moneys increases the overall riskiness of the system, because they are less liquid and are (usually) not under direct regulation of the central bank – the ultimate provider of liquidity to the monetary system. The recognition of these processes led to the idea of the paradox of liquidity, outlined by Lavoie (2014, p. 21), for whom the financial system works in a way that it “seems to increase liquidity when they are really diminishing it”. Lavoie is referring to authors among the Minskyan tradition, like Nesvetailova (2007), whom argue about the progressively “illiquidness” of the financial system, regardless of its tranquil appearances. The result is a more layered financial system, in which “everybody [thinks] that they can easily access means of payment, but with virtually nobody holding safe assets without capital-loss risk“ (Lavoie, 2014, p.21). If agents try to simultaneously cash out these near moneys, i.e., to move away from the farther layers of “liquid” assets, the result is to transform these previously considered-liquid assets in not-so-liquid ones – possibly triggering a debt-deflation spiral.

According to De Conti et al. (2014), an extra conceptual dimension of liquidity is necessary to account for liquidity in the international sphere, since only a handful of currencies – led by the USD – fulfills the roles of money internationally. These authors labels this dimension as “*devis*e” liquidity². Currencies that are liquid nationally and internationally are known as central currencies whereas currencies that does not have money attributes internationally – that are not *devis*e liquid – are know as peripheral currencies. The *devis*e dimension of money liquidity depends crucially on the use of the currency in the international sphere. In other words, it is a structural feature of global economy with geopolitical and geoeconomic determinations, tied to the asymmetries of the IMFS. Hence, it is not something that can be easily created

¹Money is, therefore, understood as a debt relation.

²The origin of the term *devis*e comes from the distinction between *liquidité de la monnaie* and *liquidité de la devis*e in French. The former refers to the money attribute in the national space, whereas the latter refers to the international attribute of money of some specific currencies (De Conti et al., 2014).

through the liberalization of domestic markets. The need of a liquidity premium to demand assets denominated in peripheral currencies are born from the absence of *devise* liquidity.

The characteristics of the demand for different currencies and for the assets denominated on them are crucial to understand the *devise* liquidity dimension. Drawing a parallel with Modern Money Theory, if, in the national sphere, it is the unavoidable need to pay taxes that places State’s liabilities in the top of the money pyramid (Bell, 2001), it is the unavoidable need to meet commitments in one or other currency that defines their position in the international currency hierarchy. That is why the USD – the most used currency in financial markets; international trade; denomination of key commodities; the most important vehicle currency, among other aspects – is the most *devise* liquid currency of the IMFS. The liquidity premia of all other currencies are crucially attached to the capacity to use assets denominated in these currencies to meet outstanding obligations, as well as to its role as international store of value (Kaltenbrunner, 2015; Bonizzi, 2017). Therefore, even if peripheral currencies can easily be converted in central currencies in their national space, foreigners holding assets in these currencies are subject to an important price risk, because the liabilities of these investors are denominated in central currencies. This aspect severely reduces the liquidity of these assets, implying the possibility of capital losses.

Therefore, the best way to represent the currency hierarchy or the money hierarchy in its national and international dimensions is through a matrix, in which we have, in the columns, the “money” hierarchy *à la* Bell (2001) and Mehrling (2013), with money and public bonds – liabilities of the states – representing the most liquid assets, followed by the different layers of financial assets – represented here by M2 and M3 –, which represents the high-yielding less liquid assets in these national spaces. On the rows dimension, we have the currency hierarchy *à la* De Conti et al. (2014) and Prates and Cintra (2007), with the USD as the most *devise* liquid, followed by the other central currencies. On the other side of the matrix are the peripheral currencies, like the BRL, for example. These currencies might have the attributes of money in their national monetary area but do not fulfill this role in the internationally.

Table 1: Currency and money hierarchy

⋮	⋮	⋮
M3	M3	M3
M2	M2	M2
USD (Hegemonic currency)	EUR, JPY, GBP, etc. (Central currencies)	... BRL, ARS, KRW, etc. (Peripheral currencies)
 <i>devise liquidity</i>		

Adapted from De Conti et al. (2014)

Table 1 sums up these relations. The southwest corner of the matrix aggregate the most liquid currencies and assets in the global economy. Moving north or moving east we find the less liquid assets from a global perspective. What become clear is that peripheral currencies and the assets denominated on them are viewed as high-yielding risky assets. The absence of “investment grades” similar to the ones given to central countries, for instance, are a symptom of

it³, as well as the high correlation between peripheral currencies and high-yielding assets in the U.S. (Carneiro, 2008). A similar pattern is identified by Frenkel (2008), who characterizes this structural aspect of the world economy as a “segmented integration” of peripheral countries into world capital markets. Therefore, it should be clear that there is no such thing as perfect asset substitutability in international markets. The liquid premium of a currency is structurally tied to the absence of *devis*e liquidity. Hence, it depends on agents’ (cyclical) liquidity preference.

The most important consequence of this structural feature of peripheral currencies is the volatility of the demand for them. Lacking *devis*e liquidity, these currencies are more demanded in the upper phase of global economic cycles, when agents are accepting higher risks in exchange for higher returns. However, changes in liquidity preference (reduction in the appetite for risk) of foreign investors suddenly diminishes the demand for these assets. As a consequence, peripheral currencies are cyclically liquid, i.e., when international conditions are stable and investors are confident, these currencies can be quickly exchanged for central currencies without capital losses. However, in the case of tighter conditions in global markets, when investors are flying to quality, their liquidity vanishes. It is the paradox of liquidity, but in an inter-currency dimension (De Conti et al., 2014).

It is important to understand what drives these cycles. For Biancareli (2009, p. 9), capital flows to peripheral currencies are always a “consequence of a reduction in liquidity preference in the international level” due to the asymmetries – in special the monetary – of the IMFS. Biancareli (2009, 2011) presents empirical evidences of the influence of the global liquidity cycles on capital flows to peripheral currencies, emphasizing the importance of exogenous factors to peripheral countries as drivers of capital flows. For him, interest rates and growth rates of central economies (firstly the U.S.) are more important than the fundamentals of peripheral countries in the determination of capital flows; as a consequence, “the availability of external financing, in short, is far beyond the control of developing economies” (Biancareli, 2011, p. 4-5). Domestic factors, in his analysis, are important to mitigate the consequences of sudden drains in external funds. Rey (2013, 2016) – emphasizing the “Global Financial Cycle” – and Shin (2016) also presents evidences of the spill-over of U.S. monetary policy to peripheral countries. The latter places great emphasis in the role of USD in the global banking system, arguing that this system – as made by intermediaries of transactions between different currencies – runs on USD, the most important vehicle currency. Since these banks are more exposed to USD liabilities than the agents they’re offering protection, the “value of the dollar is a barometer of risk-taking and global credit conditions. [...]. [A] weaker dollar is associated with greater lending in dollars, lower volatility and more risk-taking, but a stronger dollar is associated with higher volatility and recoiling from risk-taking” (Shin, 2016, p. 9).

These cycles of capital flows are in the core of heterodox analyses of exchange rate behavior. For post-Keynesians, exchange rates are determined by short-term capital flows, which in turn depends on market participants expectations and portfolio decisions (Harvey, 2003; Lavoie,

³During the 2007-08 global financial crisis, even European banks, deemed as safe as the U.S. ones, faced liquidity problems when the funding market for USD froze and they could not refund their activities any longer. The central banks acted fast to build up liquidity facilities in foreign currencies – the foreign currency swap lines – in order to assure financial stability between these two important monetary areas (ECB, 2014). This event, however, highlighted two important facts: funding your activity outside your monetary area is more risky even if your currency is central; and the centrality of the USD in the IMFS.

2014). These authors distinguish between two ideal market participants: “chartists” (speculators) and “fundamentalists”. The former are typically trend chasers, whereas the latter follow fundamental news⁴ about the economy. Speculators can exacerbate exchange rate movements if their relative weight in the market is important. However, in the medium and long run, current account balances are crucial, with balanced results being the gravitational center of exchange rate movements⁵ (Lavoie, 2014).

In peripheral markets, however, the weight of international investors became so important in the last decades that their decisions affects substantially these markets and often guide market expectations. Here lies an important financial asymmetry: peripheral markets are marginal and considered risky in international investors’ portfolios; however, from the standpoint of peripheral countries, these portfolios can be very significant, since their markets are relatively small, and foreigners reallocations of portfolios have significant impacts (Prates, 2002, 2005)⁶. Therefore, the distinctive characteristic of peripheral countries is that the most important “fundamentalist” market participant – international institutional investors – cares more about the fundamentals from the center – the drivers of the global liquidity cycle – than the fundamentals from the countries they are investing in.

The preponderant aspect of exogenous factors guiding exchange rate fluctuations inspired Minskyan interpretations of financial crises in peripheral countries. The first generation of these interpretations surged in the aftermath of the 1990s EMEs crises, and focused on peripheral economic units that were indebted in foreign currency. These authors argued that an increase in capital flows eases peripheral domestic financial conditions and pushes asset prices up. These movements reinforces each other like a financial accelerator, in which the increase in collateral prices increases the creditworthiness of borrowers. Even if governments try to slow down this movement, increasing domestic interest rates, it will further attract foreign capital. However, stability breeds instability, and the continuity of this trend might reduce domestic competitiveness if real exchange rates are appreciating. This reduction have perverse consequences since they accentuate the problems related to currency mismatches. In the case of a rise in liquidity preference globally, the refinancing of foreign debt becomes more expensive, and exchange rates trends moves towards depreciation. As a consequence, the fragility of economic units balance sheets that are indebted in foreign currency becomes visible. If the government are in this situation, they are pushed to adopt pro-cyclical monetary policies in order to attract foreign capital and avoid currency mismatches problems on public debt (Kregel, 2001; Arestis and Glickman, 2002; Boyer et al., 2004). In this case, balance sheet risks are concentrated within peripheral economic units. They face significant exchange rate risk, since sudden devaluations or depreciations would diminish their income in central currencies – a flow problem – at the same time as it would increase the value, in their own currencies, of their foreign debt – a stock problem. Therefore, they could easily become insolvent in the process (Kregel, 2001).

⁴It is important to note that in a Keynesian framework the relevant “fundamental news” are conventionally determined (See Ramos (2016) for a detailed explanation).

⁵The hegemonic currency is a remarkable exception, due to its central role in global financial markets.

⁶According to Bonizzi (2017), in October 2013, 1.85% of institutional investors portfolios were allocated to EMEs bonds and equities; nonetheless, these investments were equal to roughly 21.5% of total EMEs’ portfolio liabilities in this period.

The second generation of these interpretations (De Conti et al., 2013; Kaltenbrunner, 2015; Ramos, 2016; Bonizzi, 2017) surged amidst the “sudden floods” of capital flows in the years 2010 (Silva, 2016), which were marked by the combination of historical low interest rates in developed economies together with aggressive quantitative easing policies and weak growth prospects in central countries, in parallel with a renewed fight for world’s good markets. Simultaneously, carry trade operations – a speculative investment strategy carried usually in derivatives markets that profits from interest rate differentials and exchange rate movements (BIS, 2015; Rossi, 2016) – surged in the world economy. This new environment created different risks and vulnerabilities for financially open peripheral economies. The main aspect of this new generation of Minskyan analysis is a focus on institutional investors as the central economic unit in analysis, emphasizing the behavior of these agents, and the impacts on peripheral economies. Bonizzi (2017) underlines the fact that international institutional investor’s liabilities are very rigid – basically long-term contractual obligations. Moreover, they do not have much flexibility to manage the cash-flow commitments generated by these liabilities. In other words, there is little room for liability management. Therefore, the asset allocation of these investors is their most important decision. Peripheral countries assets are among those that might fulfill their needs, particularly when interest rates are low in central economies. Therefore, “rather than a genuine preference or appetite, it is more a ‘forced’ search that is induced by the liability structure” (Bonizzi, 2017, p. 158) that motivate their adventure into exotic peripheral markets. These developments also explains their active search for hedging. Moreover, as Kaltenbrunner (2015) argues, these investors are always looking for more “liquid” positions in peripheral currencies, like equities or public bonds. Henceforth, their investments constitute a contingent liability in foreign currencies of peripheral countries, since they are always subject to liquidation if global conditions changes. Simultaneously, the expansion of carry trade activity added further pressure on exchange rates regardless of countries fundamentals like their current account, augmenting the perverse feedback between high interest rates and currency appreciations and hiding important fragilities (Flassbeck and La Marca, 2007; UNCTAD, 2007). Henceforth, carry trades not only transmit liquidity cycles to peripheral countries, but also amplifies these countries’ attachment to them (De Conti et al., 2013).

In this scenario, the price risk – of assets and exchange rates – are in the hands of international institutional investors. This represents a more comfortable situation for peripheral economies authorities, since they have more room of maneuver for dealing with their external vulnerabilities⁷. The most important aspect is that they avoid the perverse patrimonial consequences of currency mismatches⁸. However, exchange rates are still volatile and detached from domestic fundamentals, being triggered by sudden changes in liquidity preference of institutional investors and the recomposition of their assets portfolios regardless of domestic fundamentals. Moreover, due to the risks these agents are facing, depreciation events are potentially more intense due to herd behavior typical of turmoils in financial markets.

Summing up, the central idea of these Minskyan interpretations is that exogenous factors lead the formation of expectations in foreign exchange rate markets of peripheral countries.

⁷Souza Rosa and Biancareli (2016) discuss this new situation in the Brazilian economy.

⁸In fact, their balance sheet position gets better in the case of currency depreciation if their foreign assets are larger than their liabilities denominated in foreign currencies

Institutional investors (the “fundamentalists”) actively search for yields – like interest rate differentials – in the upper phase of the cycle. Whether they invest in external debt or directly in peripheral local markets, the effects are similar. In both cases, financial euphoria might rise in local markets. In both cases, peripheral currencies tend to appreciate. While currency appreciation boosts the returns for foreigners investing in locally denominated assets and can stimulate consumption, it hides growing fragilities in the productive sector and jeopardizes the capacity of generating income in central currencies – manifested in increasingly higher current account deficits. Hedge funds (the “speculators”) adds elasticity to the movement with carry trades that reinforce the exchange rate trend. When fundamentals changes in the center – with a rise in interest rates in central economies, for instance –, institutional investors reallocate their portfolios, moving capital out from peripheral countries. These movements exert pressure on exchange rates to depreciate, which creates internal problems for peripheral economies, particularly if they are facing current account deficits. In parallel, speculators start looking for signs of fragilities to execute speculative attacks. The combination of these features leads to a cyclical behavior of peripheral currencies, appreciating in the upper phases of the cycles and depreciating in its descendant phase. Furthermore, this movement is asymmetrical: the expansion is gradual, whereas the reversion is generally abrupt (De Conti et al., 2013; Ramos, 2016). Fueled by speculative attacks, exchange rates often overshoot, leading to maxi-depreciations. Then, when the worst phase of the crisis settles down and the benefits of a competitive exchange rate appears, capital starts inflowing again, restarting the cycle.

Therefore, the policy challenges faced by peripheral countries are multifaceted and dependent on the phase of the cycle. During the upper phase, it have a preventive nature: the authorities must avoid the build up of fragilities. On the descendant phase, they are aimed to control the damage caused by capital outflows and exchange rate depreciation. The room of maneuver is distinct: prevention is executed amidst plenty of foreign resources, while harm reducing measures are conducted with limited foreign resources.

3 The importance of foreign exchange rate policies

According to Ocampo (2012), balance of payments have a major role in peripheral countries macroeconomic dynamics⁹. In particular, the balance of payments exerts a crucial influence on the short-term behavior of these economies, which exert strong pressures on their macroeconomic policies – in particular monetary policy – to be managed in a pro-cyclical way, in order to secure the availability of external funds. As a consequence, authorities have to “fight hard to build the space for effective countercyclical macroeconomic policies” (Ocampo, 2012, p. 2). The main transmission mechanism of this exogenous-led cycles are exchange rates. Two types of policies are generally used to intervene in foreign exchange markets: capital account regulations

⁹This has been a major theme of structuralist economics, with its emphasis on “external gaps” or “Dutch disease” (Ocampo, 2012). Bresser-Pereira (2009, 2012), for instance, has been arguing long the centrality of the exchange rate for development macroeconomic theory and the role played by the Dutch disease in commodity exporting countries like Brazil; and of economic growth with external constraints theories.

and direct market interventions. The focus of this work is on the latter, specially during the descendant phase of the cycle¹⁰.

Direct intervention in foreign exchange rate markets usually take the form of spot market interventions to manage the stock of foreign exchange reserves. After the EMEs crises of the 1990s, several countries started to extensively accumulate reserves, in order to increase their war chest against external shocks, particularly to bridge sudden stops of capital flows (Obstfeld et al., 2010; Ghosh et al., 2012; Cruz, 2015). This reasoning, apart from the recent discussion, is not new. Keynes, in the second volume of his *Treatise on Money*, was already arguing in similar lines:

“[A] central bank must, in determining the normal level of its free reserves, consider the probable maximum amount of (a) the *sudden* fluctuations in the balance of international indebtedness which may occur before there is time to bring other safeguards into operation, and (b) the *temporary* fluctuations against which it ought to be unnecessary to make any fundamental adjustments.” (Keynes, 1930, p. 246-247, , italics on the original)

Keynes was referring to the management of the Indian economy and the India rupee – a peripheral currency – that could face a sudden withdrawal of foreign funds or experience a sharp drop in the value of its exports. Therefore, the accumulation of international reserves has a clear precautionary reason.

In the last 15 years, when liquidity was abundant in international markets – until at least 2013 – several authors had argued that countries that had hoarded foreign exchange reserves were also worried about the competitiveness of their economies. Therefore, they were accumulating foreign resources in order to avoid currency appreciation, in what become known as competitive exchange rate targeting or “neo-mercantilist” strategy (Frenkel and Rapetti, 2015; Levy-Yeyati et al., 2013; Aizenman and Lee, 2007). The important point here is that during the upper phases of the liquidity cycle, peripheral countries authorities have no technical constraint to accumulate reserves, since they can issue their own currency to purchase them (Lavoie, 2014; Frenkel and Rapetti, 2015). Moreover, if they are running on current account surpluses or balanced results, there is also no significant external constraint on their basic interest rates – since they do not need foreign financial resources to finance their current account deficits. When derivatives markets are liquid and important in the formation of exchange rates, direct interventions on these markets can be useful as well (Rossi, 2016).

There is one important caveat that hinders “competitive exchange rate targeting” interventions in the upper phase of the cycle. Inflows of capital can be very important for the internal stability of prices¹¹. This strategy also allows real wages to increase without proportionally increasing wage costs for firms, softening the distributive conflict in the economy. However, the persistence of this strategy usually leads to decreased domestic competitiveness, expressed in larger current account deficits, and augments the vulnerability of peripheral countries to exogenous induced exchange rate variability. These vulnerabilities highlights the importance of foreign exchange rate policy intervention in the reversal of the global liquidity cycle. The point

¹⁰The importance of capital account regulations have been already stressed by several authors from different theoretical backgrounds. See, for instance, Fritz and Prates (2014); Prates and Fritz (2013); Rey (2013); Akerlof et al. (2014); Rodrik (2011); Flassbeck (2001).

¹¹Appreciating currencies make imports cheaper, applying competitive pressures on domestic producers. This foreign exchange anchor is important, for instance, to dismantle hyper-inflationary processes.

here is to reduce the damages of sudden depreciations in the economy and try to soften the movement of the exchange rate to a new level consistent with the global macroeconomic conditions. However, the descendant phase of the cycle presents challenges of different nature to peripheral countries, especially if they are running on current account deficits. In this case, to sustain these deficits without adjusting exchange rates, either the incentives for capital inflows must be raised, since the premium demanded for investing in assets without *devises* liquidity increases, or a part of these deficits will need to be financed with the use of foreign exchange reserves. But now the capacity to intervene directly in the markets are strictly limited by the amount of international reserves in the hands of peripheral countries authorities (Lavoie, 2014; Frenkel and Rapetti, 2015). Furthermore, speculators are often searching for a sign of weakness that might trigger a speculative attack on peripheral currencies, testing the authorities' capacity and willingness to resist. The more liquid and accessible are the foreign exchange derivatives markets, the more intense these attacks can be. Resisting or not, the costs of these events are often very high (Farhi, 2001, 2006).

To understand why authorities try to preserve exchange rate stability in the descendant phase of the cycle, it is important to understand the following dilemma: why postpone depreciation, if it is desirable in the medium run to return the current account back to a balanced result? First, abrupt depreciation can have negative patrimonial impacts if there are currency mismatches – even sectoral mismatches can have significant impacts if concentrated in key sectors – in the economy. A depreciation of the currency is also similar to a cost shock on inflation, and can lead to higher interest rates, which in turn affects negatively the economic activity.

Therefore, central banks usually tries to soften depreciation (devaluation) pressures, while offering hedge to the public. However, if agents lose confidence in the currency's exchange rate, they will run for central currencies or for hedge opportunities. This will be even more pronounced if the agents are indebted in foreign currencies. In this case, their solvency depends on closing the mismatches in their balance sheets. Farhi (2001) makes an important analytic distinction: if speculative attacks target a fixed exchange rate regime, their impact will be felt on central bank foreign exchange reserves; if they attack a floating regime, the impact will be felt on the exchange rate. Nowadays, pure¹² exchange rate regimes are uncommon, but the analytical distinction is important, since the drain on foreign exchange reserves reflects the willingness of the central bank to defend a desired currency parity or trajectory – even when it is not declared.

Liquid derivatives markets also increase the instability of foreign exchange rate markets in the descendant phase of the liquidity cycle, due to the leveraging they allow. Derivatives markets allows speculators to bet on price variations without having the asset, increasing the volatility of prices (Carneiro et al., 2015). Furthermore, uncovered positions also destabilize the markets and reinforce one sided movements (Farhi, 1999, 2001). Franco (2000, p. 57), a former president of the BCB, highlights the fact that while a speculator can leverage his positions several times in derivatives markets that communicates instantaneously with spot markets; the authorities facing these attacks are constrained by their stocks of foreign reserves and cannot leverage. He then wonders if it is not the case for direct interventions in the derivatives markets, in order to allow the government to “fight fire with fire”.

¹²Hard pegs or free floating.

Simultaneously, local authorities must assure a good supply of hedge opportunities to preserve financial stability, and derivative contracts can be very useful in this regard. The leverage allowed in derivatives markets make these hedge cheaper for market participants. However, derivatives markets disappears if there is no opposite positions. Therefore, if the expectations are too one sided, they vanish. Foreign exchange derivatives markets of peripheral countries are particularly prone to fade since these currencies have no *devis*e liquidity. Therefore, another important role of exchange rate policy in peripheral countries is to be a market maker of foreign exchange derivatives markets – which are responsible for providing cheap hedge – in turbulent times (Farhi, 2001, 2006).

The foreign exchange swaps, a derivative contract offered by the BCB, can substitute the use of international reserves in at least three aspects on the reversal of the cycle. It can be used to provide foreign exchange hedge opportunities for market participants, “making the market” of foreign exchange derivatives amidst widespread expectations for depreciation. The central bank act as a “long ‘local currency’ ” counterpart of last resort, and the intervention is aimed to preserve financial stability, since it avoids currency mismatches (Dodd and Griffith-Jones, 2007; Prates and Farhi, 2015b). It can also provide a bridge for foreigners to bear exchange rate derived capital losses, helping to preserve asset prices in the markets foreigners had invested. The FX swaps can also create incentives for commercial banks to borrow USD abroad and invest these resources domestically, increasing their negative FX spot position and thereby limiting the pressures on foreign exchange reserves to cover current account deficits and on the basic interest rates to attract foreign capital (Garcia and Volpon, 2014). Finally, they can be used to affect market expectations, inducing speculators to losses and thereby curtailing excessive exchange rate variability (Rossi, 2015). Furthermore, the fact that Brazilian derivatives markets are totally settled in BRL adds an important advantage for the use of FX swaps in the country: the BCB can intervene in foreign exchange markets without spending a dollar, and also profits from the leveraging typical of derivatives markets.

Therefore, the FX swaps can be used to achieve similar objectives than the ones pursued by central banks when they are selling foreign exchange reserves during the reversal and descendant phase of the liquidity cycle, without losing their foreign assets. Since international reserves had become an indicator of a country’s economic “health”, it becomes even more important to preserve them. After the GFC, Aizenman and Sun (2012) noted that reserves were seldom used and then quickly recomposed. Cheung and Sengupta (2011) highlights the “keeping up with the Joneses” behavior of countries hoarding reserves, mirroring the strategies of their neighbors in a run for reserves. Therefore, selling foreign exchange reserves might be seen by foreign investors as a sign of weakness, triggering speculative attacks on the currency. Eichengreen (2016) rationalizes this as both an information asymmetry and a misperception of international reserves adequacy parameters – ceilings are regarded as floors by investors. Therefore, they expect that these thresholds should not be trespassed, which inhibits the use of foreign exchange reserves to cope with balance of payments problems, the reason these reserves were hoarded in the first place¹³. In the rest of this paper, we evaluate the use of FX swaps by the Brazilian authorities between 2011 and 2016.

¹³I am thankful to prof. Pedro Rossi, who first pointed this aspect to me.

4 The foreign exchange swaps policies

4.1 Peculiar foreign exchange rate markets

The Brazilian foreign exchange market is quite unique. It is segmented in four parts: the primary market; the secondary (interbank) market; the derivatives markets onshore; and the derivatives markets offshore. However, this segmentation does not mean that they are isolated from each other. In fact, there are “communicating vessels” between them which transmit the pressures from one to another (Prates, 2015). It is only on spot markets that it is possible to exchange BRL for foreign currencies. Nonetheless, these operations are very restricted by the Brazilian authorities, and only authorized dealers (mainly commercial banks) are allowed to hold positions on foreign currencies. On the other hand, the derivatives markets onshore does not involve any transaction with foreign currency and, as a consequence, has much less restrictions (Dodd and Griffith-Jones, 2007; Prates, 2015; Rossi, 2016).

The most important and peculiar “communicating vessel” is the one that connects derivatives and spot markets onshore. According to several authors, the BRL/USD exchange rate is formed in future markets and then transmitted to spot markets (Franco, 2000; Garcia and Urban, 2004; Dodd and Griffith-Jones, 2007; Ventura and Garcia, 2012; Prates, 2015; Rossi, 2016). To fully grasp this phenomenon, it is important to understand the meaning of the future price of a foreign currency¹⁴. According to Rossi (2016), future prices express arbitrage conditions between future and spot markets. Regardless of what the name might suggest, the future¹⁵ price of the USD is not the expected price of the USD in the future¹⁶, but expresses a relation between the domestic and the relevant foreign interest rate that are known in the present. In other words, they are not good predictors of the future prices of the USD¹⁷.

Therefore, the relation between future and spot prices in Brazilian foreign exchange markets are determined by the key actors that are in both markets: the commercial banks. This relation is expressed by the covered interest parity (CIP) condition:

$$USD^f = USD^s \cdot \frac{(1+i)}{(1+q)} \quad (1)$$

Where USD^f and USD^s means the future and spot BRL/USD exchange rate, respectively; i represents a local interest rate, and q is an onshore USD interest rate known as “*cupom cambial*”. The *cupom cambial* rate is a structured operation combining an investment that

¹⁴For simplicity, we are going to use USD from now on as a replacement foreign currency, since we are basically dealing with the BRL/USD exchange rate.

¹⁵Or forward, if we are dealing with non organized markets.

¹⁶This would be true only if the uncovered interest parity condition holds all of the time. However, the validity of this condition has scarce empirical evidence. However, UIP remains the basis of the more orthodox interpretations of foreign exchange markets. The failure of UIP is closely connected to imperfect asset substitutability in the world markets (Lavoie, 2002). See also Sarno and Taylor (2002) for a review of the empirical (orthodox) literature regarding this failure.

¹⁷This interpretation closely resembles the post-Keynesian interpretation of the relation between forward and spot rates, known as the “Cambist View” (Lavoie, 2014). In the latter, “the spread between forward rates and spot exchange rates is administratively set by foreign exchange dealers, on the straightforward basis of the interest rate differentials on the euro-currency markets that are accessible to the banks making the deal” (Lavoie, 2014, p. 482).

earns the Brazilian interbank deposit (DI) rate with a foreign exchange hedge; the result is a synthetic USD interest rate, but settled in BRL (Rossi, 2016). Due to the institutional aspects of the Brazilian foreign exchange markets, the spot markets are decentralized, whereas future BRL/USD rates are defined at the BMF&Bovespa Exchange. Therefore, the pressures that influences the BRL/USD exchange rate in the medium and long run are first felt in the future BRL/USD rate. This will alter the “*cupom cambial*”, which in turn will lead the commercial banks – profiting from their privileged position between both markets – to readjust their prices in the spot market, thereby keeping the CIP condition valid (Prates, 2015; Rossi, 2015).

Therefore, the Brazilian foreign exchange market present interesting peculiarities. First and most important, the onshore derivatives markets, determinant for the BRL/USD exchange rate formation, are totally settled in BRL. Moreover, several empirical studies had shown that, in Brazil, it is the spot price of USD that adjusts to the price of future¹⁸ USD. This relation is crucial to understand the FX swaps policies, since they affect directly the future BRL/USD exchange rates.

4.2 Definition of the foreign exchange swap

The FX swaps consists in a derivative contract in which the BCB swaps a domestic interbank deposit (DI) rate for an onshore USD interest rate (the “*cupom cambial*”) plus the BRL/USD exchange rate variation with an authorized counterpart. The FX swaps are registered at the BMF&Bovespa, and can be used as collateral in any other foreign exchange operation. Each FX swap contract has the notional value 50,000 USD; however, in the FX swap contracts the principal is not delivered. The contracts are designed to offer daily¹⁹ margin adjustments of the different financial returns in order to keep the notional value of the contract stable.

When the BCB auction FX swaps, it can take either a long position in BRL (short in USD) or a short position in BRL. The former is labeled as traditional FX swaps interventions by market conventions²⁰. In this case, the BCB receives the interest rate differential (DI rate minus the *cupom cambial*) and pays the BRL depreciation, if the BRL/USD exchange rate increases, or receives the BRL appreciation if the BRL/USD exchange rate falls. Traditional FX swaps are usually considered equivalent to sales of future USD contracts, since they are expected to push futures USD down and the *cupom cambial* up in the process. Therefore, we expect traditional FX swaps to be related with downward pressures (for appreciation) of the BRL. On the other hand, when the BCB takes a short position in BRL (long in USD), it is auctioning a reverse FX swap contract²¹ In this case, the BCB is in the opposite position of the traditional FX swap case.

¹⁸The first maturity future BRL/USD exchange rate.

¹⁹Until 2013, the contracts available in the BMF&Bovespa specified only periodical adjustments to be defined in the beginning of the contracts. However, according to Bevilaqua and Azevedo (2005), these contracts were perceived as less risky than other public instruments because they offered daily adjustments and because they were Exchange traded already in their first uses.

²⁰Also known as purchase contracts of FX swaps.

²¹Also referred as sales of FX swaps.

4.3 Can the BCB affect the BRL/USD exchange rate?

The objective of this subsection is to analyze the relation of the FX swaps interventions with the BRL/USD exchange rate variation and volatility. More specifically, the questions we try to answer are the following: there is any relation between the BCB interventions through its FX swaps and the returns of the future BRL/USD exchange rate? How did the future BRL/USD exchange rate variability behave between 2011 and 2016?

4.3.1 Database

We use daily data from the beginning of 2011 (January 3rd) to the end of 2016 (29th of December). The whole sample has 1441 observations, counting only the business days in which the BMF&Bovespa was operating. The choice of the future BRL/USD exchange rate as dependent variable is related to the fact that is this rate that is directly affected by the FX swap interventions. The future BRL/USD exchange rate chosen is the one that will be settled in $t+1$ – the most liquid future contract. This future BRL/USD exchange rate is traded at BMF&Bovespa. The data was obtained at the Reuters *Datastream*. The future BRL/USD exchange rate is plotted in Figure 1. As we can see, it varied from 1.7 to 2.25 BRL/USD between 2011 and 2014, when it sharply depreciated, peaking 4.19 BRL/USD in September 2015, and then re-appreciated to a lower level in 2016.

Figure 1: Future BRL/USD Exchange Rate, 2011 to 2016.



The next variables of interest are the BCB interventions through FX swaps²² All of the information covering the FX swaps interventions utilized in the econometric²³ analysis were retrieved from the BCB²⁴ and released on a monthly basis. The FX swaps interventions by the BCB went through different phases. In order to enrich the analysis, we divided the interventions

²²From 2011 to 2016, two types of swap contracts were issued by the BCB. The first was the “SCC” contracts, where the period of adjustments was defined by BMF&Bovespa at the beginning of each contract. The second type of contracts are the “SCS” contracts. In these, the respective interest rate is the daily effective interest rate computed in the Selic system. This is the effective interest rate that remunerates the “repurchase agreements” operations, the standard monetary policy instrument of the BCB. Another important aspect of “SCS” contracts is that periodic adjustment of positions occurs on a daily basis, using the BMF&Bovespa “Selic x dollar” referential rate. From June 2013 on, only “SCS” contracts were opened in the market.

²³I am very grateful to Marcus Frazão, member of the BCB who recently defended his thesis on the topic (Frazão, 2017) and kindly shared his database with me.

²⁴Notas para Imprensa: mercado aberto, available at <http://www.bcb.gov.br/htms/infecon/demab/default.asp>

in different types. First we divided the interventions between traditional and reverse auctions; then we divided them between expected and unexpected interventions; finally, we divided expected traditional interventions between *ad hoc* ones, meaning that they were not part of any previously announced group of interventions, the interventions that belonged to the “daily feeding program” intervention announced in 2013 that occurred between the 23rd of August 2013 and 31st of March 2015, and the interventions that only renewed existent contracts. Since the renewals and the contracts auctioned during the “daily feeding program” were all traditional swaps, we ended with six types of intervention²⁵: expected *ad hoc* traditional swap contract (*swd*); expected “program” traditional swap contract (*swdp*); expected “roll-over” traditional swap contract (*swdr*); unexpected traditional swap contract (*swdne*); expected *ad hoc* reverse swap contract (*swe*); and unexpected reverse swap contract (*swene*).

Finally, we added two control variables, in order to isolate the effect of FX swap interventions from the effect of other relevant variables for the behavior of the BRL/USD future exchange rate. They are: an index for the global price of commodities; and the level of the VIX variable. The commodity index is the S&P GSCI, and was obtained at the *Reuters Datastream* database. The inclusion of this variable follows mainly [Kohlscheen \(2014\)](#) whom finds evidences of a co-integration relation between the BRL and the price of commodities. The other control variable is the VIX. It measures market expectation of near term volatility conveyed by stock index option prices in the Chicago exchange. The original source of the VIX data is the Chicago Board Option Exchange and it was retrieved from the FRED database²⁶. The literature generally uses the VIX to proxy for the liquidity preference – or the appetite for risk – among international investors (see, for instance, [Rey \(2015\)](#) or [Ramos \(2016\)](#)) with significant results. When the VIX increases, liquidity preference in financial markets are said to be higher, or the appetite for risk from investors are lower.

4.3.2 Estimation

The presence of volatility clusters on the returns of the future BRL/USD exchange rate (*ret.er*)²⁷ induced us to utilize Autoregressive conditional heteroskedasticity (ARCH) models ([Engle, 1982](#); [Glosten et al., 1993](#); [Zakoian, 1994](#); [Nelson, 1991](#)). As is usual with financial data, we log transformed the variables of interest. Since the evidences suggested that both the log transformed BRL/USD future exchange rate and the controls VIX and commodity index are integrated of order one, we included these variables in their first differences²⁸. The control variables were included only contemporaneously. We use dummies for the FX swaps, and added them contemporaneously and with two lags, with the exception of unexpected interventions, which were included from lag 1 onwards²⁹.

²⁵There were some days in which the BCB intervened offering more than one type of contract. Particularly, it was very common in 2014 to have simultaneously the renewal of contracts at maturity and the issue of new contracts. To better distinguish the periods, however, we classified as “roll-over” days only those in which no new contract were issued, i.e., when only renewals happened.

²⁶<https://fred.stlouisfed.org/>

²⁷Evidence further reinforced by a Ljung-Box test on its squared values and by an Arch-LM test on *ret.er* that suggested the presence of heteroskedasticity.

²⁸A more detailed analysis of these tests can be found on [Macalós \(2017\)](#) and are available upon request.

²⁹The reason behind this choice is that the time frame of unexpected interventions varied substantially during the day, with interventions occurring even in the end of the BMF&Bovespa sessions. This suggests that unexpected

The baseline model for the conditional mean equation has 18 external regressors. An autoregressive term was included to remove the autocorrelation among the residuals of the model. This baseline specification can be stated as:

$$\begin{aligned}
ret.er = \mu + ret.er_{t-1} + \sum_{i=0}^2 swd_{t-i} + \sum_{i=0}^2 swdp_{t-i} + \sum_{i=0}^2 swdr_{t-i} + \sum_{j=1}^2 swdne_{t-j} + \\
\sum_{i=0}^2 swe_{t-i} + \sum_{j=1}^2 swene_{t-j} + d.l.comm_t + d.l.vix_t + u_t
\end{aligned} \tag{2}$$

Where swd_{t-i} takes the value of 1 for days in which the BCB auctioned *ad hoc* purchase swap contracts and 0 otherwise; $swdp_{t-i}$ takes the value of 1 for days classified as “program” and 0 otherwise; $swdr_{t-i}$ takes the value of 1 in exclusive “roll-over” days and 0 otherwise; $swdne_{t-j}$ takes the value of 1 for days classified as *ad hoc* non expected auction of purchase swap contracts and 0 otherwise; swe_{t-i} takes the value of 1 for days classified as *ad hoc* auction of a sale contract and 0 otherwise; and lastly $swene_{t-j}$ takes the value of one for days classified as *ad hoc* non expected auction of sale swap contracts and 0 otherwise.

To model the conditional variance, three models were selected: GARCH(1,1); GJR-GARCH(1,1); EGARCH(1,1). Their specifications are, respectively, the following:

$$\sigma_t^2 = \omega + \alpha u_{t-1}^2 + \beta \sigma_{t-1}^2 \tag{3}$$

$$\sigma_t^2 = \omega + (\alpha u_{t-1}^2 + \psi u_{t-1}^2 d_{t-1}) + \beta \sigma_{t-1}^2 \tag{4}$$

$$\ln(\sigma_t^2) = \omega + (\gamma u_{t-1} + \rho(|u_{t-1}| - E|u_{t-1}|)) + \beta \ln(\sigma_{t-1}^2) \tag{5}$$

Where u_t are the residuals from the mean equation. We first estimated with normal distribution of the standardized residuals of the conditional mean equation and then using skewed Student distributions for fitting these standardized residuals. The EGARCH model with skewed Student distribution of the standardized residuals (EGARCH.s.t.) is the one which minimizes all of the selection criteria. Nonetheless, is important to remark that the results are consistent between different specifications. The estimated parameters are presented in Table 2. Weighted Ljung-Box tests shows no evidence of autocorrelation among the residuals and the squared residuals, and Arch-LM tests indicates no signs of remaining heteroskedasticity. Robust standard errors based on the method of [White \(1982\)](#) were used to compute the p-values.

interventions are reactions to specific movements of the future BRL/USD exchange rate. Therefore, its better to assess its relation with the *ret.er* on the days following the auctions. On the other hand, expected interventions were announced in the day before their auction and the accepted offers were usually released before the opening of the market or in its first hours ([Frazão, 2017](#)).

Table 2: Impact of swap operations on BRL/USD future exchange rate returns

D.V. <i>ret.er</i>	GARCH	GJR-GARCH	EGARCH	GARCH.s.t	GJR-GARCH.s.t	EGARCH.s.t
μ	0.0215	0.0384	0.05134*	0.0290	0.0346	0.0419**
<i>ret.er</i> _{t-1}	0.0364	0.0459	0.0524	0.0518	0.0538*	0.0602**
<i>swd</i> _t	-0.0933	-0.1295	-0.0585	-0.0501	-0.0613	-0.0474
<i>swd</i> _{t-1}	-0.2156	-0.2214	-0.1847	-0.2025	-0.1936	-0.1901
<i>swd</i> _{t-2}	0.1107	0.0566	0.0890	-0.0497	-0.0487	-0.0509
<i>swdp</i> _t	-0.1710	-0.1683	-0.1951	-0.1361	-0.1470	-0.1384
<i>swdp</i> _{t-1}	0.1624	0.1578	0.1376	0.1223	0.1201	0.0975
<i>swdp</i> _{t-2}	-0.0132	-0.0053	0.0286	0.0181	0.0281	0.0339
<i>swdr</i> _t	0.1571	0.1843	0.2158	0.1367	0.1495	0.1536
<i>swdr</i> _{t-1}	-0.2972	-0.3390	-0.3081	-0.2413	-0.2519	-0.2026
<i>swdr</i> _{t-2}	0.1873	0.1883	0.1241	0.1280	0.1167	0.0504
<i>swdne</i> _{t-1}	-0.2390**	-0.2366**	-0.2134*	-0.22340*	-0.2406*	-0.2136*
<i>swdne</i> _{t-2}	0.0313	0.0657	0.0511	0.0620	0.0691	0.0566
<i>swe</i> _t	0.1908	0.2013	0.1579	0.2194*	0.2298*	0.2068***
<i>swe</i> _{t-1}	-0.1227	-0.1533	-0.1983	-0.2082	-0.2231	-0.2393***
<i>swe</i> _{t-2}	-0.1446	-0.1449	-0.1070	-0.0805	-0.0811	-0.0908
<i>swene</i> _{t-1}	0.0989*	0.1028	0.1136	0.0896	0.0890	0.0947
<i>swene</i> _{t-2}	-0.0260	-0.0276	-0.0724	-0.0078	-0.0086	-0.0289
<i>comm</i> _t	-0.1458***	-0.1399***	-0.1376***	-0.1288***	-0.1285***	-0.1279***
<i>vir</i> _t	0.0133***	0.0120***	0.0118***	0.0117***	0.0113***	0.0110***
ω	0.0088*	0.0079**	-0.0021	0.0092*	0.0087**	-0.0117
α	0.1242***	0.1443***		0.1245***	0.1491***	
β	0.8747***	0.8916***	0.9786***	0.8744***	0.8808***	0.9762***
ψ		-0.0820***			-0.0640**	
γ			0.0684***			0.0597***
ρ			0.2058***			0.2274***
<i>shape</i>				5.6500***	5.7917***	5.9609**
<i>skew</i>				1.0901***	1.0869***	1.0908***
Log-likelihood	-1692.23	-1684.148	-1680.472	-1650.788	-1648.29	-1645.382
<i>Q</i> (1)	0.448	0.709	0.941	0.686	0.749	0.953
<i>Q</i> (2)	0.512	0.827	0.905	0.779	0.870	0.904
<i>Q</i> (5)	0.592	0.792	0.839	0.744	0.824	0.834
<i>Q</i> ² (1)	0.871	0.578	0.471	0.970	0.847	0.618
<i>Q</i> ² (5)	0.895	0.917	0.774	0.879	0.935	0.829
<i>Q</i> ² (9)	0.908	0.930	0.888	0.898	0.919	0.887
Arch-LM(3)	0.317	0.654	0.322	0.304	0.636	0.327
Arch-LM(5)	0.603	0.775	0.588	0.546	0.672	0.522
Arch-LM(7)	0.646	0.774	0.722	0.612	0.678	0.631

All variables in these models have 1438 observations.

ret.er, *l.comm* and *l.vir* are pre multiplied by 100.

***: p-value smaller than 1%; **: p-value smaller than 5%; *: p-value smaller than 10%.

Q(1, 3, 5) refers to the p-values of the weighted Ljung-Box (for 1, 3 and 5 lags) tests for the residuals of the model.

*Q*²(1, 5, 9) refers to the p-values of the weighted Ljung-Box (for 1, 5 and 9 lags) tests for the squared residuals of the model.

Arch-LM(3, 5, 7) refers to the p-values of the weighted Arch-LM test (for 3, 5 and 7 lags) for detecting signs of heteroskedasticity.

4.3.3 Discussion of the results

Looking at Table 2, we can see that unexpected traditional FX swaps auctions by the BCB have a significant negative relation with *ret.er* in the day after the intervention. This relation suggests that the BCB can affect the level of the exchange rate through its FX swaps, if it intervenes unexpectedly. This result is in line with our theoretical expectations, in which, following Rossi (2015), unexpected interventions might induce losses to speculators and disturbs their references, curbing future speculative movements. This result is also in line with the results found by Janot and Macedo (2016), who also measures the daily impact of FX swap interventions. They also finds that unexpected purchases are individually significant and negatively related to *ret.er*.

The other significant coefficients are from *ad hoc* FX swap sales by the BCB. Their significance, however, is not as robust as the *swdne*, and its effect tend to fade away. As was expected, both *d.l.comm* and *d.l.vix* presents a strong relation with the *ret.er* and with the sign expected. The BRL seems to be positively related (pressure for depreciation) with commodities prices. Furthermore, the *ret.er* are positively related with variations on the VIX. This result is also in line with our expectations: an increase in global liquidity preference – proxied by the VIX – add pressure for a depreciation of the BRL.

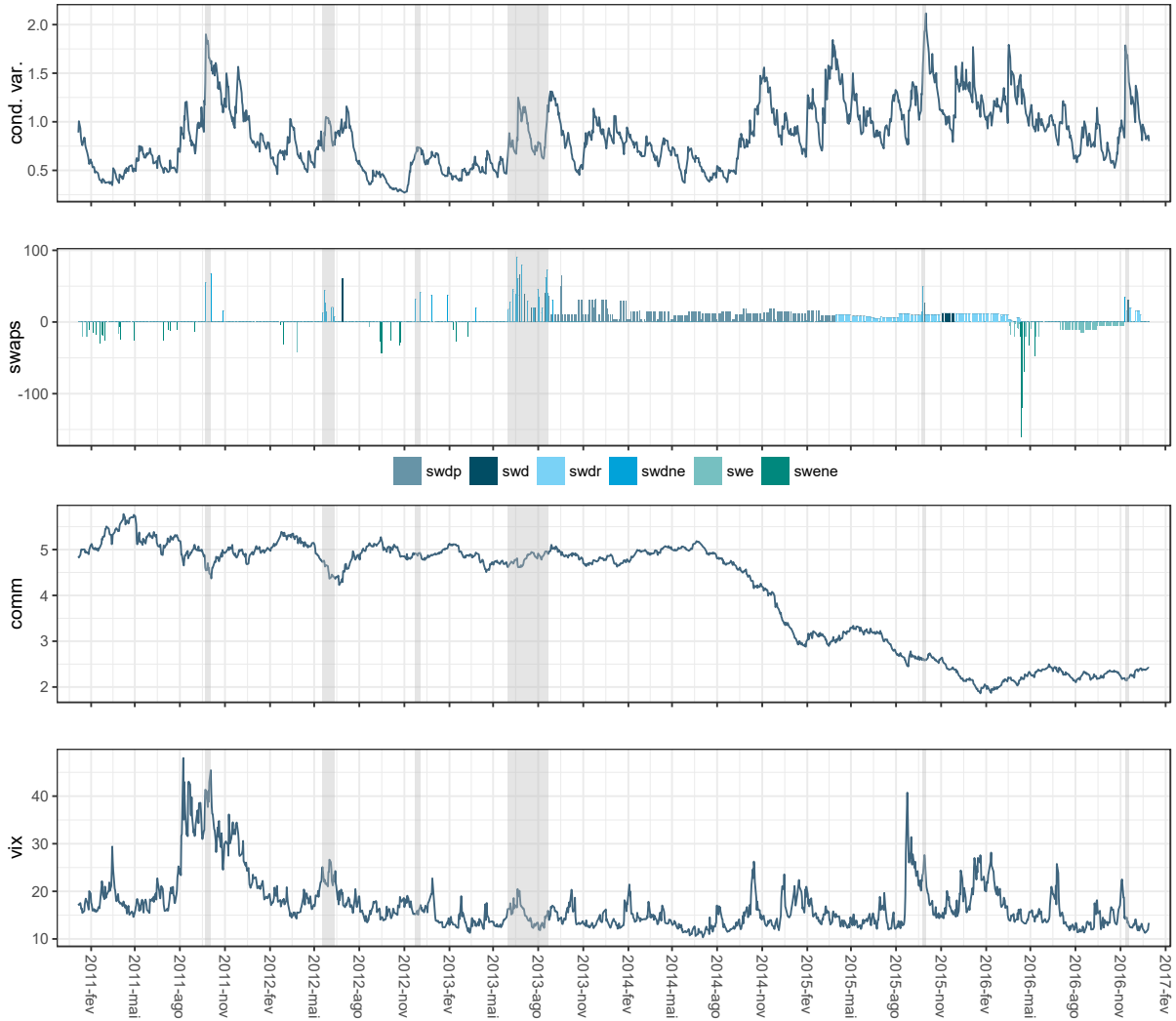
The last point to discuss is the relation between the FX swap interventions and the volatility of *ret.er*. Besides providing hedge to investors, the BCB mentioned the role of FX swaps in diminishing the Brazilian foreign exchange markets’ volatility. The literature, however, does not find conclusive evidence in this regard (Janot and Macedo, 2016; Marins et al., 2015; Frazão, 2017).

In our tests, asymmetric GARCH specifications were always better fitted to the data than the symmetrical specification. Moreover, the signs of the parameters ($\gamma > 0$ and $\psi < 0$) constitute evidences that past positive returns generates more variability afterwards than past negative returns. In other words, past increases in the price of future USD (BRL depreciation) had a higher impact on the variability of the future BRL/USD exchange rate than past appreciation of the BRL. This result is important and provides further evidence that the BRL (a peripheral currency) behave like a financial asset (De Conti et al., 2014), and that depreciation events are more intense than appreciation of the BRL, providing further evidence of the Minskyan interpretation of peripheral exchange rates behavior, as discussed in Section 2.

In Figure 2 we plot the estimated conditional variance together with the series used as external regressors in the mean equation of our models. The FX swap interventions are measured in contracts to better illustrate it, and the periods in which the BCB auctioned unexpected traditional FX swaps (*swdne*) are highlighted in gray.

It is visible that unexpected traditional FX swap auctions occurred close to peaks of high variability periods in November 2011, June and December 2012, related to the European crises or signs of reduction in commodity prices. Then, in 2013, it was the beginning of the “taper tantrum” in the U.S., which started a new phase of more constrained liquidity globally. Until September 2015, when the BCB utilized unexpected traditional FX swaps again, two periods of concentrated volatility happened. The first were around the presidential elections between September and October 2014, and just after commodity prices started to fall; the other was between March and April 2015, when the political turmoil in Brazil was accentuating. In these

Figure 2: Estimated conditional variance of *ret.er* and its external regressors



last cluster of increased volatility, the internal room of maneuver of Brazilian authorities to use FX swaps were stretched, and they already had signaled the intention of ending the “daily feeding program”. However, the increased volatility in September 2015 pushed the BCB to auction new traditional FX swaps unexpectedly. The future BRL/USD were depreciating very sharply, reaching the single largest daily variation in the 24th of September 2015. The BCB intervened unexpectedly on the 23rd and 25th of September, and also with *ad hoc* traditional auctions on the 24th and 29th of September. With these interventions, the BCB signaled to the market that it was willing to intervene – even after the end of the program and amid raising concerns about FX swaps costs – if the variability of the BRL was excessive. Finally, the last window of unexpected intervention was in November 2016, after the election of Trump to the U.S. presidency, when financial markets started to expect an increase in U.S. interest rates due to expected higher fiscal deficits.

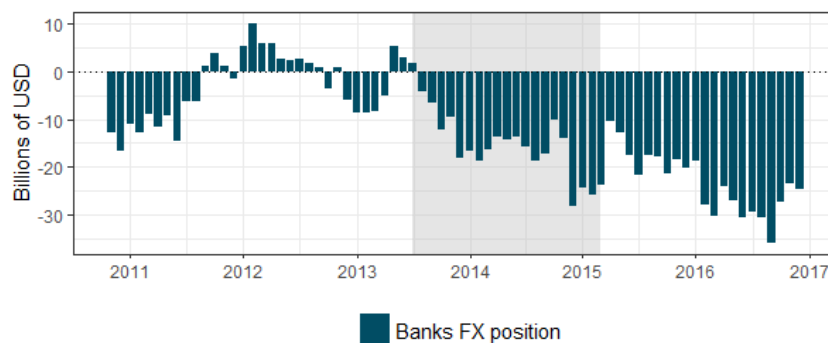
Therefore, with the exception of mid-2013, prior to the announce of the daily intervention program, unexpected interventions were very precise, and in general were followed by a decrease in the variability of the *ret.er*, as we can see in Figure 2. Comparing the days of these unexpected

interventions with the significance of the *swdne* coefficient suggests that the BCB can curtail excessive volatility when it intervenes decisively. Another aspect that emerges when we look at Figure 2 is that the “daily feeding program” appears to have been, at least in its first half, successful in reducing the variability of the *ret.er*. From August 2013 to August 2014, the conditional volatility clearly diminished. However, from September 2014 onwards, the future BRL/USD exchange rate started trending upwards, together with a strong decline in commodity prices. At the same time, the uncertainties around Dilma’s reelection, together with growing criticism about the economic policies undertaken in her previous government led to an exhaustion of the FX swaps policies (Prates and Farhi, 2015a). This results are also in line with the evidence gathered by Chamon et al. (2015) and Marins et al. (2015) that suggests that the FX swaps lost their efficacy with time.

4.4 The FX position of commercial banks

The FX swaps affects the forward premium rate, being directly related with the future BRL/USD exchange rate, through its effect on the *cupom cambial*. In the case of traditional FX swaps, they raise the *cupom cambial*, creating incentives for commercial banks to borrow USD abroad and invest them in Brazilian local markets, profiting from the interest rate differential. This operation is fully hedged, since the FX swaps also gives them protection against BRL/USD exchange rate variation. According to Garcia and Volpon (2014), the macroeconomic effect of these operations is that commercial banks ends up bringing foreign currency to the country, limiting the drain on official foreign exchange reserves and also limiting the pressure on the basic interest rate to attract foreign capital. It is in this sense that they argue that the *cupom cambial* might be seen as another policy rate of the BCB. This “attracting capital” role of FX swaps are tied to the goal of curtailing (or smoothing) depreciations and only works with systematic interventions.

Figure 3: Foreign exchange position of commercial banks, 2011-2016



Source: BCB.
Author’s elaboration.

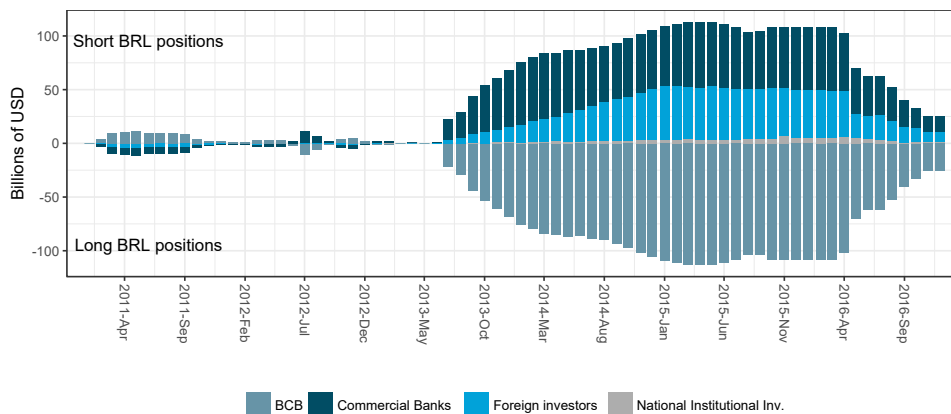
The commercial bank FX position is plotted in Figure 3. Prior to the start of the “daily feeding” program, when the BCB increased its use of FX swaps, the controls over the short (sold) spot foreign exchange position of commercial banks were removed (Garcia and Volpon, 2014; Prates and Farhi, 2015a). This was the beginning of the “taper tantrum” that marked the reversal of the global liquidity cycle. The area highlighted in gray in Figure 3 goes from

July 2013 to March 2015, roughly the period of the “daily feeding program”. As we can see, the short position of commercial banks increased substantially during this period. It is important to remember that the BRL/USD exchange rate was depreciating in this period. Uncovered short positions in USD during depreciations means losses. This suggests that the FX swaps auctioned in the period were making these positions profitable for the commercial banks, with the consequence of creating a new channel of foreign currency attraction to Brazil.

4.5 Hedge for whom?

Officially, to provide a hedge was the *raison d’être* of the FX swaps, in order to reduce the problems related to currency mismatches. As Farhi (2006) argues, it is cheaper to acquire a hedge in derivatives markets than in spot markets. Therefore, the BCB have to act as the “long BRL” of last resort in these markets, in order to keep them alive and, as a consequence, provide more accessible hedge to the public. Even if subject to losses in these operations, the central bank is acting to preserve financial stability. We use data available from the BMF&Bovespa to present the institutional positions on FX swaps, in Figure 4. As we can see, in 2011, these positions were not substantial – around 10 billion USD – and the BCB was holding short BRL (long USD) positions. From July 2013 onwards, the BCB changed the direction and raised significantly the size of its traditional FX swaps auctions, through the “daily feeding program”. As is visible in Figure 4, the BCB was the sole agent offering long BRL positions through FX swaps after 2013. The main counterparts were commercial banks and foreign investors.

Figure 4: Positions by institutional sectors in FX swaps market, 2011-2016



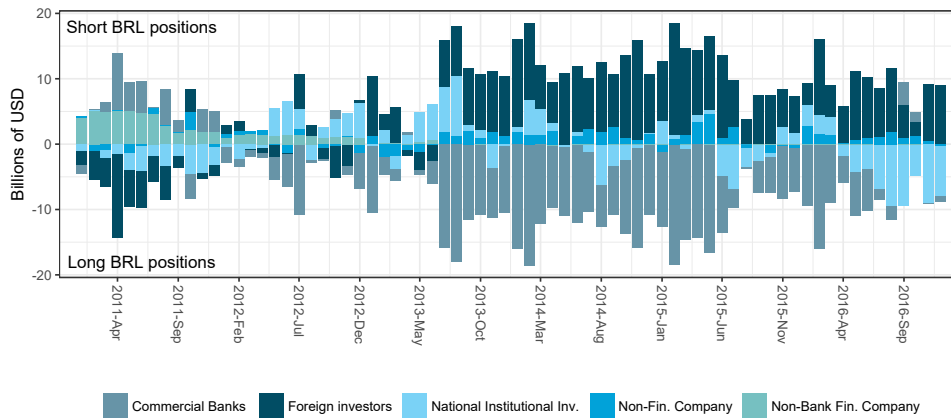
Source: BMF&Bovespa.
Author’s elaboration.

However, the FX swaps market does not provide a complete picture of hedge markets. Commercial banks were historically known for providing hedge in future markets. Therefore, to fully grasp the “hedging” role of FX swaps, it is important to look to the future USD markets. Positions in this market are presented in Figure 5. This market is probably the most relevant for hedging foreign exchange risk – the other being the OTC market registered at CETIP³⁰. FX

³⁰Unfortunately, we did not had access to this data. Nonetheless, data from 2014 provided by Garcia and Volpon (2014) suggest that OTC markets at CETIP are not as important as future USD markets traded at BMF&Bovespa.

swaps and future USD markets taken together provides a broader view of the hedging market in Brazilian foreign exchange markets.

Figure 5: Positions by institutional sectors in future USD market at BMF&Bovespa, 2011-2016



Source: BMF&Bovespa.

Individuals and financial brokers (*DTVMs* and *corretoras de valores*) were excluded due to their little relevance. As a consequence, values does not sum exactly to zero.

Author's elaboration.

As is visible in Figure 5, commercial banks were the dominant actor providing “long BRL” contracts for almost the whole period – with larger positions during the “daily feeding” program between 2013 and 2015. In this period, moreover, we can see that foreign investors were positioned in short BRL positions, betting on BRL depreciation. It is noticeable that the size of positions increased during the FX swap program period³¹, while Farhi (2001, 2006) argues that volume diminishes when expectations are more firmly held in these markets, as was arguably the case during the “daily feeding program”. This fact suggests that the FX swaps indeed facilitated hedging activity in future markets.

Similar interventions in future foreign exchange rate markets had already happened in the crises of the 1990s, as argued by Farhi (2001, 2006) and Dodd and Griffith-Jones (2007). In both cases, the BCB acted to keep future USD markets working. The comparison between the sizes in the FX swap markets and in future and spot USD markets, presented in Table 3, are elucidating: during the whole program, commercial banks short BRL (long USD) position in FX swaps were more than sufficient to cover its long BRL (short USD) positions, both in future as in spot USD markets. The size of the residual position of commercial banks suggest that they took FX swaps in excess of their needs to cover their long BRL positions, probably to speculate on future depreciation of the BRL³² and profit from BCB interventions. Similar behavior was identified during the crises of the late 1990s and early 2000s by Oliveira and Novaes (2005) and Dodd and Griffith-Jones (2007). The other important counterpart category acquiring currency hedge, both through FX swaps and future USD markets, were foreigners (non resident investors).

³¹Until June 2013, the average of long BRL (short USD) positions on future USD market was equivalent to 5.8 billion USD; between July 2013 and March 2015, encompassing the whole program plus the unusual high FX swap activity in the previous two months, this average increased to 12,8 billion USD, more than doubling; then, from April 2015 until December 2016, this mean reduced 25% to 9.6 billion USD.

³²One caveat that must be made is that our data of long BRL exposition of commercial banks are incomplete, since we do not have information about forward contracts dealt at CETIP. Nonetheless, data presented by Garcia and Volpon (2014) suggests that forward positions are not larger than future positions.

Table 3: Commercial banks FX positions¹, 2013-2015, selected months; millions of USD.

Period ²	FX Swaps	Future USD	USD spot	Residual
	<i>a</i>	<i>b</i>	<i>c</i>	<i>d = a + b + c</i>
Aug/13	23,380	- 17,918	- 4,190	1,272
Nov/13	48,117	- 7,578	- 9,577	30,962
Feb/14	59,294	-18,540	- 18,597	22,158
May/14	57,893	- 10,439	- 14,342	33,111
Aug/14	51,980	- 6,336	- 18,826	26,818
Nov/14	54,809	- 15,277	- 13,985	25,547
Feb/15	57,281	- 18,460	- 25,868	12,952
Apr/15	61,001	- 14,316	- 10,528	36,157

1/ Positive values are equal to short BRL (long USD) positions and negative values are equal to long BRL (short USD) positions.

2/ Positions in the first business day of the month.

Source: BMF&Bovespa and BCB.

Author's elaboration.

Finally, the absence of non-financial companies in hedge markets analyzed are remarkable. However, [Garcia and Volpon \(2014\)](#), who uses data from CETIP, points that non financial companies were also holding hedge instruments. [Prates and Farhi \(2015a\)](#) also refers to CETIP when analyzing hedging activity by exporters. Therefore, the most likely hypothesis is that non financial companies seek hedge on forward markets, not analyzed in this work. Further investigation on this topic is a good avenue for future research.

4.6 Costs of using FX swaps

So far we discussed the benefits of using FX swaps. Now it is time to tackle the most important drawback of this policy: its costs. At the end of 2015 and beginning of 2016, criticism about the use of FX swaps – and the whole foreign exchange rate policies toolbox – grew, both in the media and in academia (see, for instance, [Valor \(2016\)](#) and [Bacha \(2016\)](#)). The criticism was pertinent: only in 2015, 102 billions of BRL – the equivalent of 1.7% of Brazilian GDP – was spent by the BCB to cover its losses on FX swaps.

According to [Lavoie \(2014\)](#) and [Bindseil \(2004\)](#), modern central banks defines a target for the basic interest rate and intervene in the interbank market in order to sustain its target. This market is very interest-rate elastic, because commercial banks are always looking for the most profitable composition of its free bank reserves. Therefore, commercial banks will try to lend their excessive reserves in the interbank market; on the other hand, if there is a shortage of reserves in the interbank market, commercial banks will start bidding up the interest rates in order to acquire the reserves they need to meet its commitments. Since every financial asset has a liability as a counterpart, the commercial banks as an aggregate cannot create an imbalance in the market for reserves. An agent from outside is required. And the main agent that affect the market for bank reserves is the government – through the central bank or the Treasury. Be through reserve requirements or through expenditures and taxation, the government is always affecting the interbank reserve markets, and the central bank has to undertake compensating measures to keep the interest rate stable. In general, it establishes a corridor between the target interest rate, offering liquidity facilities to absorb the extra liquidity – at rates slightly below

Table 4: Effects of BCB losses on FX swaps

	Central Bank		Commercial Bank	
	Assets	Liabilities	Assets	Liabilities
(1)		(Losses in swap ops.) - 100 Reserves of fin. inst. + 100	Reserves at CB + 100	(Profits in swap ops.) + 100
(2)		Reverse repos + 100 Reserves of fin. inst. - 100	Reverse repos + 100 Reserves at CB - 100	
(F)		(Losses in swap ops.) - 100 Repos + 100	Repos + 100	(Profits in swap ops.) + 100

Author's elaboration.

the target – and to inject liquidity – slightly above the target. When the BCB makes the daily adjustment of its positions in open FX swaps contracts, it is injecting or removing money (bank reserves) from the economy. As a consequence, these adjustments have a direct impact on the management of the interest rate target of the central bank, which in turn affect the stocks of wealth in the economy with the corresponding distributive effect.

Table 4 present the effect of an hypothetical BCB loss with FX swaps. In the first (1) row, we can see that the central bank pays a commercial bank by creating a deposit on its account at the central bank; this operation will be registered as a loss in the central bank accounts, and will have to be deduced from its equity; the commercial bank, on the other hand, will end up with higher assets and higher profits. On the second row (2) we see the compensation of the operation: when commercial bank account is credited, the commercial bank will try to lend these resources at the interbank market, thus exerting downward pressures on interest rates³³; the central bank, to sustain its operational interest rate target, will have to absorb these resources – we illustrate this compensating measure with the issue of reverse repurchase agreements (reverse repos) by the central bank³⁴. The final row (F) represents the final impact of the adjustment. As we can see, central bank losses on FX swaps – a decrease in its equity – is matched by an increase in the outstanding amount of reverse repos in the market. For the commercial bank, higher profits will be matched by higher reverse repos in their assets.

In Table 5 we present the results of all the BCB foreign exchange operations, as disclosed in its financial statements, from 2011 to 2016. Column *a* shows the notional value of open contracts in the BCB portfolio. It reached its peak in 2015, when it was equivalent to more than 7% of the Brazilian GDP. In column *b* we can see the competence result with the FX swaps operations, i.e., the amounts of money the BCB profited or lost with its FX swaps. Comparing column *b* with column *e* – the BRL/USD exchange rate variation – makes clear that the competence result is tied to the variation of this exchange rate, a clear consequence of the design of the instrument.

The FX swaps are considered, by Brazilian institutions, part of its foreign exchange operations. According to the Brazilian law 11,803/08, all of the foreign exchange operations are netted

³³Since commercial banks do not wait new money to grant new loans, new resources will affect the interbank rate instead of generating new loans in the economy (Lavoie, 2014).

³⁴The result would be the same regardless of the monetary policy operation. In the case of remunerated reserves at the central bank, the sole difference is that the final row would be the second.

Table 5: BCB Foreign Exchange Operations, 2011-2016 – Millions of BRL (% of GDP)

Year	FX swaps ¹		International Reserves		BRL/USD exchange	Realized result ⁶	Total result
	Notional value ²	Competence result	Profitability ³	Liquid result ⁴	rate variation ⁵ (%)		
	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f = b + (d - c)</i>	<i>g = b + d</i>
2011	3,031 (0.1)	694 (0.0)	93,605 (2.1)	43,346 (1.0)	12.6	-49,565 (- 1.1)	44,041 (1.0)
2012	- 4,204 (- 0.1)	1,124 (0.0)	76,539 (1.6)	21,185 (0.4)	8.9	-54,230 (- 1.1)	22,309 (0.5)
2013	- 175,422 (- 3.3)	- 2,382 (0.0)	95,535 (1.8)	34,068 (0.6)	14.6	- 63,850 (- 1.2)	31,685 (0.6)
2014	- 284,859 (- 4.9)	- 10,681 (- 0.2)	108,165 (1.9)	24,630 (0.4)	13.4	- 94,215 (- 1.6)	13,950 (0.2)
2015	- 426,770 (- 7.1)	- 102,628 (- 1.7)	443,664 (7.4)	259,973 (4.3)	47.0	- 286,319 (- 4.8)	157,345 (2.6)
2016	- 85,504 (- 1.4)	83,804 (1.3)	- 235,597 (- 3.8)	- 324,123 (- 5.2)	- 16.5	- 4,722 (- 0.1)	- 240,319 (- 3.8)

Source: BCB - Demonstrações financeiras; BCB - Notas para imprensa - Política fiscal; BCB - BRL/USD monthly (purchase) exchange rate, end of the period.

1/ Operations realized through auditions and registered at BMF&Bovespa.

2/ Notional value of BCB exposition to USD. Negative values mean short USD positions.

3/ Include gains/losses with exchange rate retranslation, marked to market and the interest income received.

4/ Profitability of reserves minus its holding costs, measured as the average of interest rates remunerating BCB liabilities multiplied by the amount of international reserves.

5/ Free purchase BRL/USD exchange rate, end of periods. Values from December to December. Source: BCB.

6/ Sterilization costs – as explained in note 4/ – plus the competence result of foreign exchange swaps.

Author's elaboration.

out before being available to be transferred to or covered by the Treasury. Furthermore, the Brazilian institutional framework consider as profits or losses all the capital gains derived from the effect of exchange rate variation on its international reserves, even if they are not realized. Since the value in BRL of BCB international reserves and the results of FX swaps operations varies with the BRL/USD exchange rate but in opposing directions, the FX swaps are “hedged” by the international reserves, in an accounting perspective. The result of this combination can be observed in column *g* of Table 5. As it is visible, years like 2015, when the BCB had significant realized losses, it accounted a profit in its foreign exchange operations. This institutional arrangement gives more freedom to the BCB to undertake its FX swaps policy, since it does not record significant losses during periods of sharp depreciations of the BRL, usually associated with turmoils in the economy.

We should keep in mind, nonetheless, that losses in FX swaps, even when covered by international reserves profits, will increase the outstanding amount of reverse repos in the market, which are remunerated at the basic Selic (interbank) interest rates. These amounts will add to the already unusual high outstanding reverse repos in the market, which in turn generates an endogenous source of BCB losses (Silva, 2016; De Conti, 2016). The results of FX swaps, consequently, have an important distributive impact, since reverse repos are part of the wealth of its holders and generate interest incomes. However, is important to remark that FX swap losses were not so large in the last years when we consider a broader period. For instance, FX swaps were very profitable for the BCB in 2016, when the BRL appreciated. As a consequence,

Table 6: Effects of international reserves sales

	Central Bank		Commercial Bank	
	Assets	Liabilities	Assets	Liabilities
(1)	International reserves - 100	Reserves of fin. inst. - 100	Foreign currency + 100	Reserves at CB - 100
(2)		Reverse repos - 100	Reverse repos - 100	Reserves at CB + 100
(F)	International reserves -100	Reverse repos - 100	Foreign currency +100	Reverse repos -100

Author's elaboration.

from the 113 billion BRL in reverse repos losses injected in the markets between 2014 and 2015, 83.8 billion BRL were removed in 2016 (see column *b* in Table 5). Thus, if the FX swaps can become very costly during exchange rate overshoots, the losses are likely to be reverted once the BRL/USD exchange rate move downwards. On the other hand, even if the FX swaps are covered by profits originating from international reserves, the compensation of the injections of money it originates cause an impact on the interbank reserves market and adds to the public sector nominal result, affecting fiscal indicators. Since investors and rating agencies use indicators, such as public debt growth rate, to assess the creditworthiness of a given country, the increase in public debt generated by losses in FX swaps can undermine foreigners confidence in the economy, affecting their expectations and increasing the premium they are demanding to acquire assets denominated in BRL. Therefore, the effectiveness of FX swaps to diminish the burden on interest rates to attract foreign capital decreases with the number of outstanding open contracts in the market.

5 Final remarks: an inescapable trade off

The FX swaps can be used to replace selling international reserves in at least three aspects: i) it provides hedge opportunities; ii) it creates incentives for commercial banks to internalize USD which in turn alleviates the pressure on the international reserves to fund current account deficits; and iii) they affect market expectations and curb accentuated movements in the BRL/USD exchange rates. Moreover, they are totally settled in BRL, which amplifies the BCB's room of maneuver to undertake countercyclical foreign exchange operations. We also saw how the losses with the FX swaps are covered by "capital gains" with the international reserves. However, since these adjustments are spent into the economy, they end up being compensated by liquidity absorption operations, resulting in higher outstanding amounts of reverse repos. Thus, they expand the stock of public debt with important distributive effects, on the one hand, and deteriorate fiscal indicators, on the other, which means that its effectiveness diminishes if the BCB uses extensively this policy.

Henceforth, the FX swaps can reduce the constraints imposed by the Mundellian "macroeconomic trilemma", widening the room of maneuver of BCB to intervene in foreign exchange

markets without promptly facing the intrinsic constraint on the use of foreign exchange reserves: the scarcity of foreign currency. However, this increased policy space to manage the external vulnerability charges its toll by constraining the internal policy space of the monetary authority, since it can substantially increase the amount of domestic public debt. On the other hand, sales of foreign exchange reserves have a different effect, as is illustrated in table 6. As we can see, the final result of selling foreign exchange reserves is that the central bank ends up with less assets – it reduces the amount of foreign assets in its portfolios – but also with less liabilities – it has to offer liquidity to the markets in order to sustain the level of its basic interest rates, diminishing the outstanding stocks of reverse repos in the market.

Therefore, there is an inescapable trade off when public authorities decides to use FX swaps instead of selling foreign exchange reserves. When it sells its international reserves, it holds its internal policy space, at the costs of less foreign assets (it diminishes the gross public debt and leave liquid public debt stable). But less external space is problematic, since significant drains on foreign exchange reserves are seen as a signal of weakness by investors, which can trigger further attacks on the currency while the capacity to answer are diminishing. On the other hand, when using FX swaps, the BCB keep its external space, but at the expense of its internal accounts, leading to higher concerns about the sustainability of its public debt, which in turn add pressure on policy instruments – particularly on interest rates.

Thus, the cons of using FX swaps in terms of its costs are smaller than the cons of using international reserves to intervene when there is pressure for the BRL to depreciate. The fundamental reason lies in the fact that FX swaps are totally settled in BRL. Moreover, they also help to make the markets of foreign exchange derivatives and provide hedge opportunities, helping to keep financial stability. The costs of FX swaps, on the other hand, are likely to be reversed if the currency starts moving in a different direction. Also, they can be quickly and quietly removed from the markets. However, the recurrent need of “damage control” policies by the BCB should question the coherence of its whole monetary policy strategy. By using the BRL/USD exchange rate as a tool for controlling prices, the economy become too attached to global liquidity cycles, overburdening the interest rate as monetary policy instrument. It is true that the FX swaps buys the BCB sometime to perform the necessary adjustments, but ultimately it becomes too costly to be sustained and the BRL/USD will move towards a new level more consistent with the phase of the liquidity cycle.

References

- Aizenman, J. and Lee, J. (2007). International reserves: precautionary versus mercantilist views, theory and evidence. *Open Economies Review*, 18(2):191–214.
- Aizenman, J. and Sun, Y. (2012). The financial crisis and sizable international reserves depletion: From ‘fear of floating’ to the ‘fear of losing international reserves’? *International Review of Economics & Finance*, 24(C):250–269.
- Akerlof, G., Blanchard, O., Romer, D., and Stiglitz, J., editors (2014). *What Have We Learned? Macroeconomic Policy After the Crisis*, volume 1. The MIT Press, 1 edition.
- Andrade, R. P. and Prates, D. M. (2013). Exchange rate dynamics in a peripheral monetary economy. *Journal of Post Keynesian Economics*, 35(3):399–416.
- Arestis, P. and Glickman, M. (2002). Financial crisis in Southeast Asia: dispelling illusion the Minskyan way. *Cambridge Journal of Economics*, 26(2):237–260.
- Bacha, E. (2016). *A crise fiscal e monetária brasileira*. Ed. Civilização Brasileira, Rio de Janeiro.
- Bell, S. (2001). The role of the state and the hierarchy of money. *Cambridge Journal of Economics*, 25(2):149–163.
- Bevilaqua, A. and Azevedo, R. (2005). Provision of FX hedge by the public sector: the Brazilian experience. In Settlements, B. f. I., editor, *Foreign exchange market intervention in emerging markets: motives, techniques and implications*, volume 24, pages 119–126. Bank for International Settlements.
- Biancareli, A. M. (2009). International liquidity cycles to developing countries in the financial globalization era. In *XI Reunión de Economía Mundial*.
- Biancareli, A. M. (2011). Brazil, developing economies and private international capital flows: the (new) challenges in the post-crisis scenario. In *15th Conference of the Research Network Macroeconomics and Macroeconomic Policies (FMM): ‘From crisis to growth? The challenge of imbalances, debt, and limited resources’*, Berlin.
- Bindseil, U. (2004). The operational target of monetary policy and the rise and fall of reserve position doctrine. Technical report, European Central Bank, Frankfurt.
- BIS (2015). *Currency carry trades in Latin America*. Bank for International Settlements.
- Bonizzi, B. (2017). An Alternative Post-Keynesian Framework for Understanding Capital Flows to Emerging Markets. *Journal of Economic Issues*, 51(1):137–162.
- Boyer, R., Dehove, M., and Plihon, D. (2004). *Les crises financières*. La Documentation française Paris.
- Bresser-Pereira, L. C. (2009). A tendência à sobreapreciação da taxa de câmbio. *Revista Econômica*, 11(1).
- Bresser-Pereira, L. C. (2012). A taxa de câmbio no centro da teoria do desenvolvimento. *Estudos avançados*, 26(75):7–28.
- Carneiro, R. (2008). Globalização e inconvertibilidade monetária. *Revista de Economia Política*, 28(4):539–556.
- Carneiro, R. d. M., Rossi, P., Mello, G. S., and Chiliatto-Leite, M. V. (2015). The Fourth Dimension. *Review of Radical Political Economics*, 47(4):641–662.
- Chamon, M., de Souza, L. C., and Garcia, M. (2015). FX interventions in Brazil: a synthetic control approach. Textos para discussão 630, Departamento de Economia PUC-Rio, Rio de Janeiro.
- Cheung, Y.-W. and Sengupta, R. (2011). Accumulation of reserves and keeping up with the Joneses: The case of LATAM economies. *International Review of Economics & Finance*, 20(1):19–31.

- Cruz, M. (2015). The need for official reserves in Latin America: Assessing the precautionary motive, 1995-2011. *Revista Cuadernos de Economía*, pages 327–347.
- De Conti, B., Biancareli, A., and Rossi, P. (2013). Currency hierarchy, liquidity preference and exchange rates: a Keynesian/Minskyan approach. *Congrès de l'Association Française d'Économie Politique, Université Montesquieu Bordeaux IV*.
- De Conti, B. M. (2016). As relações entre o Tesouro Nacional e o Banco Central do Brasil. Technical report, IPEA.
- De Conti, B. M., Prates, D. M., and Plihon, D. (2014). A hierarquia monetária e suas implicações para as taxas de câmbio e de juros e a política econômica dos países periféricos. *Economia e Sociedade*, 23(2(51)):341–372.
- Dodd, R. and Griffith-Jones, S. (2007). *Brazil's derivatives markets: hedging, central bank intervention and regulation*. CEPAL - United Nations, Santiago.
- ECB (2014). Experience with foreign currency-liquidity providing central bank swaps. Technical report, European Central Bank, Frankfurt.
- Eichengreen, B. (2016). Global monetary order. In *The future of the international monetary and financial architecture*, pages 21–63, Sintra. European Central Bank.
- Engle, R. (1982). Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica*, 50(4):987–1007.
- Farhi, M. (1999). Derivativos financeiros: hedge, especulação e arbitragem. *Economia e Sociedade*, 8(2):93–114.
- Farhi, M. (2001). Dinâmica dos ataques especulativos e regime cambial. *Economia e Sociedade*, 17:55–79.
- Farhi, M. (2006). O impacto dos ciclos de liquidez no Brasil: mercados financeiros, taxa de câmbio, preços e política monetária. *Política Econômica em Foco*, 7:152–183.
- Flassbeck, H. (2001). The exchange rate: economic policy tool or market price? UNCTAD Discussion Papers 157, United Nations Conference on Trade and Development.
- Flassbeck, H. and La Marca, M. (2007). Coping with globalized finance: Recent Challenges and Long-term Perspectives. *Geneva: Unctad*.
- Franco, G. H. B. (2000). *The Real Plan and the exchange rate*. International Finance Section, Department of Economics, Princeton University.
- Frazão, M. V. S. (2017). *As intervenções do Banco Central do Brasil na taxa de câmbio através dos leilões de swaps cambiais e seus efeitos*. Dissertation, UFRJ.
- Frenkel, R. (2008). From the boom in capital inflows to financial traps. *Capital market liberalization and development*, pages 101–120.
- Frenkel, R. and Rapetti, M. (2015). The real exchange rate as a target of macroeconomic policy. In Calcagno, A., Dullien, S., Márquez-Velázquez, A., Maystre, N., and Priewe, J., editors, *Rethinking development strategies after the financial crisis*, chapter 6, pages 81–92. UNCTAD.
- Fritz, B. and Prates, D. (2014). The new IMF approach to capital account management and its blind spots: lessons from Brazil and South Korea. *International Review of Applied Economics*, 28(2):210–239.
- Fritz, B., Prates, D. M., and de Paula, L. F. (2014). Keynes at the periphery: currency hierarchy and challenges for economic policies in emerging economies. Anais do xlii encontro nacional de economia, ANPEC - Associação Nacional dos Centros de Pósgraduação em Economia [Brazilian Association of Graduate Programs in Economics], Natal.
- Garcia, M. and Urban, F. (2004). O Mercado interbancário de câmbio no Brasil. Textos para discussão, Department of Economics PUC-Rio (Brazil).

- Garcia, M. and Volpon, T. (2014). DNDFs: a more efficient way to intervene in FX markets? *Discussion Note*, (621).
- Ghosh, A., Ostry, J., and Tsangarides, C. (2012). Shifting Motives; Explaining the Buildup in official Reserves in Emerging Markets Since the 1980's. IMF Working Papers 12/34, International Monetary Fund.
- Glosten, L. R., Jagannathan, R., and Runkle, D. E. (1993). On the relation between the expected value and the volatility of the nominal excess return on stocks. *The journal of finance*, 48(5):1779–1801.
- Harvey, J. (2003). Exchange rates. In King, J., editor, *The Elgar Companion to Post Keynesian Economics*, pages 131–135. Edward Elgar.
- Hausmann, R. and Panizza, U. (2011). Redemption or Abstinence? Original Sin, Currency Mismatches and Counter Cyclical Policies in the New Millennium. *Journal of Globalization and Development*, 2(1):1–35.
- Janot, M. and Macedo, L. (2016). Efeitos das Intervenções Cambiais sobre a Taxa de Câmbio Futura no Brasil. *Trabalhos para discussão*, 413.
- Kaltenbrunner, A. (2015). A post Keynesian framework of exchange rate determination: a Minskyan approach. *Journal of Post Keynesian Economics*, 38(3):426–448.
- Keynes, J. M. (1930). *A treatise on money: the applied theory of money*, volume 2. AMS Press.
- Kohlscheen, E. (2014). Long-run determinants of the Brazilian Real: a closer look at commodities. *International Journal of Finance & Economics*, 19(4):239–250.
- Kregel, J. (2001). Yes, 'it' did happen again – the Minsky crisis in Asia. In *Financial Keynesianism and Market Instability*, chapter 11. Edward Elgar Publishing.
- Lavoie, M. (2002). Interest parity, risk premia, and Post Keynesian analysis. *Journal of Post Keynesian Economics*, 25(2):237–249.
- Lavoie, M. (2014). *Post-Keynesian economics: new foundations*. Edward Elgar Publishing.
- Levy-Yeyati, E., Sturzenegger, F., and Gluzmann, P. (2013). Fear of appreciation. *Journal of Development Economics*, 101(C):233–247.
- Macalós, J. P. S. (2017). *Foreign exchange swaps: a new locus of public intervention? The case of Brazil*. Master thesis, Université Paris 13.
- Marins, J., Araujo, G., Vicente, J., and Others (2015). As Atuações Cambiais do Banco Central Afetam as Expectativas de Mercado? *Trabalhos para discussão*, (393).
- Mehrling, P. (2013). The inherent hierarchy of money. In Taylor, L., Rezai, A., and Michl, T., editors, *Social Fairness and Economics: economic essays in the spirit of Duncan Foley*, chapter 21, page 394. Routledge.
- Minsky, H. P. (1975). *John Maynard Keynes*. Columbia University Press, New York.
- Nelson, D. B. (1991). Conditional Heteroskedasticity in Asset Returns: A New Approach. *Econometrica*, 59(2):347–370.
- Nesvetailova, A. (2007). *Fragile finance: debt, speculation and crisis in the age of global credit*. Springer.
- Obstfeld, M., Shambaugh, J., and Taylor, A. (2010). Financial Stability, the Trilemma, and International Reserves. *American Economic Journal: Macroeconomics*, 2(2):57–94.
- Ocampo, J. A. (2012). Balance of payments dominance: Its implications for macroeconomic policy.
- Oliveira, F. D. and Novaes, W. (2005). The Market of Foreign Exchange Hedge in Brazil: Reactions of Financial Institutions to Interventions of the Central Bank. IBMEC RJ Economics Discussion Papers 2005-13, Economics Research Group, IBMEC Business School - Rio de Janeiro.

- Prates, D. and Cintra, M. (2007). Keynes e a hierarquia de moedas: possíveis lições para o Brasil. *Texto para Discussão IE/Unicamp*, (137).
- Prates, D. and Fritz, B. (2013). Beyond capital controls: the regulation of foreign currency derivatives markets in South Korea and Brazil after the global financial crisis. In *Hochschule fuer Technik und Wirtschaft, Berlin*, number 1307, Berlin.
- Prates, D. M. (2002). *Crises financeiras nos países "emergentes": uma interpretação heterodoxa*. Thesis (phd), Universidade de Campinas.
- Prates, D. M. (2005). As assimetrias do sistema monetário e financeiro internacional. *Revista de economia contemporânea*.
- Prates, D. M. (2015). O regime de câmbio flutuante no Brasil 1999-2012: especificidades e dilemas. *Instituto de Pesquisa Econômica Aplicada (Ipea)*.
- Prates, D. M. and Farhi, M. (2015a). Foreign exchange derivatives, banking competition and financial fragility in Brazil. In *MINDS Texto para Discussão no 3*.
- Prates, D. M. and Farhi, M. (2015b). The shadow banking system and the new phase of the money manager capitalism. *Journal of Post Keynesian Economics*, 37(4):568–589.
- Ramos, R. (2016). *Financialization and its Implications on the Determination of Exchange Rates of Emerging Market Economies*. Phd thesis, CEPN/Paris 13 and IE/Unicamp.
- Rey, H. (2013). Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence, London Business School, CEPR.
- Rey, H. (2015). Dilemma not trilemma: the global financial cycle and monetary policy independence. Technical report, National Bureau of Economic Research.
- Rey, H. (2016). International Channels of Transmission of Monetary Policy and the Mundellian Trilemma. *IMF Economic Review*, 64(1):6–35.
- Rodrik, D. (2011). *The Globalization Paradox: Why Global Markets, States, and Democracy Can't Coexist*. Oxford University Press.
- Rossi, P. (2015). Institucionalidade do mercado de câmbio e a política cambial no Brasil. *Economia e Sociedade*, 23(3):645–667.
- Rossi, P. (2016). *Taxa de câmbio e política cambial no Brasil: Teoria, institucionalidade, papel da arbitragem e da especulação*. FGV Editora, Rio de Janeiro.
- Sarno, L. and Taylor, M. P., editors (2002). *New Developments in Exchange Rate Economics*, volume Two volume. Edward Elgar Publishing.
- Serrano, F. (2002). Do ouro imóvel ao dólar flexível. *Revista Economia e Sociedade*, 19.
- Shin, H. S. (2016). Global liquidity and procyclicality. In *World Bank conference*, number June, pages 1–16, Washington D.C.
- Silva, A. C. M. e. (2016). O que mostram as demonstrações? Balanços e resultados dos bancos centrais. Technical report, IPEA, Brasília.
- Souza Rosa, R. and Biancareli, A. M. (2016). Passivo externo, denominação monetária e as mudanças na vulnerabilidade externa da economia brasileira. Anais do xliii encontro nacional de economia [proceedings of the 43rd brazilian economics meeting], ANPEC - Associação Nacional dos Centros de Pósgraduação em Economia [Brazilian Association of Graduate Programs in Economics].
- Tavares, M. C. and Melin, L. E. (1997). A reafirmação da hegemonia norte-americana. *Poder e dinheiro*.
- UNCTAD (2007). *Trade and Development Report*. United Nations.
- Valor, E. (2016). Operações de swap cambial custaram quase R\$ 90 bi em 2015. *Valor Econômico*.
- Ventura, A. and Garcia, M. (2012). Mercados futuro e à vista de câmbio no Brasil: o rabo abana o cachorro. *Revista Brasileira de Economia*, 66(1):21–48.

- White, H. (1982). Maximum Likelihood Estimation of Misspecified Models. *Econometrica*, 50(1):1–25.
- Zakoian, J.-M. (1994). Threshold heteroskedastic models. *Journal of Economic Dynamics and control*, 18(5):931–955.