ISSN 1518-3548

BANCO CENTRAL DO BRASIL

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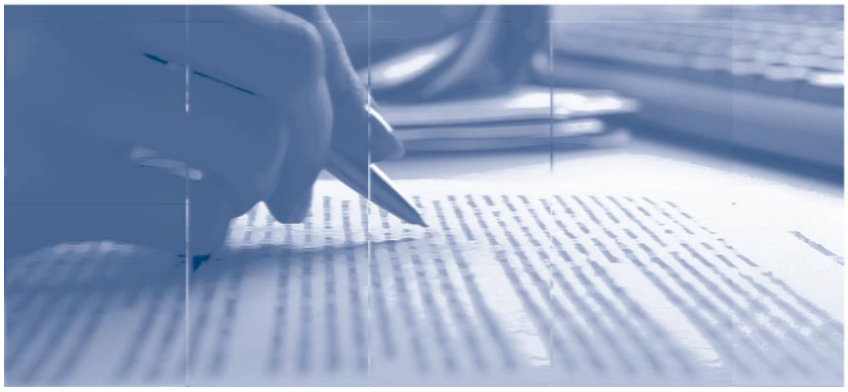
Gustavo Silva Araujo and Sérgio Leão

March, 2015

Working Papers



379

ISSN 1518-3548
CGC 00.038.166/0001-05

Working Paper Series	Brasília	n. 379	March	2015	p. 1-41

Working Paper Series

Edited by Research Department (Depep) – E-mail: workingpaper@bcb.gov.br

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OTC Derivatives: Impacts of Regulatory Changes in the Non-Financial Sector*

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Abstract

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In the aftermath of the 2007-2008 global financial crisis, a series of measures has been proposed to regulate the OTC derivatives market. The motivation is to increase the disclosure of the OTC operations aiming to decrease the probability of crisis. The main objective of this paper is to investigate how regulatory changes in the OTC derivatives market affect the non-financial sector. The Brazilian FX derivatives market provides a natural experiment for the issue: in 2011 the Brazilian government taxed short positions in FX derivatives to reduce the carry trade that was causing the local currency to appreciate. Although Chamon and Garcia (2013) find that this policy helped reduce the incentives to perform carry trade strategies, it could have unintended consequences on other markets. For example, if the banks pass through the extra cost to its clients, this taxation may affect the FX hedges of non-financial firms. This paper investigates whether and how much of the increase in the cost of OTC derivatives is transferred to the non-financial sector. The results indicate that this cost more than doubled for companies exposed to devaluation of the local currency (for instance, importers). Albeit a thorough welfare analysis is beyond the scope of this paper, the findings suggest that this cost increase may be a concern to the extent that it could prevent EMEs firms from hedging their FX positions, as the NDF quotation of some EMEs is high due to the interest rate differentials.

Keywords: OTC Markets, Capital Controls, Carry Trade, FX Derivatives, Capital Flows, Cost of hedging.

JEL Classification: F3; F38; G1; G32.

* For valuable comments, we thank Waldyr Areosa, Eduardo Lima, Raquel Oliveira, João Barroso e Cláudio Márcio Cunha. We also thank João André Pereira for the access to the data.
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1 – Introduction

After the 2007-2008 financial crisis, a series of measures has been proposed to regulate the derivatives market. The goal is to decrease the probability of systemic crisis. Acharya & Bisin (2014) observe that the opacity of the over-the-counter (OTC) market appears to have played a central role in this financial crisis. The main objective of this paper is to investigate how regulatory changes in the OTC derivatives market affect the non-financial sector. The subject is in vogue due to the current discussion about implementation of a series of regulatory changes to make the OTC market more standardized and secure (BIS, 2013). These changes can generate additional costs for financial institutions that may be passed on to customers through the banking spread. With the intent to evaluate the impact of these proposals, the Macroeconomic Assessment Group on Derivatives (MAGD) estimates that the expected benefits of the regulatory changes outweigh the costs using macroeconomic models.[1]

This paper studies the costs of regulatory changes in the OTC derivatives markets with a new approach instead of relying on predictive macroeconomic models. We evaluate whether an exogenous increase in the cost of FX derivatives is transferred to non-financial firms through prices in OTC derivatives. The Brazilian FX derivatives market provides a natural experiment for the issue: in the third quarter of 2011 the Brazilian government taxed net short positions in FX derivatives to reduce the carry trade that was causing the local currency to appreciate. The aim was to reduce the entry of international speculative capital in carry-trade operations. However, this taxation may cause unintended outcomes in the real economy. For example, this tax may undermine the FX hedges of non-financial sector if the banks pass through the extra cost to its clients. Therefore, this paper investigates whether and how much of the increase in the cost of OTC derivatives is transferred to non-financial firms — the so-called end-users of derivatives. We also investigate if there is a different outcome of the taxation when the non-financial firms assume long or short positions in this derivative market.

In our methodology for estimating the effect of the tax on non-financial corporations, we compare the spread between non-deliverable forward (NDF) transactions and the FX

[1] The Macroeconomic Assessment Group on Derivatives (MAGD) is a group led by the Chief Economist of the Monetary and Economic Department of the Bank for International Settlements (BIS) and is comprised of representatives of 29 member institutions of the Financial Stability Board (FSB).

Brazilian future market before and after the beginning of the taxation. A larger absolute spread after the taxation means that the banks passed at least some part of the regulatory costs on to firms. It is quite important to note that comparing the OTC market with the FX futures market allows us to control for macro and micro-economic shocks that influence the FX prices. Furthermore, using firm fixed effects, we control for time invariant firm-specific characteristics that influence firm demand for FX derivatives. We also employ bank fixed effects in order to guarantee that our results are not driven by bank selection in our sample. The database of this study consists of all NDF transactions between April 2011 and February 2012.

Our results show that the cost of hedging in the OTC market more than doubled for non-financial companies exposed to devaluation of the local currency (e.g., importers). For our main sample, we have 9 different model specifications and the minimum and the maximum values of the cost increase are respectively 50% and 183%, always statistically significant at 1%. As the BRL-USD NDF quotation[2] (and the NDF quotation of other EMEs) is high due to the interest rate differentials, this cost increase may be worrisome to the extent that it may prevent firms from hedging their FX positions.

Consider an example that may shed some light on the problem. In May 2011, the average FX spot quotation was R$1,613.49 per 1,000 dollars and the average expectation of the FX spot quotation for six months ahead was R$1,618.18.[3] In the Futures Market, the average quotation was 1,674.43 for the same maturity, 3.85% higher than the average spot price due to the high interest rate differentials and 3.48% higher than the average expectation. This figure represents the premium that an importer has to pay for hedging its future dollar cash flows. Therefore, the cost paid by non-financial firms in emerging countries exposed to devaluation of the local currency is significant. Moreover, when firms resort to the OTC market, banks charge an additional cost of 4.80 per 1,000 dollars on average. Our results show that this bank margin more than doubled with the taxation

[2] The BRL-USD NDF quotation means that this forward is quoted in real/dollar. Therefore, when an importer wants to hedge a future payment in dollars, it enters into a long position on the BRL-USD NDF, i.e. it buys NDF contracts. On the other hand, if an exporter wants to hedge its cash flow, it enters into a short position selling NDF contracts.

[3] The FX expectations are collected in the Central Bank of Brazil's Market Expectations System. For details of the system, see Marques (2013).

and the hedge quotation ends up higher than R$1,689 (i.e. more than 4.37% higher than the average expectation).

As the topic we are studying is contemporary, the literature is still scarce. According to BIS (2013), in September 2009, G-20 leaders agreed on the main changes to be directed to the OTC market in response to the 2007-2008 crisis: i) standardizable derivatives must be traded on exchanges or electronic trading platforms and settled through a central counterparty; ii) other OTC derivatives must be registered; and iii) OTC derivatives traded with no central counterparty must have higher capital requirements.

MAGD, by request of the OTC Derivatives Coordination Group,[4] assessed the costs and benefits of the regulatory changes proposed for OTC derivatives by G-20. Among the benefits that are being evaluated are the economic gains from reducing the chances of economic crises that may arise from the propagation of defaults in the bilateral OTC derivatives contracts. MAGD estimates that a chance of a financial crisis triggered by default in the derivatives market is reduced by 0.26 percentage points. As the cost of systemic crises can be about 60% of GDP, the expected value of the benefit is 0.16% of GDP. The estimated costs are related to higher capital requirements, to changes in the composition of the collateral and to operational costs of central counterparty. According to the study, these costs for financial institutions are passed on to customers through the banking spread. Macroeconomic models predict the impact of the increase of the long-term banking spread between 0.03 and 0.09% of GDP.

Acharya & Bisin (2014) develop a general equilibrium model for the OTC markets in a setup where risk-sharing agents have incentives to default and their financial positions are not mutually observable. Their model justifies the regulatory changes in the OTC market. OTC markets feature a counterparty risk externality that can lead to ex-ante productive inefficiency. This externality is absent when trading is organized via either a centralized clearing mechanism that provides transparency of trade positions, or a centralized counterparty such as an exchange that observes all trades and sets prices.

[4] The OTC Derivatives Coordination Group is composed of the chairmen of the following international organizations: FSB (Financial Stability Board), BCBS (Basel Committee on Banking Supervision), IOSCO (International Organization of Securities Commissions), CPSS (Committee on Payment and Settlement Systems) and CGFS (Committee on the Global Financial System).

Mello & Parsons (2012) discuss whether restrictions on the derivatives markets have impact on the non-financial sector. More specifically, they study whether a margin mandate on OTC derivative increases the cost of hedging by non-financial corporations. They argue that a non-margined derivative is equivalent to a package of a margined derivative and a contingent line of credit. Therefore, imposing margin requirement does not change the total financing or capital that the non-financial corporation requires in order to back its hedging. Nor does it raise the cost to banks of offering the hedge, at least not directly. Our article addresses this point through an empirical strategy based on a natural experiment on the FX derivatives market in Brazil.

This work also fits in the literature of capital controls and foreign exchange intervention. The global financial crisis of 2008 has been followed by a new wave of experimentation with prudential capital controls. Blanchard et al (2013) discuss the set of targets and the set of instruments of monetary policy after the global crisis. They argue that central banks of economies with greater financial frictions and more highly segmented markets could have two targets, the inflation rate and the exchange rate, and two instruments, the policy rate and foreign exchange intervention.

Brazil was the precursor of adopting measures on capital inflows after the crisis. Therefore, the Brazilian case is mentioned in several papers. Eichengreen (2013) cites that Brazilian finance Minister Mantega coined the term "currency war" in September 2010 in reaction to the unconventional monetary policies of the Federal Reserve (the quantitative easing) in the United States. These policies led to high levels of capital flows toward emerging markets, resulting in inflation and currency appreciation.

Jeanne (2012) argues that the Brazilian capital controls are consistent with the main features of the optimal prudential tax implied by theory because i) the tax should be on capital inflows; ii) the tax should be countercyclical, i.e., it should be raised when there is surge of capital inflows and reduced when the pressure decreases; and iii) the tax should also be differentiated by type of inflow: the tax rate should be higher on the flows that are systemically more dangerous (such as short-term or foreign currency debt) than on portfolio equity flows or foreign direct investment (Korinek (2010)). Blanchard et al (2013) say that the taxes on capital inflows in Brazil during the current crisis appear to have slowed down portfolio inflows and limited exchange rate appreciation.

Chamon and Garcia (2013) analyze the impact of the controls and restrictions on capital inflows that Brazil has adopted since late 2009. They find that these policies had some success in segmenting the Brazilian market from global financial markets, as measured by the spread between onshore and offshore dollar interest rates, as well as by the ADR premium relative to the underlying local stocks, but had limited effect on the exchange rate. Jinjarak et al (2013), using the synthetic control method, construct counterfactuals of each one of the changes in Brazil capital account regime in 2008–2011 and find no evidence that any tightening of controls was effective in reducing the magnitudes of capital inflows. However, they observe some modest success in preventing further declines in inflows when the capital controls were relaxed. Forbes et al (2012) use changes in Brazil's tax on capital inflows from 2006 to 2011 to test for direct portfolio effects and externalities from capital controls on investor portfolios and find that an increase in Brazil's tax on foreign investment in bonds causes investors to significantly decrease their portfolio allocations to Brazil in both bonds and equities. Similar to Forbes et al (2012), we also test for externalities from capital controls in our paper but on companies of the real sector rather than on investor portfolios. Another important result of Forbes et al (2012) is that much of the effect of capital controls on portfolio flows appears to occur through signaling — i.e. changes in investor expectations about future policies — rather than the direct cost of the controls.

Other papers on capital controls are related with our work. Jeanne, Subramanian and Williamson (2011) and Korinek (2011) transposes to international capital flows the closed-economy analysis of the macroprudential policies that aim to curb the boom-bust cycle in credit and asset prices. Frictions in the credit market lead to an amplification mechanism in which growth in credit and asset prices feed on each other, positively in the boom and negatively in the bust. Forbes and Warnock (2011) find little association between capital controls and the probability of having surges or stops driven by foreign capital flows. As our study, Forbes (2007) also investigates externalities of capital controls on non-financial firms. Specifically, they assess whether the Chilean capital controls from 1991 to 1998 increased financial constraints for different-sized, publicly-traded firms, in an Euler–equation framework. They find that smaller traded firms experienced significant financial constraints during the period.

To the best of our knowledge, this article is the first that estimates the costs of regulatory changes in the OTC derivatives markets with a microeconomic approach instead of relying on predictive macroeconomic models. The remainder of the article is organized as follows. In Section 2 we describe the institutional background. Section 3 presents the data and descriptive analysis. Section 4 discusses our empirical methodology. Section 5 presents our main results. Section 6 provides robustness checks and Section 7 concludes.

2 – Background

A. 2007-2008 Financial Crisis and OTC Derivatives

The 2007-2008 global financial crisis has increased scrutiny of the OTC derivatives market. The defense of the deregulation of the OTC derivatives market prevailed before the crisis. However, counterparty exposures related to the OTC market helped propagate and amplify the crisis as many of these exposures were not collateralized.[5] Therefore, in the post-crisis there is a consensus on the need for proper regulation seeking to make the OTC market more standardized and safer (BIS, 2013). The proposals include i) requirements for standardized OTC derivatives to be cleared through central counterparties (CCPs); ii) requirements for collateral to be posted against both current and potential future counterparty exposures, whether centrally cleared or non-centrally cleared; iii) mandatory report of non-standardized derivatives to trade repositories; and iv) requirements that banks hold additional capital against their uncollateralised derivative exposures. The main economic argument for regulatory changes in the OTC market is the reduction of the probability of an international financial crisis by limiting the potential contagion through the derivatives market (Gai et al, 2011).

In Brazil, the OTC derivatives market was also a propagation channel of the global crisis (Vervloet & Garcia, 2010). Through structured derivatives, some Brazilian firms speculated assuming short positions in foreign currency. With the devaluation of the local

[5] Levitin & Wachter (2011) claim that the market shift from a regulated to an unregulated financing market was the leading cause of the housing bubble and that there would not have been a bubble without it.

currency due to the eruption of the financial crisis, firms with high FX exposures incurred huge financial losses. Sadia and Aracruz are the best known examples (Novaes, 2011).[6]

The importance of FX derivatives on the propagation of financial crises is not restricted to the counterparty risk in OTC transactions. The FX derivatives are extremely important for the hedging of non-financial firms exposed to FX risk. Bolton, Santos and Scheinkman (2012) give the reason why firms prefer to hedge on OTC contracts than on futures market. They affirm that although the OTC contracts give firms less favorable prices, firms are typically subject to lower margin requirements than on futures market as banks understand that the movements in spot price do not give rise to higher counterparty risk. Furthermore, OTC derivatives are generally customized in terms of maturity, underlying assets and notional values, and due to the non-existence of daily settlement. Therefore, the OTC market is usually the appropriate environment for non-financial firms to hedge.

The decision to hedge in the derivatives market, however, depends primarily on the cost of hedging. This cost in turn depends on the difference between local and foreign interest rates - that affect the quotation of the FX derivatives market - and on the markup charged by banks to offer the customized product.[7] Therefore, the cost of hedging may influence the degree of protection of the non-financial sector of the economy. This raised cost may reduce the level of the real sector hedging which increases the chances of the dissemination of a crisis. Thus, there is a trade-off between these costs and the benefits of the new regulation of the OTC derivatives market: on the one hand the new OTC derivatives regulation can reduce contagion risk between counterparties in times of external shocks; on the other, an increase in the cost of hedging can increase the chances of a crisis due to the lack of protection of assets and liabilities.

B. Carry-Trade and Taxation on Short Positions in the Derivatives Market in Brazil

In the aftermath of the 2007-2008 global crisis, capital poured to emerging markets (Chamon & Garcia, 2013) driven by a combination of relatively favorable fundamentals

[6] In http://en.wikipedia.org/wiki/List_of_trading_losses, accessed on March 26, 2014, Aracruz is in 7th position of the greatest world trading losses while Sadia is in 20th position.
[7] The difference in the interest rates between emerging and developed countries causes the forward quotation to be unattractive for firms in emerging economies exposed to the devaluation of the local currency, mainly for long maturities.

and low interest rates in advanced economies. These substantial inflows can lead to a strong appreciation of the local currency. Brazil is an example of emerging country in which there was a huge appreciation of the BRL-USD quotation between 2009 and 2011.[8]

Chamon & Garcia (2013) point out undesired effects of this strong appreciation: i) loss of competitiveness of the tradable sector; ii) risk that the flows may not be directed to productive uses and end up instead fueling consumption booms as well as asset price bubbles; and iii) complications for macroeconomic management due to further stimulation of an already overheating economy, particularly if efforts to control inflation through higher interest rates attract more inflows.

Given the high local interest rates in relation to international standards, Brazil was a natural candidate for non-resident investors to do carry trade strategies.[9] The simplest version of carry trade consists of the non-resident investors financing themselves in a strong currency (e.g., the U.S. dollar) and applying the resources in the local currency. As a result, the investor is exposed to FX risk (the local currency devaluation). Another way to exploit interest rate differentials between two currencies is using the derivatives market: taking short positions in the FX derivatives markets in the currency with lower interest rates (in the Brazilian case, short positions in the U.S. dollar) gives to the investor the same positions of the traditional carry trade. The covered interest rate parity states that by selling BRL-USD forwards or futures an investor is long in the foreign interest rate and short in the local interest rate and in dollar, exactly as in the simplest version of carry trade.[10]

[8] The average FX rate on January, 2009 is R$2.31/$ and on January, 2011 is R$1,67/$.
[9] We restrict somewhat the concept of carry trade. For further discussion, we suggest Curcuru et al (2010).
[10] Applying to the Brazilian case, selling US$1x(1+$r_f$) forward is equivalent to the traditional carry trade in which the investor borrow US$1 at r_f (foreign interest rate) to invest in Brazilian bonds at r (local interest rate). If S_0 and S_1 denote the spot quote for the BRL-USD exchange rate respectively at beginning and at the end of the investment period, the final payoff in dollars of the traditional carry trade will be (S_0/S_1) x (1+r) -1x(1+r_f). If F denotes the forward quote for the BRL-USD exchange rate, when the investor sells US$ 1x(1+r_f) forward, his payoff will be (F/S_1)x(1+r_f) – 1x(1+r_f). By the covered interest rate parity, F is equal to S_0x(1+r)/(1+r_f), which makes this payoff exactly the same as the one obtained by the traditional carry trade.

Figure 1 - Long and Short Positions of Non-Resident Investors on FX Derivatives (except Options) in Brazil from April, 2010 to March, 2013.

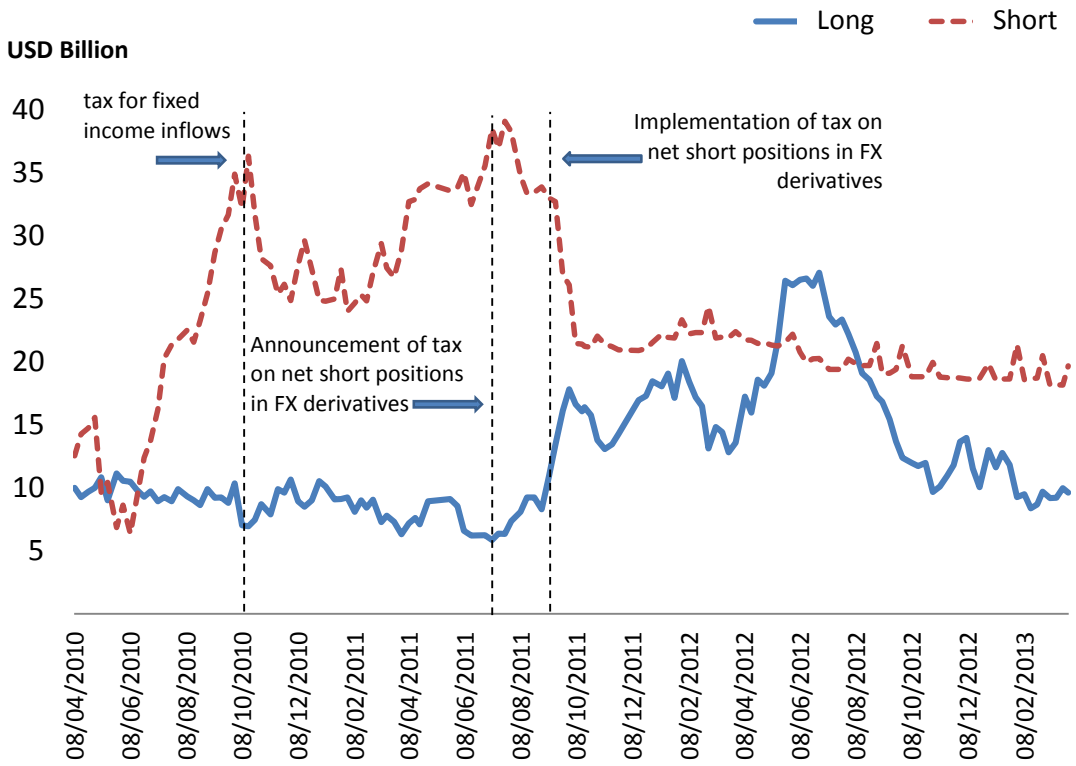
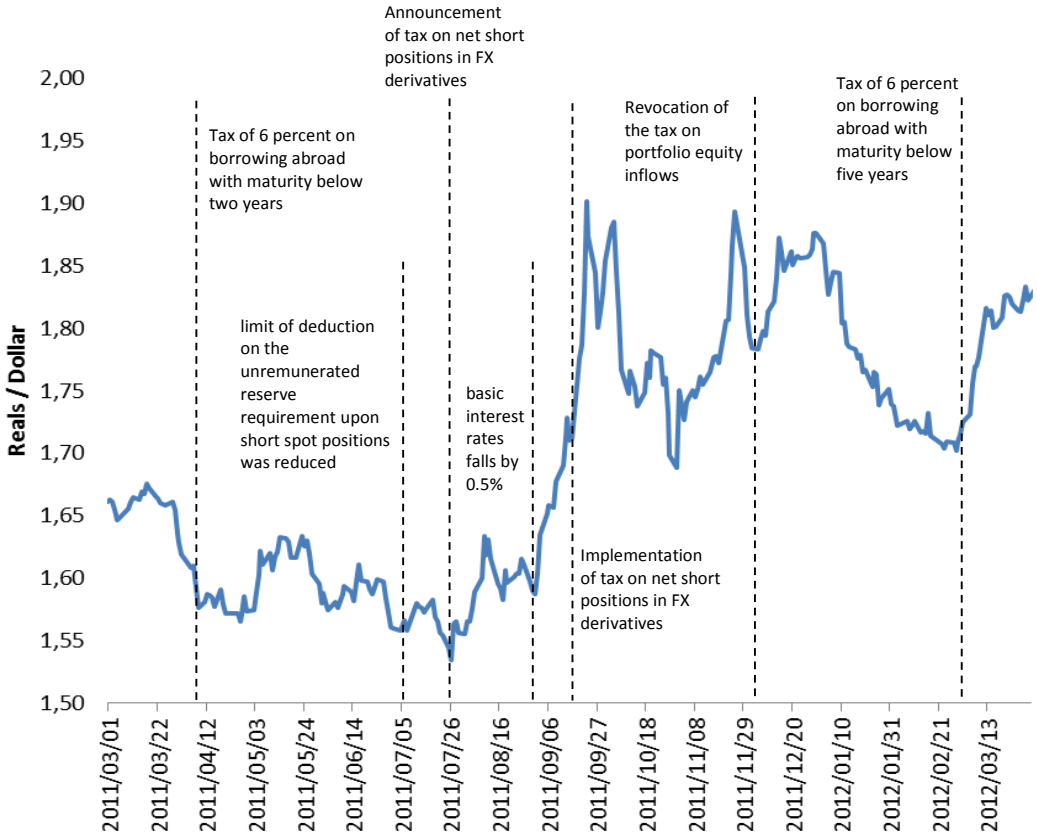


Figure 1 plots long and short positions of non-resident investors on FX derivatives (except options) in Brazil from April, 2010 to March, 2013. Between June and October, 2010, we note a rise in the short positions: the non-resident, by doing carry trade with FX forwards, avoids the 2% tax for fixed income inflows. On October, 2010 the tax for fixed income inflows were changed from 2% to 4% and shortly afterwards to 6%, and there was a temporary reduction in the short positions.[11] However, on March, 2011 the short positions returned to the same level as before, well above the level of the long positions. In September, 2011 we perceive a significant and permanent reduction in short positions and an increase in long positions. These evidences coincide with the beginning of taxation on net short positions in FX derivatives. On the last quarter of 2011, non-residents´ short

[11] Although the tax for fixed income inflows aims to restrain the traditional carry-trade, this interference signals the Brazilian government's intention to reverse the appreciation of the local currency, which could affect the earnings of investors doing carry trade through short positions in FX derivatives.

positions stabilized at a lower level while their long positions begin to display a higher variation. Figure 2 shows that in this period the local currency underwent an abrupt devaluation and the Brazilian government achieves its goal.[12]

Figure 2 -BRL-USD Exchange Rate and Foreign Exchange Measures Adopted in Brazil from March 2011 to March 2013



[12] According to the Brazilian government official site (http://www.brasil.gov.br), the Brazilian finance minister announced on July, 2011 that this tax was a way to charge a fee on some kind of financial market operations and hamper the action of speculators who were betting more and more on appreciation of the real. See http://www.brasil.gov.br/governo/2011/09/novo-decreto-detalha-mudancas-do-iof-no-mercado-de-derivativos .

In this study, we focus on the consequences of the implementation of this tax on net short positions in FX derivatives on the third quarter of 2011. This taxation, named IOF tax (IOF is the Portuguese acronym for Tax on Financial Transactions), intended to reduce the carry trade in the FX derivatives market that was causing the local currency to appreciate. Figure 2 reports the IOF and other measures adopted in Brazil and the BRL-USD spot price around this period. Besides taxation on short position in FX derivatives and on fixed income inflows, Brazilian government resort to two other types of measures during the period: i) a tax on the firms´ foreign borrowing depending on the loan maturity; and ii) reserve requirements for banks holding short positions in FX spot market. These measures, along with the IOF on fixed income flows, basically targeted to reduce the traditional carry trade.

On March 28th, 2011, Brazilian firms borrowing abroad became subject to a 6 percent tax on those flows if their maturity was less than 1 year (extended to two years shortly afterwards on April 6th, 2011). We can note that the FX rate rose after the measure, but soon returns to its downward trend. On July 8th, 2011 the limit of deduction of unremunerated reserve requirement upon short positions was reduced, but it seems that this measure had no effect in the FX rate. On July 26th, 2011 the Brazilian government announces that net short positions in FX derivatives will be taxed by the IOF, but the measure did not take effect immediately due to operational difficulties. This measure is intended to reduce the carry trade strategies with short positions in FX derivatives. The FX rate begins to have an increasing trend. On August 31th, 2011 the monetary policy committee of the Central Bank of Brazil reduced the basic interest rates by 0.5% and, as a result, carry trade strategies become less attractive.[13] On September 16th, 2011 the IOF announced on July was implemented. We notice that after all of these measures, the FX rate was in another level. After that, on December 1st, 2011 the tax on portfolio equity inflows was eliminated.[14] On February 29th, 2012, and on March, 9th, 2012, the tax on Brazilian firms borrowing abroad was extended to three years and five years, respectively.

As we are studying the effect of IOF increase on short positions in FX derivatives on the spread between forward and futures FX contracts, we restrict our sample to before the

[13] After five consecutive meetings rising the basic interest rate (from 10.75% to 12.50%), the Central Bank of Brazil inverted its monetary policy by announcing a cut of 50 base points.

[14] This is the only one measure in this period that (alone) causes the FX rate falls. Equity inflows were taxed since October, 2009.

announcement of the taxation and after its implementation. If the spread changes after the implementation, the cost of hedging in the OTC market is altered. As there are some events between the announcement and the implementation we do robustness checks to verify if these events change the spread.

3 – Data and Descriptive Analysis

Our primary dataset consists of data on Non-Delivered Forward (NDF) informed by Cetip to Central Bank of Brazil for regulatory purposes. Cetip is a public-held company and acts as the major trade repository for OTC derivatives in Brazil. We have data of each NDF contract traded between banks and non-financial firms. For each contract we have available the notional amount, currencies traded, maturity, forward price and identification of counterparts (for non-financial sector, instead of the name and ID of the firm there is a masked id that permits to track a firm along the time but do not identify it). As we are interested in evaluating the impact of new taxation on FX Derivatives short position that took place in the third quarter of 2011 – this measure was first announced in July, 27th but was actually implemented in September, 16th – our main sample restricts the analysis to the period May-June, 2011 (before the taxation) and October-November, 2011 (after the taxation). We carry out other analysis with larger samples in order to test the robustness of our results, always trying to balance the benefits of using more data against the drawback of possibly having other unobserved time varying factors that could influence our results.

Among the NDFs negotiated in the Brazilian market, we focus on BRL-USD for two main reasons: i) BRL-USD is by far the most traded NDF in Brazil, with 86% of the number of contracts and 89% of the notional value (converted in BRL for comparison) in our sample; ii) considering all types of NDFs (i.e. NDF of other currencies) may impose some complexity in the analysis that we don't want to address in this study. We also kept only the plain vanilla NDF contracts, which represents 96% of the number of contracts, excluding those with caps, floors, those whose payoff depends on the average spot price (Asian types) and those contracts where the forward rate is determined in a future date (a forward NDF contract). Moreover, in order to simplify the analysis we excluded multiple contracts with the same counterparts and different maturities traded in the same day. We

argue that what is really traded in these cases is one forward contract with several expiration dates.[15] Applying this criterion we keep 5365 contracts (32%) in the sample. We carry out robustness checks keeping the excluded contracts in order to assure that our results are not sensitive to that choice. Finally, we eliminate contracts with notional value below USD 50 thousands (189 contracts) and contracts with maturity higher than 4 years (4 contracts). The final sample comprises 5172 NDF contracts.

In our sample, there are 999 firms and 34 banks. Among the firms, 354 take only short positions in new NDF contracts, 502 take only long positions and 143 assume both positions.[16] Among those 497 firms that take short position in new NDF contracts, 179 do that before and after taxation, 132 only before and 186 only after the taxation. Among those 645 firms that assume long position, 191 of them buy BRL-USD forward contracts in both periods, 224 only before and 230 only after the taxation.

Table 1 presents summary statistics for the data in our sample. Panel A describes NDF contract level variables. These include forward price, maturity and notional amount (in US dollars) of the contract. Since future prices capture significant amount of forward price variation due to market conditions, we also show the spread between forward and future prices. In order to calculate the spread we depart from two premises: i) as we don't know the exact time that the contract was agreed, we used settlement prices of BRL-USD future contracts released daily by the Brazilian futures exchange (BM&FBovespa); and ii) as future contracts in the exchange have standard maturities, we performed a linear interpolation between the available maturities. We emphasize that settlement prices are determined by the Futures Exchange based on transactions carried out in the end of the day when there are enough liquidity or, in the absence of liquidity, the futures exchange itself has its own methodology rested on arbitrage fundamentals to assess the settlement price.[17] As daily settlements are based on these prices, we are confident that they are an appropriated measure for our purposes.

[15] In those multiple contracts traded in a day, the firm's bargain power for each maturity is different from the case where the firm trades the same notional amount and the same maturity in a single contract. In a contract with several expiration dates, each forward price is set based on the total notional that comprises all the other expiration dates involved in the deal.
[16] Only 14 firms negotiate opposite positions before and after the taxation: 9 firms change from long to short and 5 change from short to long. 51 firms buy and sell USD NDFs both before and after taxation.
[17] See http://www.bmfbovespa.com.br/pt-br/mercados/download/Metodologia_Abril-2014.pdf for the methodology adopted to determine the settlement prices by BM&FBovespa.

Forward prices show a large variation in our sample, ranging from R$1.5683 to R$2.1610. Variation in the underlying asset (USD spot rate in the local currency) and in maturity of contracts (the sample comprises maturities from less than one month to almost 4 years) are some obvious reasons for such a large interval. Spread between forward and future prices also show a significant variation. Negative values are due to firm's short position. In exchange for an OTC derivative that doesn't require margin calls and doesn't depend on the futures exchange fixing schedule, firms sell forward contracts to the banks at a discount price. For the same reason, they buy forwards at a premium.

Table 1 – Summary Statistics

Panel A - Contract-level variables

Variable	Mean	S.D.	Min	Q1	Median	Q3	Max	Obs.
Forward Price (BRL/USD)	1,7337	0,1095	1,5683	1,6311	1,7330	1,8141	2,1610	5172
Spread (Forward - Future)[1/] (BRL/USD)	0,0011	0,0134	-0,0837	-0,0038	0,0003	0,0051	0,3498	5172
Maturity (days)	123	124	25	41	74	156	1250	5172
Notional Amount (USD thousands)	3.954	11.100	50	285	950	2.900	242.000	5172
	% Number of Contracts			% Notional				
Domestic Private Bank Share	37%			28%				5172
Foreign Bank Share	57%			67%				5172
Government Owned Bank Share	6%			5%				5172

Panel B - Firm attributes

Variable	Mean	S.D.	Min	Q1	Median	Q3	Max	Obs.
Number of Banks as Counterparts	1,81	1,5873	1	1	1	2	14	999
	% Number of Firms			% Notional				
Share of Firms only selling USD NDF contracts	35%			18%				999
Share of Firms only buying USD NDF contracts	50%			24%				999
Share of Firms buing and selling USD NDF contrac	14%			58%				999

[1/] The spread forward - future is computed comparing the forward with the settlement price of the USD future contract with the same maturity. When the maturities doesn't match, we carry out a linear interpolation of the future prices.

We also present in the panel A the share of contracts with each type of bank ownership. We note a large presence of foreign banks in our sample. Foreign banks accounts for 57% of the number of contracts and 67% of the notional amount in USD NDF, while government owned banks negotiated only 6% of the number of contracts, which represents 5% of the total of notional traded in the period analyzed.

Panel B show the number of banks that a firm trades within our sample. The median firm negotiates with just one bank in our sample and 75% of the firms have trades with up to

2 firms. Panel B also illustrate the kind of positions taken by the firms in BRL-USD NDF contracts. 50% of the firms only buy BRL-USD NDF contracts in our sample, while 35% of the firms only sell these contracts. A small amount of the firms, 14% of them, buys and sells contracts, but the notional amount traded by them accounts for 58% of the total notional of the sample.

We go further in our descriptive analyses and break our sample according to the position of the firm in NDF contracts and to the period of interest (before and after the beginning of the taxation). Table 2 shows basic comparison of some characteristics of the NDF contracts and market variables between the two periods. As expected, the incidence of a tax on short positions in FX derivatives had less influence on the spread between forward and future prices when firms sell than when firms buy NDF contracts. The absolute mean spread after the tax incidence is 5% smaller than before for the firms with short positions but this difference is not statistically significant. A reduction in the absolute spread on firm short positions indicates that banks may be demanding a smaller discount after the tax incidence in other to buy NDF contracts from their clients. On the other hand, the median shows a more negative spread after the tax, indicating in turn that banks may be demanding a higher spread. The only difference between the two periods that is marginally significant in firms' short positions is related to the notional amount. At 10% level of significance, results show a 15% percent decrease in the notional amount traded after the incidence of IOF than in the period before. A possible explanation is that firms reduced the amount of hedge after the taxation fearing to extrapolate the limits imposed by the law and end up having to pay taxes to hedge their positions. The same reason may be associated to a reduction in the maturity of the contracts after the incidence of the new tax, although the difference is not statistically significant.

When analyzing to firms' long positions on NDF contracts, we observe a large and statistically significant increase in the spread between forward and future charged by the banks. The mean of spread after the incidence of the IOF is 52% larger when firms buy NDF contracts from banks. This increase in the cost may also explain the economic and statistically significant decrease (9%) in the maturity of the contracts. As the cost of buying NDF contracts increases after the incidence of new tax, firms may have opted to buy lower maturity contracts. The same reason may explain the decrease in the notional amount, although this difference is not statistically significant.

Table 2 – Descriptive Analyses

Panel A - NDF Contracts Characterisitcs

		Before Taxation			After Taxation			Mean	
	Variable	median	mean	sd	median	mean	sd	Difference	
Firms with Short Position in USD NDF	Spread (Forward - Future)[1/]	-0,0017	-0,0039	0,0091	-0,0027	-0,0037	0,0128	0,0002	
	Spread %	-0,0011	-0,0023	0,0053	-0,0014	-0,0019	0,0069	0,0004	
	log(Nocional)	13,59	13,76	1,49	13,55	13,61	1,53	-0.15	*
	log(Maturity)	4,62	4,69	0,88	4,58	4,64	0,88	-0,05	
	Number of Firms		311			365			
	Observations		1337			1250			
Firms with Long Position in USD NDF	Spread (Forward - Future)[1/]	0,0020	0,0048	0,0140	0,0040	0,0073	0,0136	0,0025	***
	Spread %	0,0012	0,0029	0,0082	0,0022	0,0041	0,0076	0,0012	***
	log(Nocional)	13,86	13,92	1,72	13,82	13,81	1,70	-0.11	
	log(Maturity)	4,09	4,24	0,77	4,04	4,15	0,67	-0.09	**
	Number of Firms		415			421			
	Observations		1309			1276			

[1/] The spread forward - future is computed comparing the forward with the settlement price of the USD future contract with the same maturity. When the maturities doesn't match, we carry out a linear interpolation.*,** and *** indicate mean difference statistically significant respectively at 10%, 5% and 1%, with standard errors corrected for cluster at firm level.

Panel B - Market Characterisitcs

	Before Taxation			After Taxation			Mean	
Variable	median	mean	sd	median	mean	sd	Difference	
USD Spot (Ptax)	1,5969	1,6006	0,0194	1,7662	1,7815	0,0500	0,1809	***
Implied volatility (3 month maturity)	0,1010	0,1037	0,0080	0,1514	0,1555	0,0190	0,0518	***
log(USD Future Turnover)	23,6739	23,6514	0,2457	23,6168	23,6345	0,2900	-0,0169	
Volatility Asymmetry (3 month option)	5,6000	5,9165	0,4844	14,2000	14,0284	2,4147	8,1119	***
Observations		43			40			

* significante at 10%,** significant at 5%,*** significant at 1%

Panel B of table 2 compares the differences between the periods before and after the tax incidence of some of the main market variables related to the FX market. All the variables reported, but the USD Future Contracts turnover, show an economic and statistically change after the taxation. Although the magnitude of these variables influences both the prices of future and forward markets for the same maturity, one may argue that the bank's margins on forward contracts, and therefore the spread between forward and future contracts, are somehow impacted by those market variables. Thus, in order to circumvent this issue and other identification concerns, we next develop a basic model and present our empirical strategy to assess the impact of the new tax incidence on the NDF market.

4 – Empirical Methodology

In this study, we investigate if the tax imposed on FX derivatives with the intention to reduce the carry trade changes the hedging cost of non-financial firms. For this purpose we compare the spread between the NDF prices and FX future prices before and after the the beginning of the taxation. By using the difference between the quotations of these derivatives we intend to control for macro and micro-economic shocks that influence the FX prices. Bolton, Santos and Scheinkman (2012) argue that transactions in forward markets are primarily between informed dealers (banks) and producers (firms) who seek to hedge against spot-price movements. The bank would most likely also engage in an opposite forward and hedge the net amount with futures contracts. Thus, the difference between the OTC transaction price and the future price is related to the profit of the bank in financial intermediation and, thereafter, is also related to the cost of the non-financial firm to hedge in the OTC Market.[18] If this spread is statistically different before and after the tax, after controlling for variables that can affect this difference, the cost of non-financial firms to hedge is changed.

Consider the environment where banks $\{1, \ldots\ldots, B\}$ trade FX forward contracts with non-financial firms $\{1, \ldots\ldots, I\}$ at instant τ of the day *t*. Define *p* as the position assumed by firm *i* on the forward transaction. $E_{ib\tau mp}$ denotes the forward price of a trade between the bank *b* and firm *i* at instant τ with settlement at *m* when the firm assumes position *p*. Let *N* be the notional value of the forward contract and $F^*_{\tau m}$ the "true" FX future price[19] (non-observable) at instant τ.

The forward price traded between banks and firms in the non-financial sector on the OTC market can be described by:

[18] Bolton, Santos and Scheinkman (2012) give the reason why firms prefer to hedge on OTC contracts than on futures market. They affirm that although the OTC contracts give firms less favorable prices, as banks understand that the movements in spot price do not give rise to higher counterparty risk, firms are typically subject to lower margin requirements than on futures market. Other reasons may be the daily settlement and the standardization of the futures contracts.

[19] This terminology comes from the microstructure literature (Glosten, 1987). The "true" price can be defined as follows. Let F^{**} be the value of the future price if all agents have access to inside information. Suppose that the risk of inside information is not priced. In this case, the "true" future price, based on all common-knowledge information (H), is $F^* = E[F^{**}|H]$. This value is non-observable. The observable prices in the future market are the bid and the ask price. The trade price occurs at the bid or at the ask price.

$$E_{ib\tau mp} = F^*_{\tau m} + BidAsk^{F^*}_{\tau mp} \times F^*_{\tau m} + margin(N, X_b, Y_i, Z_\tau, m) \quad (1)$$

where

$BidAsk^{F^*}_{\tau mp}$ is the spread (in percentage) of the quotation of the "true" future price at instant τ with maturity *m*.

X_b is the set of bank characteristics;

Y_i is the set of firm characteristics;

Z_τ is the set of micro and macroeconomic variables that affect the FX market at instant τ (such as FX quotation, volatility, FX asymmetry, etc.); and

$margin(N, X_b, Y_i, Z_\tau, m)$ is the value charged by the bank *b* for offering the OTC Market services to the firm *i* which depends on the notional and the maturity of the trade, the set of counterpart's characteristics and the micro and macroeconomic variables that affect the FX market at the trade instant.

As the FX future market have high liquidity, especially for low maturities,[20] we can simplify the model by assuming that the value of the $BidAsk^{F^*}_{\tau mp}$ is small relative to the difference between the price of the forward trade ($E_{ib\tau mp}$) and F^*_{tm} :

$$E_{ib\tau mp} - F^*_{\tau m} = margin(N, X_b, Y_i, Z_\tau, m) \quad (2)$$

As we don't know the instant τ that the forward contract was agreed (we only know the day of the trade, *t*), we use the settlement daily price of the future contract for $F^*_{\tau m}$.

[20] The trades in our sample have low maturities. See Table 1.

$$E_{ib\tau mp} - F_{tm} = margin(N, X_b, Y_i, Z_\tau, m) + \varepsilon_{tm} \quad (3)$$

where F_{tm} is the settlement future price with maturity *m* on day *t*.

That is, we can model $E_{ib\tau mp} - F_{tm}$ as a function of N, X_b, Y_i, Z_τ, m.

We expect positive $E_{ib\tau mp} - F_{tm}$ for firm's long positions as banks sell forward contract at higher prices than the future quotation. For firm's short positions, we expect the opposite. We call $E_{ib\tau mp} - F_{tm}$ as the spread between the NDF trade prices and FX future prices.

$$Spread_{ib\tau mpt} = margin(N, X_b, Y_i, Z_\tau, m) + \varepsilon_{tm} \quad (4)$$

Define π = {0,1}, where 0 is the period before the entry of the tax and 1 the period after the tax.

$$Spread_{ib\tau mpt}(\pi = 1) = Spread_{ib\tau mpt}(\pi = 0) + \gamma\pi \quad (5)$$

We are interested in the value of coefficient γ, that is the impact of the tax on the spread. According to equation (5), we can estimate the impact of the tax for both long and short positions separately. This is relevant because this impact may be different for each position. We can also estimate, for instance, the impact for different maturities or for different types of banks. Furthermore, we can employ i) firm fixed effects to control for time invariant firm-specific characteristics that influence firm demand for FX derivatives; and ii) bank fixed effects in order to assure that the results are not driven by bank selection in our sample.

For long positions of the firms, if γ is positive (negative) the spread increases (decreases) with the taxation as the spreads for long positions are positive. However, for short

positions of the firms, if γ is positive (negative) the spread decreases (increases) as the spreads for short positions are negative.

As the instant τ is unknown in our sample we employ the variables that affect the FX market of day *t* (Z_t) instead of using Z_τ. The variables we apply are

i) The foreign exchange (BRL/USD) spot price, reported by Central Bank of Brazil.[21] The higher this price, the higher we expect the spread;
ii) The implied volatility (*IVol*) for 3-month at the money (ATM) FX options of the day *t*, reported by Reuters. The ATM call is the one with delta 0.5;[22]
iii) The volatility asymmetry for 3-month FX options. This is a proxy of the asymmetry of the underlying asset, in this case, the dollar spot. This variable is calculated by the methodology described in Xing, Zhang and Zhao (2010). The volatility asymmetry is the *IVOL* of an out-of-the-money (OTM) call minus the *IVOL* of an OTM put. We use this variable to capture market pressures for changes in the dollar spot. We considered for the OTM calls and puts the ones with delta 0.1. If there is a positive variation in the volatility asymmetry, the probability of positive extreme changes in the BRL/USD quotation increase (increase the chances of a high devaluation of the local currency); and

We also use the BRL-USD turnover as a Z_t variable. This variable is the daily volume traded at the FX Brazilian future market. We use this variable as a proxy of the FX demand which can affect the spread between NDF and FX future prices.

[21] We used for the FX spot price the PTAX quotation which is an average rate of transactions of FX dealers.
[22] The implied volatility is highly correlated for different maturities. We choose the 3-month maturity considering the maturity between the mean and median of NDF sample for the options with higher market liquidity.

5 – Main Results

As discussed before, we expect that the main impact on the Non-Financial Sector of the IOF over short positions in FX Derivatives must have occurred on the OTC transactions when firms buy Non-Deliverable Forwards (NDFs). The rationale is that banks would transfer additional costs on holding taxable short positions on FX Derivatives to the firms that assume long positions in new NDF contracts. For banks, these additional expenses reflect not only the IOF amount itself, but also the cost due to changes in their market operations in order to avoid the incidence of IOF when they sell FX derivatives to firms. To the extent that the IOF is charged over changes in daily position, since this new tax was implemented, the hedge for those operations has to be done in the same day to avoid an increase in bank's short position. In order to do so, banks became more vulnerable to the whims of the Futures Market[23] or have their bargain power reduced on their OTC Derivatives long position transactions.

5.1- Impact of IOF over short positions on FX Derivatives when Firms Buy Non-Deliverable Forwards

Table 3 presents the main impact of the IOF on the OTC transactions when firms buy NDF contracts. The dependent variable analyzed is the spread between the Forward Price and the Future Price for the same maturity.[24] In column 1, we present results for the entire sample, while columns (2)-(9) we restrict to firms that have deals with banks in our sample both before and after the IOF implementation. The coefficient of interest is both economically and statistically significant for all specifications. The impact is also even larger than the reported in the descriptive analysis. Comparing to the mean spread observed before the incidence of IOF, the impact varies from 60% increase in column (1), which specification comprises the entire sample and have only notional amount and maturity controls, to 165% in column (9), the most comprehensive regression with firm fixed effects, bank fixed effects and market controls. The minimum and the maximum

[23]Although there are regulatory limits to holding FX market risk, when a bank attend the capital requirements, it can defer its hedge in order to find better market conditions in periods of high volatility or wait to the conclusion of a new contract with other client that assume opposite position. After the incidence of IOF, the time for such a hedge was constrained to intra-day market operations.

[24]As discussed before, we obtained prices for each maturity by linear interpolation of the settlement prices of the standard maturities.

values of the cost increase are respectively 50% and 183%, always statistically significant at 1%. Since the BRL-USD NDF price is already high due to the interest rate differentials, increasing the OTC FX derivative's cost may prevent even more Brazilian firms from hedging their FX short exposures. This raised cost may reduce the intensity of the non-financial firms hedging which makes them more vulnerable to FX shocks.

In column (2), we add bank fixed effect and column (3) controls for firm fixed effect. The coefficients of notional amount and maturity show that the spread between forward and future prices responds in a quadratic way to the increase in these variables.

In columns (4) to (9), we add market controls to the specification of column (3). We introduce first the implied volatility variable in column (4). As presented before this coefficient is measured based on FX options with 3 months maturities traded in BM&FBovespa. Although one would expect that higher FX volatility is associated with higher bank margin on OTC derivatives, the signal coefficient points to another direction. According to our sample results, after controlling for notional amount and maturity we found that higher volatility is negatively correlated to the spread. One possible explanation is that there is more rigidity on Forward Prices than on Futures Prices, particularly in high volatility environment, i.e. while banks tend to keep their quotation offer to clients during a certain window of time, the observed settlement future price is set at the end of the day and take in consideration all the information disclosed in the day. Therefore, although further investigation is needed to ascertain the reasons for this negative correlation, it's possible that the negative value of the correlation may have resulted from the measure adopted for the future price. It's relevant to note that this negative correlation remains statistically significant when we add other market variables in columns (5) to (9).

In columns (5), (7) and (9), we control for the log of future turnover. Employing this variable we try to capture the variation in the market demand for foreign currency. When this demand increases, we expect that banks charge a higher margin when selling FX OTC derivatives. The estimated coefficients confirm this assumption. The correlation between the log of future turnover and the forward-future spread is positive and statistically significant at 1%.

We add volatility asymmetry in columns (6) to (9). This measure intends to capture how the chances of an increase in the dollar spot rate vary differently when compared to the chances of a decrease in the exchange rate. As the implied volatility does not take into account this aspect, adding this control is important to distinguish when the currency market is in an up or in a downtrend. The asymmetry coefficient is negatively correlated to our measure of spread, although it is statistically significant only in column (9). The explanation of this sign follows the same reasons alleged for the sign of implied volatility.

Table 3 - Effect of IOF over Short Position on FX Derivatives on the Spread between Forward and Future Prices
Firms buy NDF contracts

Dependent Variable:	Forward Price-Future Price								
	All Sample	Firms in both periods							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After incidence of IOF over Short Position in FX Derivatives	0.0029***	0.0025***	0.0024***	0.0052***	0.0059***	0.0072***	0.0088***	0.0067***	0.0079***
	(0.0006)	(0.0005)	(0.0005)	(0.0011)	(0.0011)	(0.0021)	(0.0020)	(0.0021)	(0.0020)
log(notional)	-0.0125***	-0.0095**	-0.0059**	-0.0063**	-0.0058**	-0.0063**	-0.0057**	-0.0064**	-0.0058**
	(0.0037)	(0.0038)	(0.0028)	(0.0028)	(0.0026)	(0.0028)	(0.0026)	(0.0028)	(0.0026)
log(notional)^2	0.0004***	0.0003**	0.0002**	0.0002**	0.0002**	0.0002**	0.0002**	0.0002**	0.0002**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
log(maturity)	-0.0151**	-0.0093	-0.0115*	-0.0110*	-0.0094	-0.0111*	-0.0095	-0.0110*	-0.0093
	(0.0070)	(0.0062)	(0.0062)	(0.0061)	(0.0061)	(0.0061)	(0.0062)	(0.0062)	(0.0062)
log(maturity)^2	0.0022***	0.0012	0.0013*	0.0012*	0.0011	0.0013*	0.0011	0.0012*	0.0011
	(0.0008)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
implied volatility				-0.0533***	-0.0714***	-0.0590***	-0.0797***	-0.1141**	-0.1931***
				(0.0191)	(0.0179)	(0.0208)	(0.0193)	(0.0575)	(0.0544)
log(USD future turnover)					0.0076***		0.0078***		0.0080***
					(0.0010)		(0.0010)		(0.0010)
volatility asymmetry (3 month option)						-0.0002	-0.0003**	-0.0003	-0.0005***
						(0.0002)	(0.0001)	(0.0002)	(0.0002)
dollar spot								0.0215	0.0441**
								(0.0210)	(0.0195)
Observations	2,585	1,861	1,861	1,861	1,861	1,861	1,861	1,861	1,861
R-squared	0.1321	0.0821	0.3753	0.3812	0.4195	0.3825	0.4221	0.3832	0.4248
Firm Fixed Effect	NO	NO	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effect	NO	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of the incidence of IOF over short positiitions in FX Derivatives market on the difference between the prices in the Forward (OTC) and Futures (Exchanges) Market for the same maturity.We compare the Forward Contracts traded in 2011 from May, 1st to Jun, 30th with those agreed from Oct,1st to Nov,30th of the same year. There are 645 firms that buy USD forward in the sample, 191 buy in both periods, 224 only before the incidence of IOF and 230 only after. There are 32 banks in this sample, 25 sell contracts in both periods and 2 banks appear only in the second period.The announcement of the IOF was in July, 26th but the effectiveness of the new tax only took place in September, 16th. Standard-Errors reported in parentheses are clustered at firm level. *** significant at 1% ** significant at 5% * significant at 10%

Columns (8) and (9) controls for dollar spot rate. This is another variable that may be associated to the demand for foreign currency. One might expect that importer or firms with debt in foreign currency would have a higher propensity to hedge their positions when the dollar spot goes up. In both specifications, the estimated coefficient is positive. In column (9), it is also statistically significant at 5%.

5.2- Impact of IOF over short positions on FX Derivatives when Firms Sell Non-Deliverable Forwards

In this section we present the impact of IOF on NDF transactions when firms sell NDF to banks. As discussed in the beginning of this section, the incidence of the IOF does not impose any additional cost to banks for buying OTC derivatives. If anything, when the government taxes the increase of bank's short position, after selling FX OTC derivatives a bank may have incentives to hedge their position with another OTC derivative at the same day in order to avoid paying the tax. Therefore, banks may reduce their margin when buying NDFs from firms in order to prompt this deal.

Table 4 shows the results for the same set of specifications reported when firms buys NDF from banks. As depicted in the Descriptive Analysis, the spread between Forward and Future prices is negative in most of the cases, because banks demand a discount at future prices in order to buy customized FX OTC derivatives from firms. Therefore, a positive coefficient on the period after the incidence of IOF indicates that this discount (the absolute value of the spread) was reduced. We indeed observed a positive coefficient on the period after the incidence of IOF in all specifications, but one. Nonetheless, the measured impact is statistically significant in only 4 out of the 9 regressions. Particularly, the coefficient is not statistically significant when we add market variables controls.

Table 4 - Effect of IOF over Short Position on FX Derivatives on the Spread between Forward and Future Prices
Firms sell NDF contracts

Dependent Variable:	Forward Price-Future Price								
	All Sample	Firms in both periods							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After incidence of IOF over Short Position in FX Derivatives	0.0004	0.0011*	0.0015**	0.0035***	0.0049***	0.0001	0.0032	-0.0005	0.0024
	(0.0006)	(0.0006)	(0.0006)	(0.0012)	(0.0013)	(0.0023)	(0.0024)	(0.0022)	(0.0023)
log(notional)	0.0107***	0.0086***	0.0017	0.0018	0.0010	0.0017	0.0010	0.0018	0.0011
	(0.0028)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0031)	(0.0030)
log(notional)^2	-0.0003***	-0.0003**	-0.0001	-0.0001	-0.0000	-0.0001	-0.0000	-0.0001	-0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
log(maturity)	-0.0041	-0.0015	0.0090*	0.0089*	0.0092*	0.0087*	0.0091*	0.0087*	0.0090*
	(0.0044)	(0.0039)	(0.0048)	(0.0048)	(0.0050)	(0.0049)	(0.0050)	(0.0049)	(0.0050)
log(maturity)^2	0.0001	-0.0001	-0.0012**	-0.0012**	-0.0012**	-0.0012**	-0.0012**	-0.0012**	-0.0012**
	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0006)	(0.0005)	(0.0006)
implied volatility				-0.0372**	-0.0568***	-0.0232	-0.0496**	-0.0835*	-0.1527***
				(0.0181)	(0.0193)	(0.0200)	(0.0217)	(0.0496)	(0.0550)
log(USD future turnover)					0.0060***		0.0058***		0.0061***
					(0.0009)		(0.0010)		(0.0010)
volatility asymmetry (3 month option)						0.0003*	0.0002	0.0003	0.0000
						(0.0002)	(0.0002)	(0.0002)	(0.0002)
dollar spot								0.0241	0.0406**
								(0.0163)	(0.0172)
Observations	2,587	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038
R-squared	0.1024	0.1344	0.4067	0.4092	0.4278	0.4118	0.4283	0.4127	0.4308
Firm Fixed Effect	NO	NO	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effect	NO	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of the incidence of IOF over short posititions in FX Derivatives market on the difference between the prices in the Forward (OTC) and Futures (Exchanges) Market for the same maturity. We compare the Forward Contracts traded in 2011 from May, 1st to Jun, 30th with those agreed from Oct,1st to Nov,30th of the same year. There are 497 firms that sell USD forward in the sample, 179 sell in both periods, 132 only before the incidence of IOF and 186 only after. There are 30 banks in this sample, 28 buy contracts in both periods and 2 banks appear only in the second period. The announcement of the IOF was in July, 26th but the effectiveness of the new tax only took place in September, 16th. Standard-Errors reported in parentheses are clustered at firm level. *** significant at 1% ** significant at 5% * significant at 10%.

6 – Robustness

In this section we carry out a series of robustness checks in order to assess the validity of our main results. First of all, we replicate the tables 3 and 4 replacing the spread forward minus future price by the percentage spread. This variable is the ratio between the spread and the future price. Using this dependent variable we address concerns about our results being driven by changes in the level of future quotation. When the future price is higher, the same absolute spread accounts for a lower percentage spread. Tables 5 and 6, presented in the Appendix, shows that the results remain unchanged after this robustness.

Next, we run the main specifications extending the period analyzed. For before the IOF, we consider the period from April, 12th to July, 7th, 2011; for after the IOF we consider September, 22th 2011 to November, 30th 2012. These periods represents the largest windows between other capital control measures adopted by the Brazilian government (see Figure 2). Table 7 in the Appendix shows the results for firms buying NDF contracts. Although in a larger period other time-varying unobservable may have affected the results, in all the specifications the coefficient of interest remains positive and statistically significant at 1%.

We performed other two tests to rule out the hypothesis that our results might be driven by other events in the economy. Table 8 analyses the episode of the reduction in the limit of deduction on the unremunerated reserve requirement upon FX Short Spot Position on July, 8th 2011. The impact on the spread observed in the neighborhood of this change is null.

Table 9 studies the impact of the surprise fall of 50 basis points of the Brazilian basic interest rate (SELIC rate) announced by the Monetary Policy Committee (COPOM) on August, 31th 2011. This change led to a reduction of the difference between the local and foreign interest rate and making the carry trade strategy less attractive. According to the results, there is no evidence of an impact on the forward-future spread.

Finally, we rerun our main regressions (Table 3) without excluding the multiple contracts with the same counterparts and different maturities traded in the same day. Although those contracts are registered independently, they seem to have been negotiated together. Therefore, for considering those contracts in our analysis, we aggregated the multiple expiration dates summing the notional amount and taking average of spread between future and forward prices and the average of

maturity, both of them averaged by the notional amount. Tables 10 and 11 show that the results remain the same for firm's long and short positions.

7 – Conclusion

In this study we investigate how regulatory changes in the OTC derivatives market can affect the non-financial sector. For this purpose, we use a natural experiment which took place on the Brazilian FX derivatives market: the taxation of short positions in FX derivatives in 2011. The intention of the Brazilian government was to charge non-resident investors in order to diminish the carry trade that was causing the local currency to appreciate. However this cost may be transmitted also to non-financial firms — the so-called end-users of derivatives.

In order to estimate the effect of the tax on non-financial firms, we compare the spread between NDF and FX future prices before and after the entry of the tax. With this strategy we control for macro and micro-economic shocks that influence the FX prices. As the taxation took place on the second half of 2011, the database consists of all NDF transactions between April 2011 and February 2012. A higher spread after the taxation means that the banks transferred some part of the tax to the non-financial sector. In our empirical strategy we also use firm fixed effects in order to control for time invariant firm-specific features and bank fixed effects to be sure that our results are not driven by bank selection.

To the best of our knowledge, this paper is the first one to study the costs of regulatory changes in the OTC derivatives markets with a microeconomic approach instead of relying on predictive macroeconomic models. The results show that the cost more than doubled for companies exposed to devaluation of the local currency (for instance, importers). Therefore, although effective as macroprudential/capital control measure, the tax over short positions in derivatives had this unintended consequence of increasing the cost of hedging for non-financial firms. As the BRL-USD NDF quotation is high due to the interest rate differentials, this cost increase is a concern to the extent that it may prevent firms from hedging their FX positions.

The international liquidity held after the 2007-2008 global financial crisis imposes trade-offs on economies that are recipients of capital flows (the costs associated with macroprudential

measures). The international community should recognize these trade-offs when analyzing the consequences of liquidity measures. As the spread increase inferred in our study can be seen as an increase in the OTC cost, the international community should also recognize the trade-off of more regulation versus higher costs. Furthermore, this trade-off may be worse for EMEs because the derivatives market is still incipient in these economies.

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Appendix – Robustness Results of Section 6

Table 5 - Robustness: Percentage Spread
Firms buy NDF contracts

Dependent Variable:	(Forward Price-Future Price)/Future Price								
	All Sample	Firms in both periods							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After incidence of IOF over Short Position in FX Derivatives	0.0014***	0.0013***	0.0012***	0.0030***	0.0035***	0.0043***	0.0053***	0.0041***	0.0048***
	(0.0003)	(0.0003)	(0.0003)	(0.0007)	(0.0006)	(0.0012)	(0.0011)	(0.0012)	(0.0011)
log(notional)	-0.0073***	-0.0055**	-0.0033**	-0.0035**	-0.0032**	-0.0035**	-0.0032**	-0.0035**	-0.0032**
	(0.0022)	(0.0022)	(0.0016)	(0.0016)	(0.0015)	(0.0016)	(0.0015)	(0.0016)	(0.0015)
log(notional)^2	0.0002***	0.0002**	0.0001**	0.0001**	0.0001**	0.0001**	0.0001**	0.0001**	0.0001**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
log(maturity)	-0.0077**	-0.0048	-0.0062*	-0.0059*	-0.0050	-0.0059*	-0.0050	-0.0059*	-0.0049
	(0.0039)	(0.0033)	(0.0033)	(0.0033)	(0.0033)	(0.0033)	(0.0033)	(0.0033)	(0.0034)
log(maturity)^2	0.0011**	0.0006	0.0007*	0.0007*	0.0006	0.0007*	0.0006	0.0007*	0.0006
	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
implied volatility				-0.0352***	-0.0455***	-0.0388***	-0.0506***	-0.0671**	-0.1123***
				(0.0107)	(0.0102)	(0.0118)	(0.0109)	(0.0324)	(0.0307)
log(USD future turnover)					0.0044***		0.0045***		0.0046***
					(0.0006)		(0.0006)		(0.0006)
volatility assimetry (3 month option)						-0.0001	-0.0002**	-0.0002*	-0.0003***
						(0.0001)	(0.0001)	(0.0001)	(0.0001)
dollar spot								0.0110	0.0239**
								(0.0119)	(0.0111)
Observations	2,585	1,861	1,861	1,861	1,861	1,861	1,861	1,861	1,861
R-squared	0.1259	0.0767	0.3775	0.3854	0.4239	0.3870	0.4269	0.3875	0.4294
Firm Fixed Effect	NO	NO	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effect	NO	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of the incidence of IOF over short posititions in FX Derivatives market on the percentage difference between the prices in the Forward (OTC) and Futures (Exchanges) Market for the same maturity.We compare the Forward Contracts traded in 2011 from May, 1st to Jun, 30th with those agreed from Oct,1st to Nov,30th of the same year. There are 645 firms that buy USD forward in the sample, 191 buy in both periods, 224 only before the incidence of IOF and 230 only after. There are 32 banks in this sample, 25 sell contracts in both periods and 2 banks appear only in the second period.The announcement of the IOF was in July, 26th but the effectiveness of the new tax only took place in September, 16th. Standard-Errors reported in parentheses are clustered at firm level. *** significant at 1% ** significant at 5% * significant at 10%

Table 6 - Robustness: Percentage Spread
Firms sell NDF contracts

Dependent Variable:	(Forward Price-Future Price)/Future Price								
	All Sample	Firms in both periods							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After incidence of IOF over Short Position in FX Derivatives	0.0005	0.0008**	0.0010***	0.0021***	0.0029***	0.0005	0.0023*	0.0002	0.0018
	(0.0003)	(0.0003)	(0.0003)	(0.0007)	(0.0007)	(0.0012)	(0.0012)	(0.0012)	(0.0012)
log(notional)	0.0059***	0.0048***	0.0008	0.0009	0.0004	0.0009	0.0004	0.0009	0.0005
	(0.0015)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)
log(notional)^2	-0.0002***	-0.0002**	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
log(maturity)	-0.0027	-0.0014	0.0044*	0.0043*	0.0045*	0.0042*	0.0045*	0.0042	0.0044*
	(0.0024)	(0.0021)	(0.0025)	(0.0025)	(0.0026)	(0.0026)	(0.0026)	(0.0026)	(0.0026)
log(maturity)^2	0.0001	-0.0000	-0.0006**	-0.0006**	-0.0006**	-0.0006**	-0.0006**	-0.0006**	-0.0006**
	(0.0003)	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
implied volatility				-0.0209**	-0.0316***	-0.0143	-0.0289**	-0.0479*	-0.0862***
				(0.0096)	(0.0104)	(0.0106)	(0.0116)	(0.0279)	(0.0309)
log(USD future turnover)					0.0033***		0.0032***		0.0034***
					(0.0005)		(0.0005)		(0.0006)
volatility assimetry (3 month option)						0.0002	0.0001	0.0001	-0.0000
						(0.0001)	(0.0001)	(0.0001)	(0.0001)
dollar spot								0.0134	0.0226**
								(0.0092)	(0.0097)
Observations	2,587	2,038	2,038	2,038	2,038	2,038	2,038	2,038	2,038
R-squared	0.1026	0.1379	0.4151	0.4176	0.4356	0.4194	0.4359	0.4203	0.4383
Firm Fixed Effect	NO	NO	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effect	NO	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of the incidence of IOF over short posititions in FX Derivatives market on the percentage difference between the prices in the Forward (OTC) and Futures (Exchanges) Market for the same maturity. We compare the Forward Contracts traded in 2011 from May, 1st to Jun, 30th with those agreed from Oct,1st to Nov,30th of the same year. There are 497 firms that sell USD forward in the sample, 179 sell in both periods, 132 only before the incidence of IOF and 186 only after. There are 30 banks in this sample, 28 buy contracts in both periods and 2 banks appear only in the second period. The announcement of the IOF was in July, 26th but the effectiveness of the new tax only took place in September, 16th. Standard-Errors reported in parentheses are clustered at firm level. *** significant at 1% ** significant at 5% * significant at 10%.

Table 7 - Robustness of the Effect of IOF over Short Position on FX Derivatives on the Spread between Forward and Future Prices

Firms buy NDF contracts - Period Before the IOF (Apr, 12th to Jul, 7th) and Period After the IOF (Sep, 22th to Nov 30th)

Dependent Variable:	Forward Price-Future Price								
	All Sample	Firms in both periods							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After incidence of IOF over Short Position in FX Derivatives	0.0018***	0.0017***	0.0013**	0.0102***	0.0107***	0.0179***	0.0195***	0.0129***	0.0145***
	(0.0006)	(0.0005)	(0.0005)	(0.0011)	(0.0011)	(0.0019)	(0.0019)	(0.0022)	(0.0022)
log(notional)	-0.0125***	-0.0089**	-0.0053	-0.0068**	-0.0068**	-0.0068**	-0.0067**	-0.0066**	-0.0065**
	(0.0036)	(0.0036)	(0.0033)	(0.0032)	(0.0031)	(0.0032)	(0.0031)	(0.0032)	(0.0030)
log(notional)^2	0.0004***	0.0003**	0.0002*	0.0003**	0.0002**	0.0003**	0.0002**	0.0002**	0.0002**
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
log(maturity)	-0.0169**	-0.0084	-0.0125	-0.0118	-0.0108	-0.0125*	-0.0114	-0.0119*	-0.0108
	(0.0070)	(0.0073)	(0.0076)	(0.0073)	(0.0073)	(0.0074)	(0.0074)	(0.0069)	(0.0070)
log(maturity)^2	0.0024***	0.0011	0.0015*	0.0014*	0.0013	0.0015*	0.0014	0.0014*	0.0013
	(0.0008)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0008)	(0.0008)
implied volatility				-0.1592***	-0.1777***	-0.1623***	-0.1846***	-0.3431***	-0.3674***
				(0.0190)	(0.0191)	(0.0187)	(0.0187)	(0.0437)	(0.0437)
log(USD future turnover)					0.0044***		0.0051***		0.0052***
					(0.0007)		(0.0007)		(0.0007)
volatility asymmetry (3 month option)						-0.0009***	-0.0010***	-0.0012***	-0.0013***
						(0.0002)	(0.0002)	(0.0002)	(0.0002)
dollar spot								0.0876***	0.0884***
								(0.0172)	(0.0170)
Observations	5,263	4,088	4,088	4,088	4,088	4,088	4,088	2,591	2,591
R-squared	0.1496	0.0864	0.3930	0.3993	0.4013	0.3994	0.4013	0.4120	0.4288
Firm Fixed Effect	NO	NO	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effect	NO	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of the incidence of IOF over short posititions in FX Derivatives market on the difference between the prices in the Forward (OTC) and Futures (Exchanges) Market for the same maturity.We compare the Forward Contracts traded in 2011 from Apr, 12th to Jul, 7th with those agreed from Sep,22th to Nov,30th of the same year. There are 773 firms that buy USD forward in the sample, 233 buy in both periods, 328 only before the incidence of IOF and 212 only after. The announcement of the IOF was in July, 26th but the effectiveness of the new tax only took place in September, 16th. Standard-Errors reported in parentheses are clustered at firm level. *** significant at 1% ** significant at 5% * significant at 10%

Table 8 - Effect of Change on Reserve Requirements over Short Position on Dollar Spot held by the banks on the Spread between Forward and Future Prices Firms buy NDF contracts - Period Before (Apr, 1st to May, 31th) and Period After (Jul, 11th to Jul, 21th)

Dependent Variable:	Forward Price-Future Price								
	All Sample	Firms in both periods							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After the Change in Reserve Requirements	0.0001	0.0007*	0.0001	-0.0004	-0.0005	-0.0003	-0.0004	-0.0000	-0.0001
	(0.0007)	(0.0004)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
log(notional)	-0.0109***	-0.0057**	-0.0008	-0.0012	-0.0011	-0.0012	-0.0010	-0.0009	-0.0008
	(0.0041)	(0.0027)	(0.0021)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)
log(notional)^2	0.0003**	0.0002*	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
log(maturity)	-0.0142*	-0.0096	-0.0048	-0.0044	-0.0045	-0.0046	-0.0047	-0.0048	-0.0048
	(0.0081)	(0.0067)	(0.0038)	(0.0037)	(0.0037)	(0.0037)	(0.0037)	(0.0037)	(0.0037)
log(maturity)^2	0.0021**	0.0012	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
	(0.0010)	(0.0008)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
implied volatility				-0.0536**	-0.0485**	-0.0794***	-0.0747***	-0.2024***	-0.1923**
				(0.0215)	(0.0216)	(0.0255)	(0.0249)	(0.0760)	(0.0755)
log(USD future turnover)					-0.0006		-0.0007		-0.0004
					(0.0006)		(0.0006)		(0.0006)
volatility asymmetry (3 month option)						-0.0007**	-0.0007**	-0.0015***	-0.0014***
						(0.0003)	(0.0003)	(0.0005)	(0.0005)
dollar spot								0.0433*	0.0408*
								(0.0229)	(0.0227)
Observations	1,549	840	840	840	840	840	840	840	840
R-squared	0.1492	0.1591	0.6048	0.6084	0.6089	0.6097	0.6103	0.6122	0.6124
Firm Fixed Effect	NO	NO	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effect	NO	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of the incidence of Reserve Requirements over short posititions in dollar spot market on the difference between the prices in the Forward (OTC) and Futures (Exchanges) Market for the same maturity.We compare the Forward Contracts traded in 2011 from Apr, 1st to May, 31th with those agreed from Jul,11th to Jul,21th of the same year. There are 461 firms that buy USD forward in the sample, 93 buy in both periods, 321 only before the change on Reserve Requirements and 47 only after. The announcement of the reduction in the limit of deduction on the unremunerated reserve requirement upon FX Short Spot Position was in July, 8th but the effectiveness of the new tax only took place in July 10th. Standard-Errors reported in parentheses are clustered at firm level. *** significant at 1% ** significant at 5% * significant at 10%

Table 9 - Effect of the Surprise on the Police Interest Rate (Selic) on the Spread between Forward and Future Prices Firms buy NDF contracts - Period Before (Aug, 16th to Aug, 30th) and Period After (Sep, 2nd to Sep, 14th)

Dependent Variable:	Forward Price-Future Price								
	All Sample			Firms in both periods					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After the Announcement of the Policy Interest Rate (Selic)	-0.0057***	-0.0029**	-0.0023	0.0018	0.0016	0.0028	0.0031	-0.0159**	-0.0156**
	(0.0011)	(0.0012)	(0.0016)	(0.0024)	(0.0023)	(0.0027)	(0.0027)	(0.0060)	(0.0059)
log(notional)	-0.0129**	-0.0062	0.0019	0.0001	-0.0005	0.0017	0.0011	-0.0021	-0.0027
	(0.0051)	(0.0066)	(0.0082)	(0.0090)	(0.0093)	(0.0091)	(0.0093)	(0.0090)	(0.0091)
log(notional)^2	0.0004**	0.0002	-0.0001	-0.0000	-0.0000	-0.0001	-0.0001	0.0001	0.0001
	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
log(maturity)	-0.0198**	-0.0127**	-0.0062	-0.0078	-0.0073	-0.0065	-0.0030	-0.0070	-0.0036
	(0.0090)	(0.0062)	(0.0091)	(0.0089)	(0.0094)	(0.0088)	(0.0100)	(0.0075)	(0.0086)
log(maturity)^2	0.0027**	0.0015**	0.0007	0.0010	0.0009	0.0008	0.0004	0.0010	0.0006
	(0.0011)	(0.0007)	(0.0010)	(0.0010)	(0.0011)	(0.0010)	(0.0011)	(0.0009)	(0.0010)
implied volatility				-0.2507	-0.2333	-0.2467	-0.1739	-1.1166***	-1.0425***
				(0.1678)	(0.1636)	(0.1653)	(0.1519)	(0.4053)	(0.3821)
log(USD future turnover)					-0.0013		-0.0053		-0.0050
					(0.0026)		(0.0033)		(0.0032)
volatility asymmetry (3 month option)						0.0028	0.0059	-0.0047	-0.0017
						(0.0032)	(0.0038)	(0.0032)	(0.0031)
dollar spot								0.4146***	0.4122***
								(0.1418)	(0.1375)
Observations	386	172	172	172	172	172	172	172	172
R-squared	0.2478	0.1439	0.4691	0.4982	0.4991	0.5028	0.5116	0.5773	0.5853
Firm Fixed Effect	NO	NO	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effect	NO	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of the Surprise on the Police Interest Rate (Selic) on the difference between the prices in the Forward (OTC) and Futures (Exchanges) Market for the same maturity.We compare the Forward Contracts traded in 2011 from Aug, 16th to Aug, 30th with those agreed from Sep,2nd to Sep,14th of the same year. There are 189 firms that buy USD forward in the sample, 39 buy in both periods, 88 only before the incidence of IOF and 62 only after. The announcement of the change in the Policy Interest Rate was in Aug, 31th. Standard-Errors reported in parentheses are clustered at firm level. *** significant at 1% ** significant at 5% * significant at 10%

Table 10 - Robustness Employing NDF Contracts with Multiple Expiration Dates
Firms buy NDF contracts

Dependent Variable:	Forward Price-Future Price								
	All Sample	Firms in both periods							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After incidence of IOF over Short Position in FX Derivatives	0.0129***	0.0059***	0.0044***	0.0056***	0.0063***	0.0102***	0.0114***	0.0093**	0.0099***
	(0.0019)	(0.0017)	(0.0011)	(0.0017)	(0.0017)	(0.0035)	(0.0035)	(0.0037)	(0.0037)
log(notional)	-0.0050	-0.0028	-0.0002	-0.0003	-0.0001	-0.0005	-0.0003	-0.0007	-0.0006
	(0.0074)	(0.0058)	(0.0031)	(0.0031)	(0.0030)	(0.0032)	(0.0031)	(0.0032)	(0.0031)
log(notional)^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.0003)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
log(maturity)	-0.2313***	-0.1217**	-0.0494***	-0.0493***	-0.0471***	-0.0494***	-0.0473***	-0.0495***	-0.0473***
	(0.0242)	(0.0497)	(0.0144)	(0.0145)	(0.0143)	(0.0145)	(0.0143)	(0.0145)	(0.0143)
log(maturity)^2	0.0275***	0.0146**	0.0060***	0.0060***	0.0057***	0.0060***	0.0057***	0.0060***	0.0058***
	(0.0028)	(0.0058)	(0.0017)	(0.0018)	(0.0017)	(0.0018)	(0.0017)	(0.0018)	(0.0017)
implied volatility				-0.0245	-0.0385	-0.0392	-0.0549	-0.1598**	-0.2390***
				(0.0454)	(0.0458)	(0.0494)	(0.0498)	(0.0668)	(0.0693)
log(USD future turnover)					0.0086***		0.0087***		0.0091***
					(0.0012)		(0.0012)		(0.0013)
volatility asymmetry (3 month option)						-0.0005**	-0.0005**	-0.0007***	-0.0008***
						(0.0002)	(0.0002)	(0.0002)	(0.0002)
dollar spot								0.0467	0.0711**
								(0.0287)	(0.0289)
Observations	3,948	2,935	2,935	2,935	2,935	2,935	2,935	2,935	2,935
R-squared	0.4017	0.1825	0.7765	0.7766	0.7808	0.7771	0.7815	0.7774	0.7821
Firm Fixed Effect	NO	NO	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effect	NO	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of the incidence of IOF over short posititions in FX Derivatives market on the difference between the prices in the Forward (OTC) and Futures (Exchanges) Market for the same maturity.We compare the Forward Contracts traded in 2011 from May, 1st to Jun, 30th with those agreed from Oct,1st to Nov,30th of the same year. In this robustness exercice we kept those contracts with different expiration dates celebrated between the same counterparts in the same day. Although those contracts are registered independently, they seem to have been negotiated together. Therefore, for considering those contracts in our analysis, we aggregated the multiple expiration dates summing the notional amount and taking average of spread between future and forward prices and the average of maturity, both of them averaged by the notional amount.There are 922 firms that buy USD forward in the sample, 269 buy in both periods, 314 only before the incidence of IOF and 339 only after. The announcement of the IOF was in July, 26th but the effectiveness of the new tax only took place in September, 16th. Standard-Errors reported in parentheses are clustered at firm level. *** significant at 1% ** significant at 5% * significant at 10%

Table 11 - Robustness Employing NDF Contracts with Multiple Expiration Dates
Firms sell NDF contracts

Dependent Variable:	Forward Price-Future Price								
	All Sample	Firms in both periods							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After incidence of IOF over Short Position in FX Derivatives	0.0002	0.0012**	0.0014***	0.0025**	0.0038***	-0.0029	0.0001	-0.0036*	-0.0009
	(0.0006)	(0.0005)	(0.0005)	(0.0011)	(0.0011)	(0.0021)	(0.0021)	(0.0021)	(0.0021)
log(notional)	0.0094***	0.0069***	0.0021	0.0022	0.0022	0.0021	0.0021	0.0021	0.0021
	(0.0024)	(0.0025)	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0022)	(0.0023)
log(notional)^2	-0.0003***	-0.0002**	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
log(maturity)	0.0014	0.0023	0.0098**	0.0098**	0.0095**	0.0095**	0.0093**	0.0095**	0.0092**
	(0.0042)	(0.0037)	(0.0043)	(0.0043)	(0.0045)	(0.0044)	(0.0045)	(0.0044)	(0.0045)
log(maturity)^2	-0.0005	-0.0005	-0.0013***	-0.0013***	-0.0012**	-0.0012**	-0.0012**	-0.0012**	-0.0012**
	(0.0004)	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
implied volatility				-0.0198	-0.0390**	0.0005	-0.0237	-0.0657	-0.1347***
				(0.0173)	(0.0172)	(0.0198)	(0.0203)	(0.0450)	(0.0480)
log(USD future turnover)					0.0058***		0.0052***		0.0056***
					(0.0008)		(0.0008)		(0.0008)
volatility asymmetry (3 month option)						0.0006***	0.0004**	0.0005**	0.0002
						(0.0002)	(0.0002)	(0.0002)	(0.0002)
dollar spot								0.0266*	0.0439***
								(0.0137)	(0.0142)
Observations	4,110	3,420	3,420	3,420	3,420	3,420	3,420	3,420	3,420
R-squared	0.0918	0.1433	0.4118	0.4125	0.4290	0.4190	0.4318	0.4200	0.4344
Firm Fixed Effect	NO	NO	YES	YES	YES	YES	YES	YES	YES
Bank Fixed Effect	NO	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of the incidence of IOF over short posititions in FX Derivatives market on the difference between the prices in the Forward (OTC) and Futures (Exchanges) Market for the same maturity.We compare the Forward Contracts traded in 2011 from May, 1st to Jun, 30th with those agreed from Oct,1st to Nov,30th of the same year. In this robustness exercice we kept those contracts with different expiration dates celebrated between the same counterparts in the same day. Although those contracts are registered independently, they seem to have been negotiated together. Therefore, for considering those contracts in our analysis, we aggregated the multiple expiration dates summing the notional amount and taking average of spread between future and forward prices and the average of maturity, both of them averaged by the notional amount.There are 605 firms that sell USD forward in the sample, 231 sell in both periods, 152 only before the incidence of IOF and 339 only after.The announcement of the IOF was in July, 26th but the effectiveness of the new tax only took place in September, 16th. Standard-Errors reported in parentheses are clustered at firm level. *** significant at 1% ** significant at 5% * significant at 10%