



**LUND UNIVERSITY**

**DEPARTMENT OF ECONOMICS AND MANAGEMENT**

**MASTER THESIS IN ECONOMICS**

**MACROPRUDENTIAL POLICY: THE CASE OF BRAZIL**

JUNE 2014

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**Abstract:**

In the wake of 2008 financial crisis there has been growing interest in issues related to macroprudential policy and the coordinated attempt to ensure financial stability as a whole. The main objective of the paper is to provide a combination of both theoretical and empirical analysis of the effectiveness of macroprudential policy, implemented in Brazilian economy in 2010. Based on an existing methodology and using data from 46 countries, the paper develops methods for assessing the sensitivity of capital flows to global financial conditions. The main empirical findings cannot be interpreted in terms of effectiveness of the measures, since the interaction terms aiming to capture potential shift in Brazilian capital inflows turn out to be statistically insignificant both prior and after the introduction of the measures.

Keywords: Macroprudential Policy; Systemic risk, Brazil; Capital flows;

Acknowledgments: I would like to thank my supervisor Martin Strieborny and the Ph.D. student Milda Norkute for their valuable inputs and guidance during the writing process. Also, I would like to thank the faculty librarian Claes Olsson for his help on the data gathering process.

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## **I. Introduction.**

*"Going forward, a critical question for regulators and supervisors is what their appropriate field of vision should be. Under our current system of safety-and-soundness regulation, supervisors often focus on the financial conditions of individual institutions in isolation. An alternative approach, which has been called system-wide or macroprudential oversight, would broaden the mandate of regulators and supervisors to encompass consideration of potential systemic risks and weaknesses as well..."*

Federal Reserve Chairman, Ben Bernanke (2008)

The recent financial crisis of 2008-2012 provoked soaring social cost who has so far incurred not only in terms of bail outs, but mostly related to forgone decrease in economic output. The impact on the real economy has shattered the public's confidence on the financial sector, its intermediaries and mostly its regulation. Since banks, financial institutions and the complementary "Shadow Banking System"<sup>1</sup> played a major role in triggering off the sub-prime crisis, a new consensus appeared in both policy makers and academia focusing on an enhanced regulation of the financial system as a whole. Most of the worlds' advanced countries and even more emerging countries have implemented various instruments in order to handle the necessary financial stability in parallel with the other objectives related to macroeconomic stability.

Central role for the swelling of the causes that led to the collapse of Lehman Brothers and continually to the distress that followed, played the global conditions prior to 2007, a period broadly called "the great moderation". In advanced countries the general financial deregulation especially in USA (see, Sherman. 2009 for a detailed analysis), was carried out with greater confidence in the capacity to dispel risk and intense utilization of sophisticate derivative products (such as, the famed CDS and CDO). Relied with full confidence on US response to handle efficiently other intricate situations such as the "9/11" or the "Internet bubble", the global financial system continued to feasibly generate excessive-risk taking behavior by both lenders and borrowers. United States managed to achieve the specific efficiency by implementing loose monetary policy to produce quick recoveries, an approach which had been heavily criticized both prior and after the blast of the crisis (see for example, Taylor 2008 and Adrian and Shin 2008). Moreover, and mainly in Europe, private and public debt hiked, frequently beyond existing institutional fiscal pacts such as the Maastricht treaty, a fact that formulated a vulnerable environment when the danger appeared.

Currently, a great argument related to the interaction between credit dynamics and the well-known asset price bubble (and its role as a major rationale for the burst) had induced one more time economists to provide diverse responses. Typically, allowing the function of growing asset prices is likely to magnify positive wealth effects (on

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<sup>1</sup> According to the Financial Stability Board (FSB), global regulations for the shadow banking system will come into effect by 2015.

the topic of - consumer prices or purchasing power), however, and supposing that the constant climb in assets prices is not justified by fundamentals, regulators seem to have neglected the bubble danger that lurked aside. The function of the financial system gave the impression that under the regulation of a set of established micro-prudential instruments designed to control the role of financial intermediaries would continue its upward tendency eternally. In the long run, those measures proved insufficient to handle the magnitude of the situation. Once again in the economic history, the cost of rescuing the improperly regulated financial system was beyond any imagination inducing authorities to act without any further delay<sup>2</sup>.

In that context, beyond the imprudent financial market behavior, procyclicality<sup>3</sup>, corrosion of lending standards, and mainly exacerbated leverage and credit led to unsound consumption, financed by debt. These channels triggered an international debate regarding “global imbalances” which divided the analytical thinking into two sides. In one part of the spectrum, plenty of international economists argued that “*current account deficits and surpluses were a win-win situation for both developing and developed countries*” (Silva and Harris, 2012) while the conflicting view claimed that the specific situation was an unstable equilibrium, promoting financial distress to spread globally and finally facing the second most severe economic crisis following the Great Depression - (see for example, Roubini and Setser (2005) and Obstfeld and Rogoff (2009)).

Considering the macroeconomic and financial vulnerability of advanced, emerging and developing countries the crisis caught them in relatively dissimilar situations. According to recent studies due to the deep and integrated financial markets, the advanced countries seemed to be the great losers in terms of output decline compared with the rest of the world (Campello et. al., 2009 and Russo and Katzel, 2011). Mainly the countries in the European periphery appear to be widely affected accompanied with significant depressing outcome in the whole Europe and United States. Additionally, developing countries have been widely affected as well, attributable to the direct interconnectedness with the leading countries through various channels such as dependence on foreign direct investments, trade, and remittances. Whereas, various emerging countries, including Brazil, managed to overcome the turmoil due to the relative sound fundamentals, confirming the attempts of those countries to go forward into the pursuit of advanced economies.

In the case of Brazil specifically, since the mid-1990s -preceding the crisis- the local authorities had adopted regular macroeconomic policies to manage inflation fluctuations and fasten expectations, including an inflation targeting structure. Furthermore, Brazil jointly with plenty of emerging economies chose a flexible exchange rate regime as an initial cushion against capital flows (mainly inflows) and

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<sup>2</sup> A study by Hahm et al. (2012) provides an extensive analysis on the costly rescuing after the outburst of the financial crisis.

<sup>3</sup> Procyclicality is the tendency of financial variables to fluctuate around a trend during the economic cycle. Thus, increased procyclicality means fluctuations with broader amplitude. Taken from, Jean-Pierre Landau, Spain's conference on Procyclicality and the Role of Financial Regulation (2009).

the forgone instability that those flows can give rise to. Eventually and perhaps most notably, Brazilian authorities did not follow the uncertain recipe that most of the sophisticated economies held related to actions of financial deregulation of the former to the crisis period. In contrast, they insisted on maintaining a cautious and prudential regulatory outline on the financial sector, accompanied by well-capitalized institutions and closely-persistent supervision, (Silva et. al. 2012).

After the blast of the global 2007 crisis, numeral academics and mainly policymakers started calling on central banks to adopt systematically and directly a financial stability aim into their reaction function. Given that under the earlier lax regulation in combination with the broader view that the already mentioned traditional micro-prudential tools proved to be inadequate to dampen financial risk, the global community had to act and “generate” a new policy toolkit able to lessen financial risk as soon as possible. That “new” objective was destined to consider the interaction between achieving the macroeconomic goals in parallel with a broad financial stability. With the initial vision on the side of systemic risk, abundance of proposals based on prudential framework extended the existing toolkit towards a macroeconomic aspect which meant to be the initiative behind “macroprudential” regulation.

*We need a new set of macro-prudential policy tools which will enable the authorities more directly to influence the supply of credit [ . . . ]. These tools are needed because credit/asset price cycles can be key drivers of macroeconomic volatility and potential financial instability [ . . . ].*

*(Chairman of the UK Financial Services Authority, Turner, 2010a).*

The widely growing literature on macroprudential policy to date, has tried to define and set its objectives but there are various approaches resembling a pure definition. Broadly speaking, macroprudential (Map) policy aims to strength financial stability but once again there is no common definition of financial stability<sup>4</sup>. Certainly though, most Central Banks made clear that Map measures are not a substitute for monetary policy and is more likely treated as the toolkit to fill the existing gap related to financial regulation. The major fundamental idea, was to expand the existing micro-prudential tools alerting the focus from individual supervision of financial institutions and banks in a more comprehensive toolkit restricting the uncontrolled operation of the financial system as a whole. A latest study by Galati and Moessner (2013) provides an explicit literature review related to macroprudential policy, based on particular tools - their usage, implementation, effectiveness and interplay with monetary policy. Next, a study by the Committee on the Global Financial System (CGFS 2010) of the Bank of International Settlements (BIS), provides the available set of instruments and frameworks abbreviating experiences denoted by Central

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<sup>4</sup> A working definition of financial stability according to Silva et al. (2012): A financial system is “stable” when it continues performing its functions across a time dimension without building-up systemic risk measured across its cross section dimension.

Banks worldwide. The same paper provides a range of existing tools illustrated in Table 1 below, which categorizes a variety of instruments as specified by the vulnerability they address and the financial system's section they intent to restrict.

**Table 1: Macroprudential measures by system component and vulnerability.**

		Financial system component				
		Bank or deposit-taker		Non-bank investor	Securities market	Financial infrastructure
		Balance sheet*	Lending contract			
Vulnerability	Leverage	capital ratio risk weights provisioning profit distribution restrictions credit growth cap	LTV cap debt service / income cap maturity cap		margin/ haircut limit	
	Liquidity or market risk	liquidity / reserve requirements FX lending restriction currency mismatch limit open FX position limit	valuation rules (eg, MMMFs)	local currency or FX reserve requirements	central bank balance sheet operations	exchange trading
	Interconnect edness	concentration limits systemic capital surcharge subsidiarisation				central counterparties {CCP}

Source: CGFS Working paper No 38 (2010)

Approaching at a slow pace the main subject of this paper, since the topic of Map policy has recently been put under thoroughly analysis<sup>5</sup>, plethora of empirical studies were conducted by researchers from all over the world, with precursors papers by the IMF (see, Lim et al. 2011 and Nier et al.2012) and the BIS (see, BIS working papers number 21, 38 and 128), depicting instructions from country occurrences in implementation of Map instruments. Most of the studies just mentioned found that when an instrument or a combination of instruments was implemented according to the required situation, it managed to reduce systemic risk quite effectively, either in its time or cross sectional dimension<sup>6</sup>. In that spirit, an influential paper by Bruno and Shin (2013) confirms the previous findings by IMF and BIS. The particular study draws conclusions on the effectiveness of Map regulation implemented by Korean authorities in 2010. The analysis that follows is based on this particular paper, developing the same methodology as the authors applied but considering different a geographical area, that of Brazil, and expanding the time period until the end of 2013.

Since 2010, the central Bank of Brazil has introduced a series of macroprudential measures aimed to monitor system risk while the country has been exposed to international economic uncertainty and capital flow volatility. The main policy issue troubling the authorities since the global financial crisis is to restrict and control the

<sup>5</sup> As an early use of the term, BIS records suggest that its first appearance in an international context dates back to 1979.(Clement 2010)

<sup>6</sup> The time dimension of systemic risk deals with the evolution of aggregate risk in the financial system over time while the cross section dimension is related to the distribution of risk across the financial system at a given point in time, and has to be understood looking at the interconnectedness and resilience of the market structure.(Silva and Harris 2012), (Borio 2009).

large capital inflows. The review of the performance of Brazil's macroprudential instruments that the paper explores is based on a panel study, where Brazil is the country of interest among a sample of 46 countries. In line with Bruno and Shin (2013), the approach is aimed to treat the countries other than Brazil as a comparison group and derive conclusions regarding the effectiveness of the policy applied.

Regarding the main findings of the empirical study, the interaction terms which have been designed to capture potential shift in Brazilian capital inflows turn out to be statistically insignificant. Consequently, the explanatory variables that succeeded to explain the decrease in Korea's capital inflows after the introduction of the measures are not associated with banking capital flows of Brazil. Furthermore, vulnerability to global banking factors is statistically insignificant both prior and after the introduction of the measures. Potential reasons, explaining the specific outcome could be the combination of (i) small share of foreign banks presence, (ii) relatively low dependence on external funds and (iii) limited foreign exposures. Besides, the composition of capital flows between the two countries seemed to have affected the output of the empirical investigation. Apart from the empirical analysis related to capital flows, my study investigates under a theoretical perspective the broad effectiveness of macroprudential policy, implemented in various frictions of the domestic economy, concluding that, Brazilian authorities managed to overcome the severe turmoil of the global financial crisis in a quite sufficient way.

Based on empirical evidence, the paper attends to fill the gap related to the implementation of macroprudential policy on Brazil associated to capital flows. The specific question my study seeks to answer is the following: Compared to the rest of countries in the sample, the paper seeks to identify whether the Brazilian vulnerability to global banking factors, associated with capital flows, was enhanced since the period of implementation (2010), or not. The rest of the paper is organized as follows: Section 2 provides detailed analysis regarding the broad concept of macroprudential policy. Section 3, presents a thorough examination of the global banking system linked to the crisis and its impact on Brazilian economy. Next, section 4, narrows down the case of Brazil and section 5 describes the implementation of Map policy. Section 6 describes the data and model specification while the main empirical investigation is presented in Section 7. Finally, section 8 discusses further potential reasons behind the insignificant outcome of the empirical part and the last section concludes.

## II. Macroprudential Policy.

### A. Definition:

The explosive nature of the global financial environment made Map a useful policy response for numerous countries threatened by the exogenous shock. The reaction though varied to a large extent among policymakers worldwide. As an immediate consequence, the demand for a concrete definition was compulsory, not only related to the term but mainly of its objectives and scope. Regarding the role of Map policy, in accordance with a paper conducted under the demand of Bank of England (2009), the term has always been associated with the broad concern related to the interaction between the overall macroeconomy and the financial system.

More precisely, objectives such as provision of payment services and credit intermediation are aimed to contribute the avoidance of boom and bust cycle of credit and liquidity. In that context, authorities seem to be determined to raise regulatory standards via a significant increase on the cost of financial intermediation. Thus, the primary role of Map policy would be to pacify the fury of credit cycle. Taking everything under consideration, the International Monetary Fund (IMF) in cooperation with the BIS and the Financial Stability Board, defined Map based on three different elements which are: Its' objective, its analytical scope, its instruments and associated governance<sup>7</sup>:

- *Objective: To limit the risk of widespread disruptions to the provision of financial services and thereby minimize the impact of such disruptions on the economy as a whole. Systemic risk is largely driven by fluctuations in economic and financial cycles over time, and the degree of interconnectedness of financial institutions and markets.*
- *Analytical Scope: The focus is on the financial system as a whole (including the interactions between the financial and real sectors) as opposed to individual components.*
- *Instruments and associated governance: It primarily uses prudential tools that have been designed and calibrated to target systemic risk. Any non-prudential tools that are part of the framework need to be specifically designed to target systemic risk through their governance arrangements.*

At that point, derived from papers on relevant literature, an important distinction should be made between micro-prudential and macro-prudential frameworks (See Table 2A, in Appendix-Micro in opposition to Macro prudential measures). As a starting point, based on a paper by Hanson et al. (2011), “a microprudential approach is one in which regulation aims to prevent the costly failure of individual financial institutions. By contrast, a macroprudential approach recognizes the importance of general equilibrium effects, and seeks to safeguard the entire financial system”. In that point, attention should be directed on the conventional banking guideline which is

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<sup>7</sup> Source: Lim et al. 2011, Macroprudential Policy: What Instruments and How to use them?

based on the subsequent logic: Government-insured deposits could be and frequently are, the source of banks financing, which in turn generates a motivation for bank directors to take imprudent risks, since losses will be covered by the taxpayers.

Undoubtedly, the mechanism just described, has been efficiently restricted by microprudential policy, which induces banks to internalize losses. Thus, under the specific regulation, the potential losses of deposit insurer are lessened to the most achievable way. The question that normally arises is: why this policy proved to be inefficient to cope with the magnitude of the recent financial crisis? The key factor and the major critique conceals behind the adequate capital ratio that each bank should maintain. Provided that, the instrument of capital ratio is defined as the total amount of capital over the total amount of assets, the authorities are not concerned how the required adjustment will be obtained<sup>8</sup>. During crisis periods, the continuously reduction of assets, known as fire-sale, that bulk of troubled institutions performed, ended up with the blast that occurred since the collapse of Lehman Brothers in 2007.

Having understood the reasoning behind the inadequate microprudential regulation it is totally understandable why the swift to a more macroprudential approach was obligatory. As in most cases related to economic crisis, prior warnings made their appearance not only relatively close to the crisis (Borio, 2003<sup>9</sup>), but a couple of decades ago. In particular, Chiriacescu (2013) explains thoroughly the “Misky’s financial instability hypothesis” which dates back in 1974. Surprisingly, the specific theory emerged only in the wake of the recent financial crisis. In a nutshell, the theory states that due to increased asset prices the subsequent financial growth is linked with periods of prolonged prosperity, which end up to an undeniably fragile and vulnerable financial interaction. Paradoxically, Misky’s proposal on amplification of supervisory and regulation complies entirely with the current state of global economy.

In that context, a vast number of studies have been published, exploring mainly under a theoretical perspective, the relationship involving the interplay of macroprudential with monetary policy (Beau et. al 2011). For instance, Angelini et al. (2011), Kannan et al. (2009) and Agenor and Silva (2011) develop a dynamic general equilibrium model, to assess the interaction between a countercyclical macroprudential and monetary policy. Regarding the empirical part, a paper by Nier et al. (2012) which presents evidence from Central Eastern- South Eastern Europe, Brazil, Turkey, Korea and United States- sheds light on the relationship of those two policies. Since the specific topic (interaction of monetary with Map policy), is not the main focus of this paper, I will not expand my analysis further except from a general conclusion. Broadly speaking, both theoretical and empirical evidence propose that

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<sup>8</sup>A troubled bank, is supposed to restore the sufficient capital ratio. The regulator does not care whether the bank adjusts via the numerator or via the denominator—that is, by raising new capital or by shrinking assets. In most cases, banks that act under the interest of their shareholders will tend to fix their damaged capital ratio by shrinking assets rather than by raising new capital, even when the latter is more desirable from a social perspective. Hanson et al.(2011)

<sup>9</sup> In his study conducted in 2003, Borio illustrated the necessity to strength banking supervision and regulation under the unfamiliar in those days, macroprudential approach.

Map tools, which are analyzed in the next subsection, could be functional complement to monetary policy in alleviating the economy after the primary distress.

### B. Macroprudential Instruments:

Regarding the various instruments applied, country experience indicate that it is not feasible to combine them together into one big category, but rather to include them into one wide-ranging toolkit which is separated into three main types of measures: Credit, liquidity and capital related. Table 2 presents a selection of measures and the respectively explanation of their use. In general, according to different situations that each country may face, there is a great number of instruments that can be applied depending on which of them are politically and economically more convenient. For example, the employment of different instruments might vary, depending on county's credit cycle or the potential diversity in the composition or size of the banking sector.

**Table 2: Macroprudential instruments, credit-liquidity and capital related.**

Type of Measures	Instruments	Description
<i>Credit-related</i>	Caps on the Loan to Value	Imposes a down payment constraint on households' capacity to borrow. Limits the procyclicality of collateralised lending.
	Caps on the Debt to Income	Ensures banks 'asset liquidity and dampens the cyclicity of collateralized lending. Constraints further the households' capacity to borrow.
	Caps on foreign Currency Lending	May be used to address foreign-exchange induced systemic risk.
	Ceiling on Credit or Credit growth	Imposed on total bank lending or credit to a sector. Dampens the credit/asset price cycle and limits common exposure to a specific risk.
<i>Liquidity-Related</i>	Limits on Net open Currency positions	Limits banks' foreign exposure to foreign currency risks and moderates sharp exchange rates fluctuations.
	Limits on Maturity mismatch	Used to address systemic risk since the choice of assets/liability maturity creates an fire sale of assets during crisis period.
	Reserve Requirements	Aiming to have a direct impact on credit growth provides a liquidity cushion to alleviate systemic crunch.
<i>Capital-Related</i>	Countercyclical Capital Requirements	Can take the form of a ratio to restraint credit expansion.
	Time varying /Dynamic Provision	Calibrated on historical bank-specific loses and dampens the cyclicity in the financial system
	Restrictions on profit Distribution	Intended to ensure the capacity adequacy of banks.

Source: Lim et al.(2011).

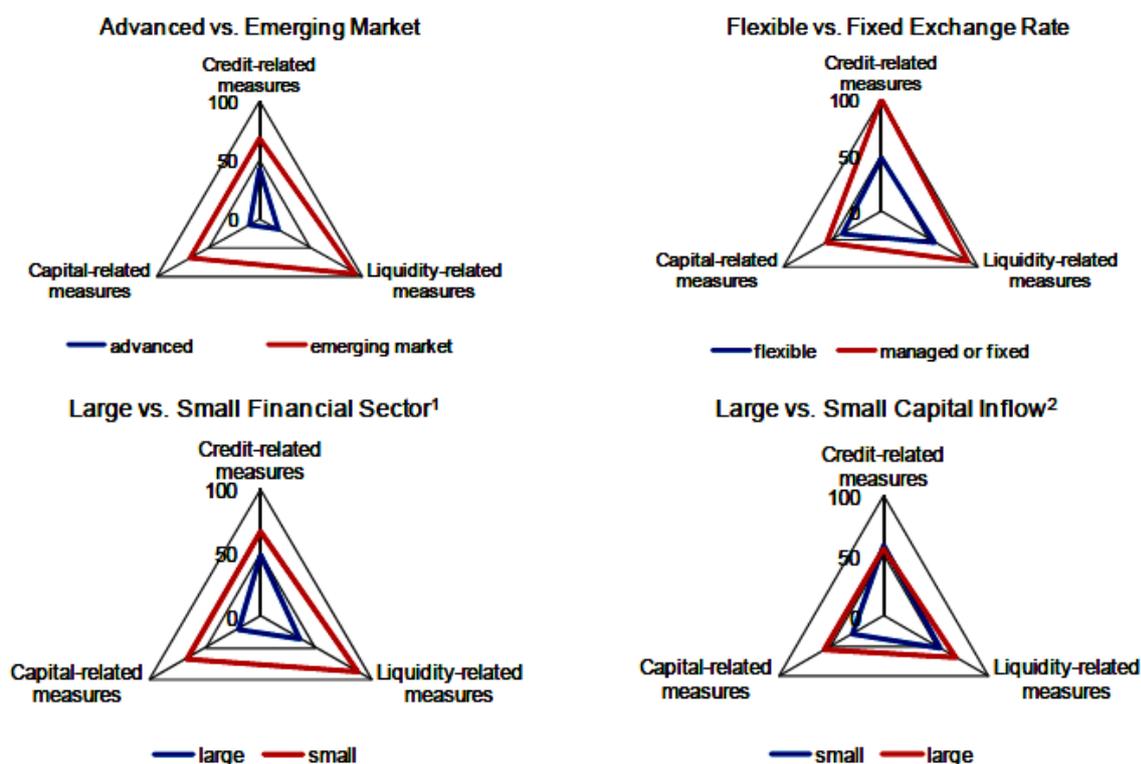
The elaborate investigation of each instrument is beyond the purposes of this paper since a large number of existing studies provide an advanced analysis on the subject of theoretical background, usage and implementation. For a thoroughly report of the

above, the interested reader is encouraged to look through the original papers of CGFS Working paper n.38 (2010), Lim et al. (2011), Hanson et al. (2011), Shin (2011) and a discussion paper by Bank of England (2011).

Next, there are several motives behind the use of each instrument and the rationale that indicates its preference. Compared to monetary and fiscal policies, Map tools are more flexible, with lower lags on implementation. For instance, these instruments are profoundly functional when a tightening of monetary policy is not desired. Furthermore, the majority of the tools are able to limit the cost of policy intervention since they can be modified to target on risks of specific sectors without causing a widespread decrease of economic activity. Additional reasons can be that in most cases, the simple and easy implementation of those tools, combined with the lack or minimization of potential market distortions is considered as a great advantage. Especially for the advanced economies, which are dominated by big nonbank financial sectors and complex interconnected financial systems, Map toolkit manages to eliminate the latent regulatory arbitrage and foster the financial stability.

Regarding the choice of instruments, a number of aspects dominate. More precisely Figure (1) illustrates that mainly the selection relies on the magnitude of the financial sector, the regime of exchange rate, and finally whether the examination refers to advanced or emerging countries.

**Figure 1: Implementation of Macroprudential Measures.**



Note: Percentage of countries in each group using each type of instrument.  
Sources: IMF Financial Stability and Macroprudential Policy Survey, 2010

As Figure 1 depicts, emerging market economies compared to advanced economies appear to have made a widely use of Map instruments, which according to IMF

is mainly due to the significantly smaller and not as much as in leading economies, developed financial sectors. Moreover, according to Figure 1, the selection of exchange rate regime influences the choice of instruments. Given that fixed or managed exchange rate restricts the space for interest rate policy, countries with the particular regime tend to implement more Map instruments. For instance, credit-related in parallel with liquidity- related measures are more likely to be met in these countries. Finally and perhaps most importantly during a crisis, the type of shock threatening the domestic economy is another factor that may influence the choice of instruments. Given the degree of openness, mainly for emerging markets, excessive capital inflows can cause a negative impact on the financial sector. Hence, liquidity related measures and tools in order to moderate the resultant credit growth are more commonly used by those economies. In general, country experience highlights that, Map policy usage is straightly directed to restrict the negative consequences of inflows, such as, excessive leverage and credit growth, rather than to be treated as capital controls that target in reducing the volume of flows.

### C. Effectiveness:

The proponents of the use of macroprudential tools (see for example, Lim et. al 2011 and Claessens and Ghosh 2012) claim that countries which used a combination of them, managed successfully to achieve their wide stability goals, such as avoiding uncontrolled credit creation or excessive currency mismatches. On the other hand, there are no stated opponents of the specific policy without this implying that there are no possible implications that might arise. Since those instruments have been introduced mainly over the last four years, researches and policymakers are in a relatively cautious position to derive instantly conclusions regarding their efficiency. Table 3 below summarizes the effectiveness of various macroprudential instruments in terms of frequency.

**Table 3: Effectiveness on macroprudential measures in terms of frequency.**

Effectiveness in economic terms	Non- core to core liabilities		Bank assets		Bank leverage	
	Growth	Pro-cyclicality	Growth	Pro-cyclicality	Growth	Pro-cyclicality
1	Debt to Income cap (DTI)	Profit redistribution limits (PRD)	Debt to Income cap (DTI)	Debt to Income cap (DTI)	Debt to Income cap (DTI)	Debt to Income cap (DTI)
2	Reserve Ratio limit (RR)	Limits on Foreign lending (FC)	Dynamic provisioning (DP)	Loan to value cap (LTV)	Limits on Foreign lending (FC)	Limits on Foreign lending (FC)
3	Credit growth cap (CG)	Loan to value cap (LTV)	Profit redistribution limits (PRD)	Reserve Ratio limit (RR)	Loan to value cap (LTV)	Profit redistribution limits (PRD)

1=Most effective in economic terms. 3=Less effective in economic terms

Most frequently effective
2 <sup>nd</sup> most frequently effective
3 <sup>rd</sup> most frequently effective

Source: Galati and Moessner (2013)

Even so, given the empirical evidence to date, the effectiveness and the general impact of Map policy are not so far from being relative understood. In most cases, the assessment of effectiveness was examined in combination with other policies, whereas, deeper and enhanced observation of Map efficacy in isolation is extremely essential, as well. My analysis using evidence from Brazil contributes exactly on that later view. Besides, abundance of recent studies tried to evaluate the effectiveness of Map tools focusing both on advanced and emerging countries. For instance, Wignall and Roulet (2013), Galati and Moessner (2012), Lim et al. (2011) and Claessens and Ghosh (2012) are just a few in comparison with the respectively existing literature.

Certainly, there is a number of limitations related to the evaluations of the measures. Firstly, since most of the macroprudential instruments are targeted at the balance sheet of financial institutions, firm level data should be readily available and consistent. In addition, the total number of governments that chose to apply macroprudential instruments in a systemic way is relatively small, a fact that limits the degree of confidence during the statistical analysis. Table 1A in appendix provides a complete selection with countries experience and the frequency of their use. Next, selection bias is another issue that may influence the outcome since it usually favors situations accompanied by countries facing high risk where tools are implemented due to the necessity of response. Finally, the majority of empirical studies do not take into consideration issues such as market distortions and further costs which are also key essentials to account after the Map instruments implementation.

As a closing subject related to Map policy and its effectiveness, it would be neglectful not to refer to the importance of international consistency addressed to country authorities worldwide. As stated by a report conducted under the request of G20 governments in 2011, implications may arise due to (i) the closely integrated international capital markets, (ii) the likelihood of negative externalities and (iii) mostly as a result of regulatory arbitrage. In order to achieve the desired stabilization, collaboration on Map policies entails sufficient institutional mechanisms aiming to endorse coordinated policy actions.

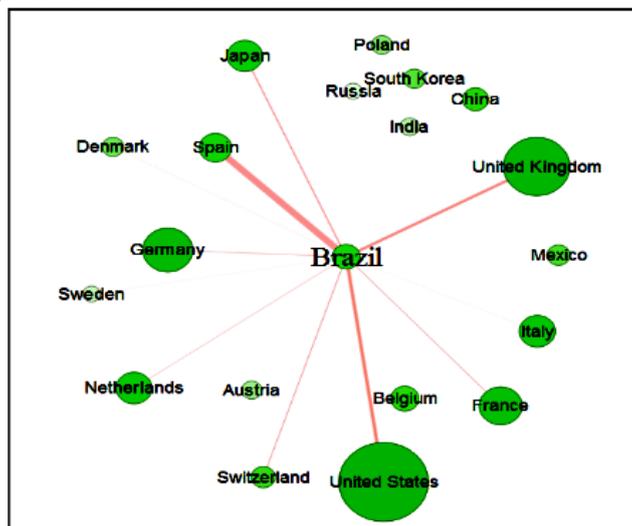
Over the past years, the Financial Stability Board, IMF, G20 and BIS appear to coordinate their actions both in international and domestic level. These attempts target on the recognition of common vulnerabilities and potential links within financial systems, to guarantee that Map construction in individual countries are commonly consistent. At international level, countries should act without further delay given that the potential negative outcome in the absence of coordination could be destructive for the general financial system. An obvious message from the latest crisis is that, the interconnectedness that characterizes the global banking system is highly likely to spread systemic risk from one country to the rest of the world. The next section seeks to highlight the main aspects governing the global banking system.

### III. Global banking system.

Given that macroprudential policy seeks to restrain systemic risk, it would be functional to identify and examine potential indicators of systemic risk. In line with Bruno and Shin (2013), the next section of this paper deals with the underlying mechanisms and complexity of global banking activity, which is considered to be a “key driver of financial conditions both within and across borders”. Moreover, in this particular section beyond from describing the function of global banking system, I will deliberately introduce the key variables of interest that are closely related to the empirical part that follows in section 5.

To begin with, interconnectedness or specifically “banking interaction channels” is one of the most essential features of financial systems and one of the major canals of systemic risk spreading to a global scale. The vulnerability that characterizes the overall economy can be reflected by the fact that potential undersized shocks affecting only a small number of banks can rapidly affect the entire global financial system through a contagion effect. What the recent financial crisis has made clear is that, the network formation of the banking system has to be taken into consideration in the sense of eliminating systemic risk. The relevant literature on the nature of interconnectedness of financial networks indicates that beyond the expected “small-sized” shocks, the unpredictable “large-sized” negative events are more likely to extend through the international borders. Specifically, regarding the interbank exposure in Brazil according to Figure 2, cross-border interconnectedness in terms of external sources of funding is highly vulnerable to sudden stops from European countries and the United States.

**Figure 2: Cross boarder Interconnectedness in Brazil.**



Source: Silva et. al. (2012)

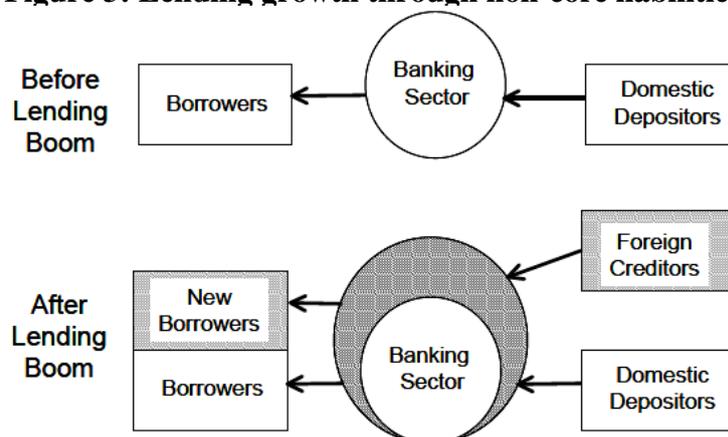
In addition, a closer look on the liabilities side of a random bank balance sheet reveals the fast development of bank lending that took place the period prior to

2007<sup>10</sup>. The specific growth in interbank lending was accomplished by shifts in the composition of bank's funding, a process which varies from the traditional way of lending. Precisely, since banks are intermediaries who need to borrow from different sources in order to satisfy the demand for new loans, their major source of funding is the "retails deposit of the household sector" or in accordance with a term that is widely used: "the core funding".

In opposition, during a period of a credit boom, the admittance to core deposit funding is not in the same level with the lending growth, a fact that leads banks to alternate their finance of lending using "non-core" liabilities<sup>11</sup>. When the financial system has an open banking sector, a central element of non-core funding is the cross-border bank financing where banks draw on wholesale funding supplied by the global banks. Figure 3, depicts in a straightforward representation, the origin of foreign exposure linked with the growth of non-core liabilities. The top graph shows the condition of the banking sector before a credit boom, while the bottom graph describes the system after the boom.

The primary drawback hindering behind the precise method is that, the banking sector's expansion is based on non-core liabilities from foreign creditors, creating uncertain exposure during crisis period, when foreign creditors under the general turmoil initiate the process of deleveraging. Moreover, a study by Hahm et al. (2013) highlights that the proportion of non-core to core funding is a constantly reliable measure of a country's exposure to a credit crisis. Subsequently, a recent paper by Bruno and Shin (2014), investigate a number of global factors that are associated with banking capital flows. For instance, the leverage activities of global banks become apparent in order to explain the supply push dynamics in cross-border capital flows.

**Figure 3: Lending growth through non-core liabilities.**



Source: Shin/Bank of Chile (2010)

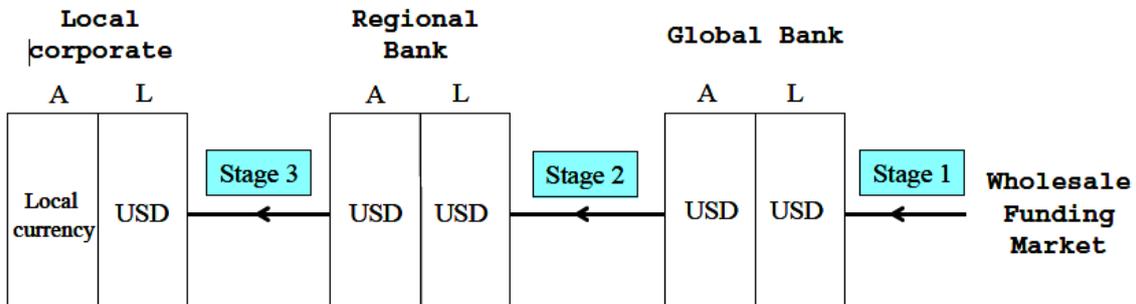
Consequently, related to the liable behavior of the banking sector, the contribution of macroprudential policy, aiming to alleviate such global supply push forces, is straightforward. The empirical analysis that follows in section VII can be schematically illustrated in Figure 4, which outlines the interplay that occurred between local and global banks. In particular, the mechanism across the three stages

<sup>10</sup> See Figure 1A in appendix.

<sup>11</sup> For deeper understanding related to "core" and "non-core" liabilities, see Shin and Shin (2010).

functions as follows: “Global banks increase wholesale US dollar funding via borrowing in financial centers and then lend to local banks (stage 1). In turn, local banks draw on the cross-border funding (stage 2) in order to lend to their local borrowers (stage 3)”.

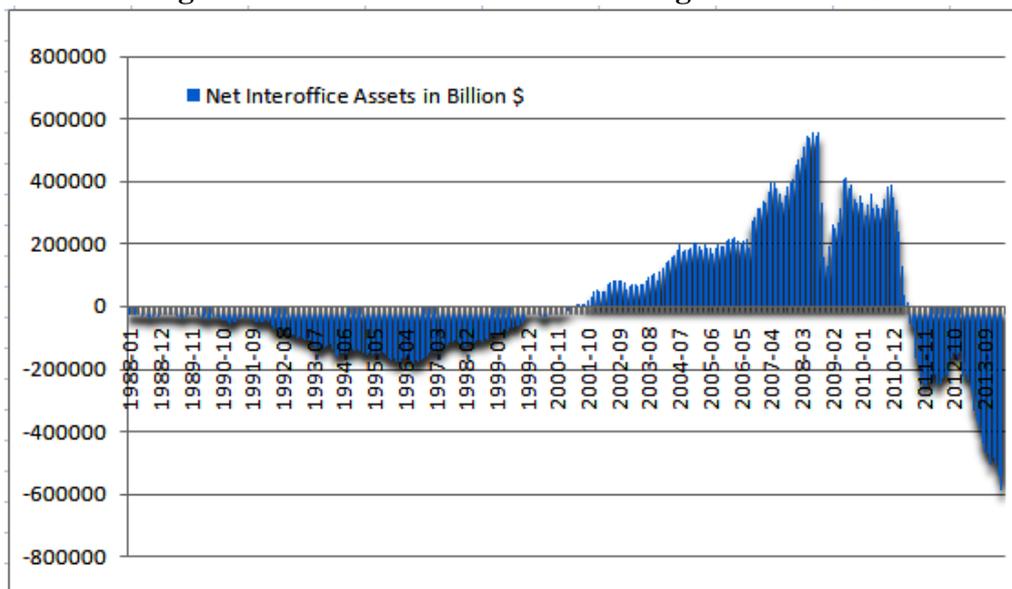
**Figure 4: The different stages of cross border banking flows.**



Source: Bruno and Shin (2013)

A paper by BIS (2010), portraits the process through branches and subsidiaries of foreign banks in the United States make use of money market funds which are directed afterwards back on their headquarters, (Process which most “big” European banks implemented prior to 2007<sup>12</sup>). Expressed in a different way, linked to the expression of US in the role of global liquidity insurer, the funds transferred by branches to headquarters (or interoffice assets) reflect the massive size of gross capital outflows that occurred in US following the crisis. Figure 5, represents the net interoffice assets of foreign banks in the US, which reflect the net claim of foreign bank’s branch on their headquarters.

**Figure 5: Net interoffice assets of foreign banks in US.**



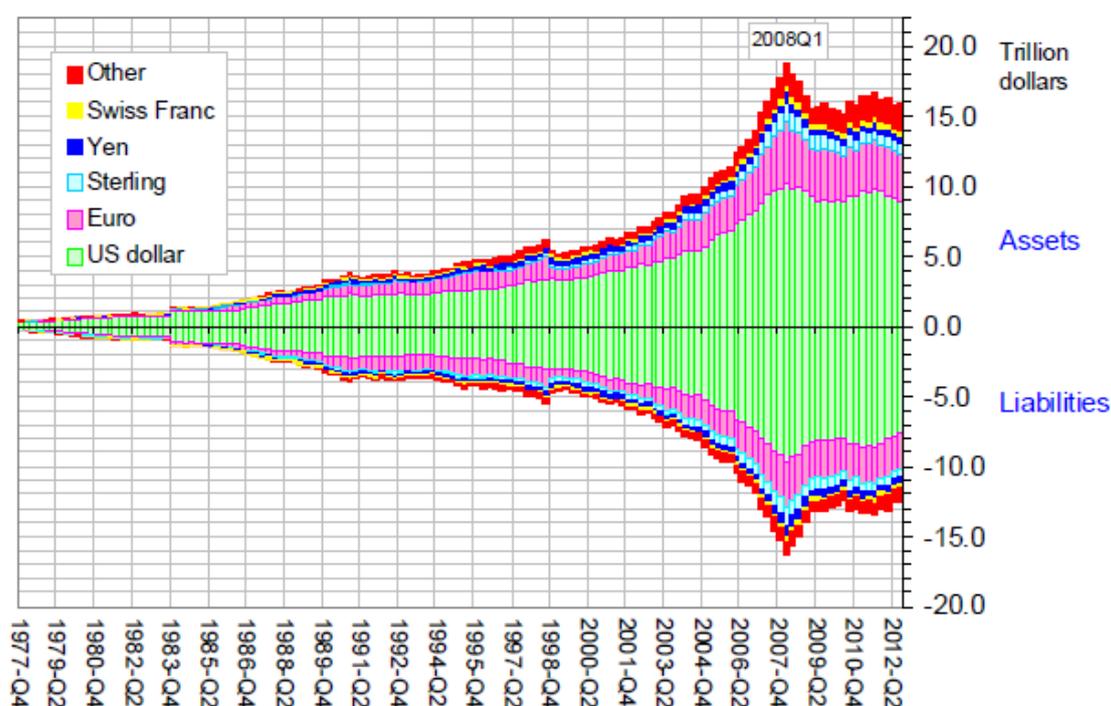
Note: The specific series is given by the negative of the “net due to foreign-related offices,  
Source: Federal Reserve H8 series.

<sup>12</sup> For a better understanding, Figures 3A and A4 in appendix plot the claims (deposits and loans) of relatively “big” and “small” European countries in terms of banking exposure.

As a general rule, net interoffice assets would be negative under regular circumstances (prior to 2000s), for the reason that branches of foreign banks operate as lending settlements. In contrast, as Figure 5 illustrates, net interoffice assets from 2001 until 2010, shifted notably positive. Effectively, it is easily observable that the net interoffice position of foreign banks in the US mirrors the degree to which global banks were associated in providing US dollar funding to the rest of the world. Regarding the empirical part of this paper, in accordance with Bruno and Shin (2013) and aiming to identify a major supply push force, the growth of the net interoffice account position of foreign banks in the United States has been implemented, as a key empirical proxy.

Next, as Figure 6 depicts, the rationale for the focus on US dollar-denominated bank flows yields from the prevailing role played by the US dollar in the global banking structure. Figure 6 plots the foreign currency assets and liabilities of banks globally according to BIS locational banking statistics. According to Figure 6, the US dollar is the supreme currency servicing activities of global banks and in parallel is the currency underpinning the growth of gross capital flows. In comparison, the role of other currencies worldwide is way smaller, given that the US dollar assets only exceeded 10 trillion dollars in 2008 out of 19 trillion dollars in total. Taking everything under consideration, net interoffice assets of foreign banks in the US is anticipated to indicate the accessibility of US dollar funding for cross-border transactions.

**Figure 6: Foreign currency assets and liabilities of BIS reporting banks, classified according to currency.**



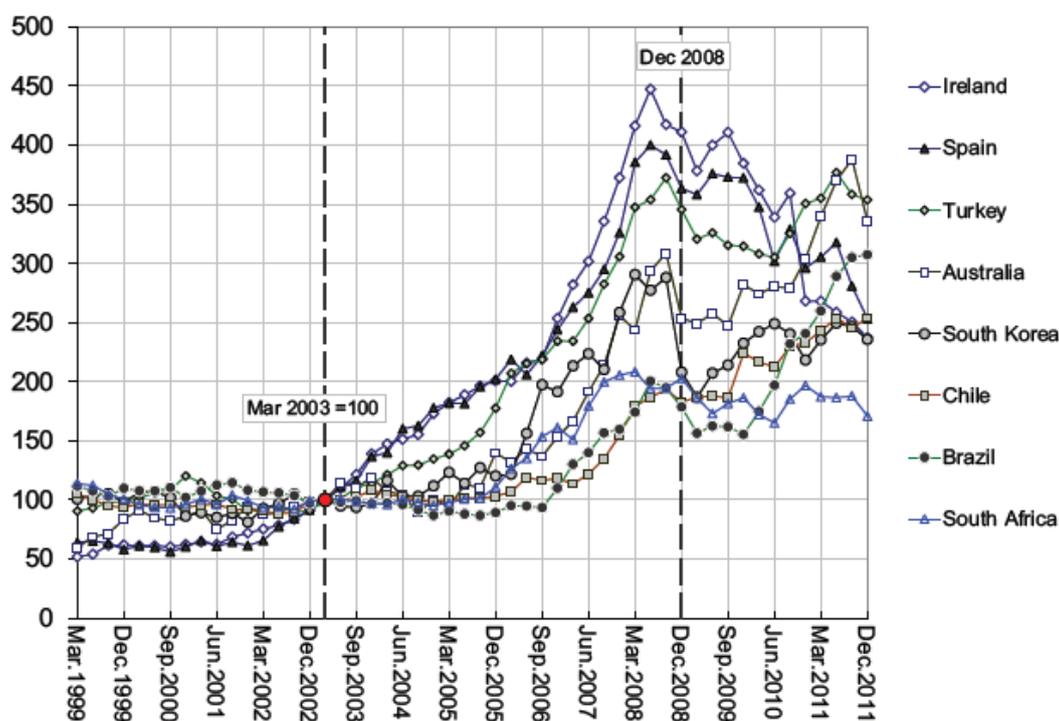
Source: BIS Locational Banking Statistics Table 5A.

Returning back to Figure 4, stage (2) refers to the cross-border capital flows that take place through the banking sector. The equivalent variable describing the connection presented in stage 2 is the claims of the banks in countries that report loan amounts to the BIS. An illustrative presentation of the importance of the specific

variable is easily seen in Figure 7 which includes the cross-border claims of BIS-reporting banks for a selection of countries. What is apparent from Figure 7 is the harmonized increase in cross-borders lending before 2008, regardless of the wide geographical spread between those countries. The particular capital flows mirror the interplay of the supply and demand for wholesale funding between international and local banks. More accurately, “*the liabilities of local banks serve as the assets of global banks, and the lending by global banks is the supply of wholesale funding, while the borrowing of local banks is its demand*”, (Bruno and Shin 2013). The overall economy could be affected by global supply push factors that play a major role in indicating the direction of capital flows. Under such circumstances, the implementation of macroprudential policy is likely to dampen the potential negative consequences and contribute in a beneficial way to the stabilization of the economy.

Based on the above, the general concept governing the present paper is the following: Since, global aspects influence all countries at the same level, the following analysis utilizes the available panel data by considering the rest countries in the sample as a comparison group, to investigate how the vulnerability of capital flows into a particular country (Brazil), fluctuates before and after the implementation of Map measures. The empirical analysis takes under consideration two sets of global factors. Firstly, as already mentioned, an international aspect which replicates the activities of global banks is the growth in the net interoffice assets of foreign banks in the US (Figure 5). The observable proliferation of cross-border banking transactions could be revealed in the fast growth of net interoffice assets. Merely analyzing Figure 5 and 7, it is straightforward that a correlation exists, involving the buildup in cross border lending (Fig.7) with the accumulation in wholesale funding raised by global banks (Fig.5).

**Figure 7: External claims (loans and deposits) of BIS reporting country banks.**



Note: The series are normalized to 100 in March 2003.

Source BIS Banking Statistics Table 7A.

Secondly, another global factor that is included in the empirical part is related to the well-known VIX index<sup>13</sup>. Relevant literature confirms that variations in the VIX index are strictly connected with leverage activities of international banks (see for example, Adrian and Shin 2010). A fact that converts banking sector leverage as a key feature of cross border claims. During periods of increased leverage activities, extra units of bank capital could denote increased levels of cross-border claims. Additionally, higher amounts of banking leverage indicates that existing bank capital will maintain even greater volumes of lending. Consequently, according to a theoretical perspective explicitly analyzed by Bruno and Shin (2013), since VIX index is associated with banking leverage, firstly the level of the VIX and secondly the change in the VIX are two variables able to determine the direction of capital flows.

#### IV. The case of Brazil

A reasonable question that one could ask, would be why the analysis is implemented specifically on the Brazilian economy and by which criteria the selection was based. Given that the study of Bruno and Shin (2013) was applied on the case of South Korea, my first goal was to identify a country which would be similar (as plausible that can be) to Korea's economical environment. Secondly, in order for the paper to have a coherent aspire, the preferred country should have implemented macroprudential tools in the wake of 2008 global financial crisis, as South Korea did. On the whole the following principles have indicated the rationale behind my selection: In line with Fritz and Prates (2014), apart from the managed float exchange rate regime, plenty of similarities exist between the two countries prior to the crisis. Namely, a couple of common characteristics implemented both in Korea and Brazil, are the "*high degree of financial openness*", "*antagonistic reserve accumulation strategy*" and "*inflation target policy*".

Moreover, domestic currency appreciation was the major method applied to lessen inflationary pressures in both countries. Another common feature is that both countries have a well-developed and actively traded equity and public bonds market, in addition to the deep foreign currency (FX) derivatives market<sup>14</sup>. Taking those aspects together, it is straightforward to clarify the heavy impact that the crisis had on those countries' currencies and financial markets. Finally and mostly related to the empirical analysis that follows in subsequent section, both Korea and Brazil have faced large capital inflow episodes since 2009 and have been the "*major destinations for portfolio inflows during the new boom in capital flows to emerging countries*". Fritz and Prates (2014 p.220).

Hence, Figure 8 illustrates the close correlation in terms of capital flows since it plots vis-à-vis capital inflows towards South Korea (top chart), and the respective flows entering the Brazilian economy (bottom chart). According to those two graphs, a common trend related to total capital inflows is observed, even though the composition (Portfolio investment-equity/ debt securities / Banking investments) of the funds might differ in size. Both economies, experienced massive capital surges

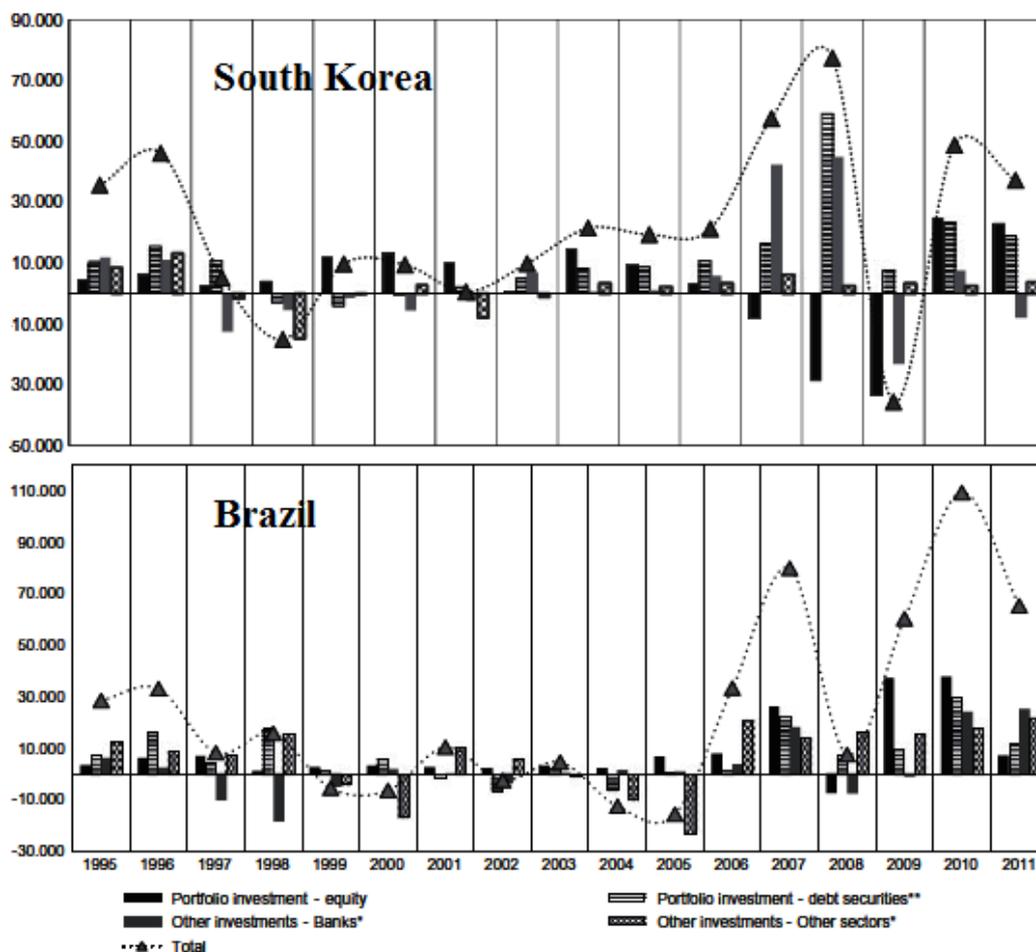
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<sup>13</sup> Chicago Board Options Exchange (CBOE) index of implied volatility (VIX) in the Standard and Poor's (S&P) 500 stock index option prices in the United States.

<sup>14</sup> Those two countries have the largest FX derivatives market among the emerging economies (Mihaljek and Packer 2010).

(hot money<sup>15</sup>) prior to 2008, followed by a significant drop after the Lehman Brothers collapse and hiked again during 2010. In total, the combination of all the above factors verifies the motives behind the selection of the Brazilian economy employed in the present paper. The next section presents the condition of the Brazilian economy before and throughout the global financial crisis.

**Figure 8: Capital Flows in South Korea and Brazil (in million US\$)**



Source: Fritz and Prates (2014)

### A. The effects of global financial crisis in Brazil:

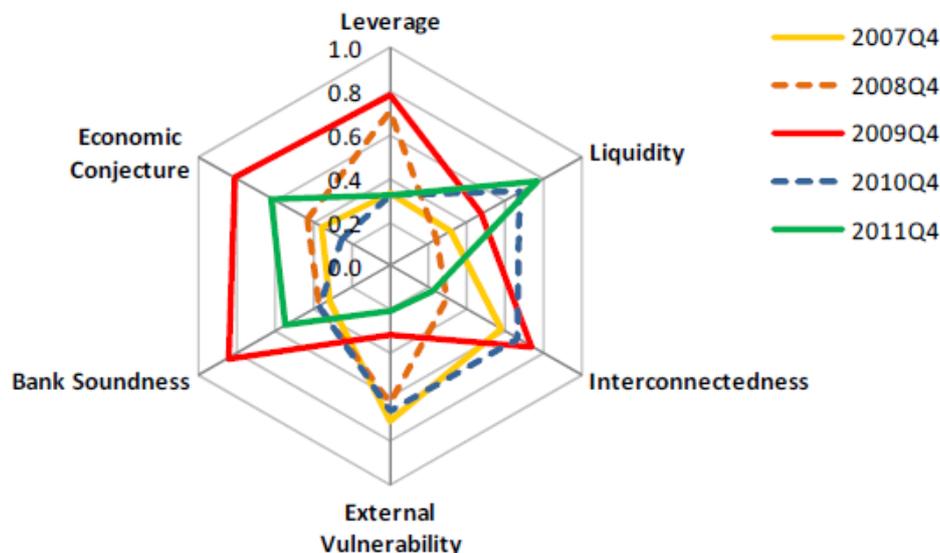
In the context of capturing the effects of global financial crisis in Brazilian economy, the financial stability Map (Figure 9)<sup>16</sup> demonstrates the evolution of key factors related to systemic risk. The progression of the Map, spans from 2007 until the end of 2011 and is based on six systemic factors: leverage, liquidity, interconnectedness, external vulnerability, bank soundness and economic conjecture.

<sup>15</sup> Sales and Barroso (2012), analyze in detail the global liquidity that took place in 2009-10 (See, Figure2A in Appendix). Especially for emerging economies, policymakers are primarily concerned by inflationary pressures, rapid credit expansion, rising assets prices and exchange rate volatility.

<sup>16</sup> The various dimensions depicted in the figure have been calculated by (Sales et. al. 2012) as proxies respectively to the factors mentioned on the main text: Credit to GDP gap/ Loan to deposit ratio/ interconnectedness index/ international reserves to short-term external debt ratio/ non-performing loans to total gross loans/ real GDP growth rate(YOY).

According to Figure 9, the relative weight of singular risks has modified over the period, with a significant broad expansion (as the red line depicts) in 2009.

**Figure 9: Financial stability Map in Brazil.**



Source: Silva et. al. (2012)

In particular, leverage has been soaring compared to the rest of the dynamics along 2008/09. Conversely, following the blast of the global financial crisis liquidity risk was the factor that threatened the stability of the Brazilian economy (see blue and green line). Moreover, risks related to cross-border interconnectedness have been rapidly increased until 2010 and eventually dropped to adequate levels only by the end of 2011. After a period of steady rising in external vulnerability, Brazilian authorities managed to restrain its' growth in 2009 but it hiked once again the subsequent year. That is just one indication of how fragile the domestic financial system can be related to global conditions and its huge impact on vulnerable economies. Finally, financial threat linked to bank soundness, peaked in 2009 reflecting the necessity for banking regulations that followed the next years.

Eventually, the Brazilian economy managed to overcome the severe turmoil of the global financial crisis in a quite sufficient way. Apart from the set of Map measures implemented when the conditions required, the main point that should be noted regarding the countries' capability to *"sail against the wind"*, was Brazil's sound macroeconomic background which dominated over the preceding years. In line with a paper by Tabak and Staub (2006), the likelihood of a devastating collapse in the Brazilian banking system prior to the crisis seemed to be highly implausible. This is mainly attributed on the combination of sound macroeconomic policies<sup>17</sup> and improvements in the regulation of financial markets that took place in the late 1990s. Table 3A in Appendix, summarizes the main features that reflect the sound and promising Brazilian economy.

Before analyzing the response of the Brazilian authorities it would be useful to demonstrate a selection of statistical features representing the impact of the crisis into

<sup>17</sup> Driving forces reflecting the Brazilian macroeconomic conditions are: The abandon of a crawling peg and the adoption of a floating exchange rate regime, an inflation targeting outline and the enforcement of a new payment system.

the domestic economy. According to the Central Bank of Brazil, following the Lehman Brothers episode, trade flows dropped by 6.9% in comparison with the previous year; the overall industrial production shrank by 27% QOQ; capital outflows increased by 36% QOQ provoking the exchange rate to depreciate by 32% YOY and finally, credit growth fell by 35% YOY. The reaction of Brazilian authorities was quick since they immediately took measures even from the early appearance of the shock.

Initial priority in their actions, was to deal with the imminent liquidity issues both in domestic and foreign currencies. Bank reserve requirements were declined, a fact that provided money supply into the economy equal to 4% of nations' GDP. Next, as an attempt to stabilize the trembling global condition, the Central Bank injected the exchange currency market by 14.5\$ billions which is equivalent to 7% of the entire international reserves at the end of 2008. Apart from those interventions, local authorities employed a combination of monetary and fiscal policies, the examination of which goes beyond the purpose of the paper. Eventually, the response of the Brazilian economy generated the expected "V-shaped"<sup>18</sup> recovery pattern. Thus, during the most destructive period of the global financial crisis (end of 2010), the Brazilian economy achieved a remarkable comeback. For example, compared to the previous year levels, GDP rate expanded by 7.2%; domestic demand grew by 10.3%; private consumption increased by 7.2% and investment by 11.1%.

At the same time, global conditions and more precisely interventions by the Federal Reserve in the form of quantitative easing which aimed to boost the domestic economy (US) had generated spillovers to emerging countries (affecting Brazil as well). In the long run, the global environment directed its attention to the option of emerging markets (increased demand for assets) and simultaneously forced emerging markets currencies to appreciate. Figure 10, plots on the left panel the-Foreign Net Portfolio Investments and on the right panel-Exchange rates for a group of countries. Regardless of policy actions in the specific countries, additional capital flows continued to cross their borders, contributing further to currency appreciation accompanied with inflation pressures in their economies. In turn, surges in capital inflows contributed to a rapid growth of domestic credit as a result of relaxed local credit standards and lowered funding cost. Authorities had to deal with the latent risk of credit and asset price bubbles, given that those massive inflows amplified foreign currency exposure which made banks more vulnerable.

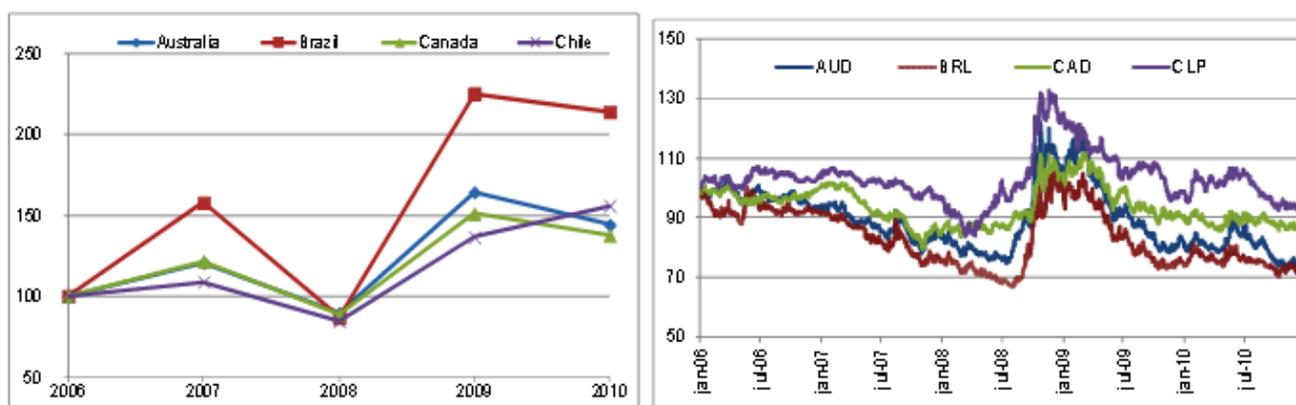
Concerning especially the case of Brazil, those challenges were present with overheating signs threatening the economy. One major issue for the Central bank was to limit the excessive credit expansion. During the previous decade, based on strong fundamentals<sup>19</sup> that characterized the Brazilian economy, credit expansion was already a foremost concern for the authorities. The unexpected events (inflows) that followed during the global financial crisis could aggravate the existing from the previous years' credit growth. The general fragile environment described above, made obligatory the response under the new approach of macroprudential policy

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<sup>18</sup> See Table-3A in Appendix, Industrial Production.

<sup>19</sup> Baka and Kokenyne (2011), explain in detail the Brazilian environment in the 2000s. A combination of: (i) liberalizations in key capital movement restrictions, (ii) sound macroeconomic policy, (iii) relative high interest rate differentials with advanced economies and, (iv) low exchange rate volatility, attracted huge inflows in the domestic market.

**Figure 10: Foreign net portfolio investments (left graph) and exchange rates (right graph), (normalized to 100).**



Source: Silva and Harris (2012)

## V. The Brazilian response to the crisis:

At the end of 2010, Brazilian authorities relied on a broad textbook framework to cope with the rising risks of macroeconomic and financial disorder. To begin with, major concerns for policymakers were mostly related to the control of supply-demand imbalances and restriction of inflation variations. Those issues were controlled with the adoption of appropriate fiscal and monetary policies (for a detailed analysis see, Silva and Harris 2012). Whereas, for issues related to credit growth and capital flows management, Map instruments were established aiming to dampen systemic risk. Therefore, central banks interventions aimed to moisten speculative behavior and repel excessive capital flows of short-term investments into the country.

On the board subject of capital flows, in September 2010 the Brazilian Finance Minister, Guido Mantega, made clear by his statement that “*macroprudential policy was introduced to avoid the entrance of short-term capital flows*” given that “*a global currency war was underway*”<sup>20</sup>. In that sense, in 2012 the IMF relatively reversed its persistent position concerning capital management, stating that under specific conditions capital controls could be an appropriate instrument in emerging markets, designed to moderate foreign exposure and systemic risk. Baba and Kokenyne (2011) discuss the effectiveness of capital controls in emerging markets (included Brazil) prior to the crisis, while a study by Chamon and Garcia (2013) examines the same topic but in the aftermath of 2008 crisis. Both papers verify the view that controls are sufficient in terms of restraining the growth of credit bubble, however, the authors argue that extensive use of capital controls have limited effect on currency appreciation pressures.

### A. Macroprudential Policy in Brazil:

According to the Central Bank of Brazil, the most important Map instruments placed into practice were the following: (i) *increased bank reserve requirements* to reduce the contagion effect of global liquidity to the domestic credit market. (ii) *increased capital requirements* for targeted fragments of the credit market (mainly for

<sup>20</sup> See an article in Financial Times- September 27<sup>th</sup> 2010: “The Brazil in currency war alert” by Wheatley and Garnham.

consumer loans) intending to improve the quality of loan origination and finally (iii) new reserve requirements on banks short spot foreign exchange positions and taxation of the specific inflows to coordinate imbalances on the foreign exchange market and to moisten the soaring variation of capital flows.

**Table 4: Applied macroprudential measures in Brazil by system component and vulnerability.**

		Financial system component				
		Bank or deposit-taker		Non-bank investor	Securities market	Financial infrastructure
		Balance sheet*	Lending contract			
Vulnerability	Leverage	capital ratio	LTV cap			
		risk weights	debt service / income cap		margin/haircut limit	
		provisioning	maturity cap			
		profit distribution restrictions	margin/haircut limit			
		credit growth cap	tax on household credit			
	Liquidity or market risk	liquidity / reserve requirements		tax on FX deriv	central bank balance sheet operations	exchange trading
		FX lending restriction	valuation rules (eg. MMMFs)	tax on ext credit		
		currency mismatch limit				
	Interconnect edness	open FX position limit				
concentration limits					central counter parties (CCP)	
systemic capital surcharge						
		subsidiarisation				

Source: Silva and Harris (2012).

In accordance with Table 1 that was presented in the introduction section, the range and orientation of the above tools can be outlined in Table 4 above. In particular, the cells covered with pink color represent the implementation of the specific measures on some segments of the credit market, while red cells indicate implementation to all financial system components. On the subject of density across the different financial system elements, it is clear from Table 4 that special attention has been paid on perils related to banking sector's Balance sheet. In general, the comprehensive Brazilian Map toolkit was specifically designed to address issues of leverage, liquidity/market risks and interconnectedness.

Analytically, authorities implemented reserve requirements with initial aim to ensure liquidity supply within the financial sector and to reinforce the exposed overall economy. The Central Bank gave permission on "big-sized" banks to utilize parts of their required reserves, given that these funds were to be used to provide liquidity on smaller and middle-sized banks. Additionally, facing the threat of credit growth, reserve requirements were employed for a second time by the end of 2010 as a countercyclical buffer. Reserve requirements were increased from 15% to 20% on deposit terms aiming to lessen the fast credit expansion. A study by IMF (Garcia-Escribano et al. 2011), examined specifically the impact of reserve requirements as a Map tool in the Latin America region. They found that the implementation of reserve requirements restrain systemic risk and contributes to manage the procyclicality of private sector bank dynamics. Furthermore, Montoro and Moreno (2011), examine the use of reserve requirements as a policy instrument, using again the same countries as a sample of their investigation. However, the authors argue that beyond the apparent positive effects (such as: stabilizing interbank rates / curb credit growth / and reduce capital flows volatility), there are trade-offs between the use of reserve requirements

and the growing cost in the financial sector. Therefore, implications may arise in the financial system since borrowers have an incentive to look for other sources of funding<sup>21</sup>.

**Table 5: Consumer and vehicle loans by maturity and loan to value level.**

Operation	Maturity and LTV	Risk Weight
Vehicles (financing and leasing)	between 24 and 36 months and LTV > 80%	150%
	between 36 and 48 months and LTV > 70%	
	between 48 and 60 months and LTV > 60%	
	more than 60 months and any LTV	
Payroll-deducted loan	more than 36 months	
Personal loan	more than 24 months	
Other consumer loans		100%

Source: Silva and Harris 2012.

Next, another measure applied to restrict the credit market growth and precisely the rapid expansion of new vehicle loan credit, was the implementation of Financial Transactions Tax (IOF). In the middle of 2011, Brazilian policymakers found it optimal to raise the level of IOF considering individual credit actions. A recent study by Martins and Schechtman (2013), examines in detail the economic impact of the particular loans pricing measure implemented by the authorities. For instance, IOF rate was doubled in size from 0.0041% to 0.0082% per day or in percentage terms the IOF tax rate on transactions was raised from 1.5% to 3%. Moreover, related to credit market instruments the adoption of stricter policy against consumer loans for a variety of purposes was achieved with increased capital requirements. In practice, Table 5 summarizes the guideline (maturity and loan to value) established by the Central Bank to limit the growth of consumer loans. Precisely, for household loans above 24 months, capital requirements were increased via a significant extension in the previous percentage of Risk Weight Factor (RWF)<sup>22</sup> from 75% to 150%.

Beyond the above Map measures which had been targeted unilaterally on the credit market of the Brazilian economy, additional Map tools have been applied on the side of foreign exchange market. As mentioned before, authorities took actions in order to restrain short-term and speculative capital inflows. Those interventions aiming to stem short term carry trades in both spot and future markets had a secondary effect, by means of putting further pressure for domestic currency appreciation<sup>23</sup>. Explicitly, since the IOF tax is applicable to several segments of the economy depending on the

<sup>21</sup> Normally, borrowers will seek for alternative resources from other foreign countries or even from the unregulated financial sector.

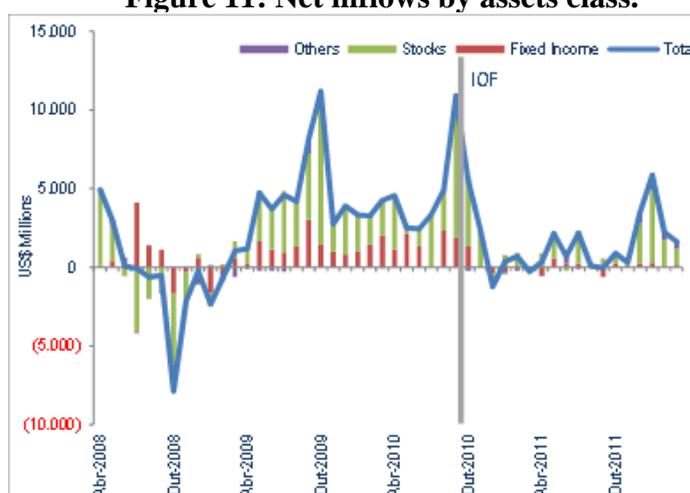
<sup>22</sup> Aiming not to interact with vulnerable segments of the Brazilian economy, the Risk Weight Factor was not applicable to agricultural credit operations, mortgage loans or credits for acquisitions of trucks and similar vehicles.

<sup>23</sup> Carry trade is commonly performed in the derivative market through the acquisition of long positions on a high yield currency (Brazilian Real) and short position on a funding currency (Dollar, Euro or Yen).

necessity of each situation, authorities applied IOF tax on non-residential portfolio investments and on margin deposits on derivatives. The former taxation on financial transactions introduced for foreign portfolio investment in fixed income instruments was initially increased from 2% to 4% and afterwards from 4% to 6%. In addition, the latter tax on arriving remittances designed to dampen the exposure on derivatives positions, was set at 6 percent as well. The particular macroprudential instrument is closely associated to the well-known Tobin Tax (1978), which was initially proposed to influence currencies conversation<sup>24</sup>. It is worth mentioning that Tobin's tax, indented to curb the return on "hot money" and therefore lessen exchange rate instability, fact that is in a way, one of Map policy objectives.

A number of supplementary restrictions were implemented in order to support the effectiveness of the above measures. For example, every domestic transport of non-resident funds was weighted down by an immediate IOF levy. Furthermore, domestic banks were prohibited to borrow securities abroad, in order to minimize potential ways of avoiding the taxation on derivative margin deposits. Figure 11 below, plots portfolio net inflows in Brazilian economy for the period between 2008 and 2012. A quick examination of the Figure provides valuable signs on the effectiveness of the measures just described. The exact date of IOF tax implementation is depicted by the vertical grey line. Thus, comparing the levels of portfolio inflows before and after the implementation of the specific measure, the efficiency of the tax is straightforward.

**Figure 11: Net inflows by assets class.**



Source: Silva and Harris 2012

A second measure implemented in foreign exchange market was bank reserve requirements on short positions in the FX spot market. In January 2011, the local authorities established a 60% steady reserve requirement on banks short position in the foreign exchange spot market that exceed 3 billion US\$. Besides, in June of the same year, government shrank the requirement to FX positions larger than one billion US\$. Considering the impact of those two measures, financial behavior adjusted with a daily demand to sell domestic currency equal to 447 and 621 billion US\$ respectively<sup>25</sup>. The logic governing the specific Map measure was the limitation of the

<sup>24</sup> Even though Tobin tax might repulse foreign investments that could have a positive impact on real economy, numerous of economists worldwide argue that the potential revenue from the taxation could be utilized in cases of emergency like the recent global financial crisis.

<sup>25</sup> The former case represents lower quantity of money since the total amount of positions between 1-3 billion dollars were higher than the sum of the positions above 3 billion dollars.

banking sector to transact in spot and derivatives market. By increasing the cost of those transactions, the aim was to shrink the liquidity of the market, which could be interpreted as an indirect message to potential foreign carry traders, intended to curb their speculative intentions. Beyond the above motivation, an additional objective of the Central Bank was to constraint the hazardous behavior of domestic banks. In particular, given the soaring liquidity in global markets, Brazilian banks attempted to take advantage of the different interest rates, via an enlargement on their foreign funding. In turn, those funds could be invested in highly-yielding Brazilian assets.

With regard to the stability of the whole financial system, authorities tried to moisten the magnitude of the specific approach. The main concern was to prevent the negative event of sudden outflows or a potential distress to the exchange rate, since once again such approach could leave banks defenseless to currency mismatch and excessively reliant on foreign funds<sup>26</sup>. In conclusion, the combination of firstly, the significant increase in IOF tax and secondly the implementation of reserve requirements on short foreign currency position, worked adequately to intercept potential speculative attacks on the Brazilian currency.

Given that the majority of advanced economies preferred to obtain a relative pathetic pose against the use of Map instruments, the Central Bank of Brazil did not rely on the efficacy of the broad toolkit mentioned above, to secure the domestic economy. Conversely, in the middle of 2011 additional set of measures came into practice. Specifically, IOF taxation has been also implemented on external credit inflows aiming to alleviate long-term flows and to minimize speculative short-term inflows. The IOF levy has been placed to 6% on domestically issued debt securities or inflows associated with external borrowing and maturity below one year. Regardless the application of the particular IOF tax, capital inflows surged compared with the level of 2010, by 14.6% (see also, Figure8- Capital inflows in Brazil). Local authorities expanded the tax to loans with maturity below 2, 3 and 5 years consecutively within a month (October 2011). Roure et. al. (2013) argue that, the efficiency of those modifications is doubtful, given that Brazil eventually taxed loans with maturity below one year<sup>27</sup>. Considering the amplified international liquidity in 2011, the growth in capital inflows can be primarily attributed on the attractiveness of the Brazilian assets as a secure and safe destination for global investor funds.

Bearing in mind the existence of a significant trade-off between imposing consequent taxations on foreign exchange markets and latent spillovers to the real economy, the Central Bank of Brazil persisted on imposing a supplementary IOF tax on FX derivatives. The rate of the specific tax was set at 1%, regardless any kind of transactions of financial derivatives (acquire or sale), or residence positions (residents or nonresidents), with the capability to be calibrated up to 25% maximum. Those Map measures were initially designed to hamper the immoderate and intense short positions and secondly to prevent speculative attacks on the exchange rate<sup>28</sup>. Figure

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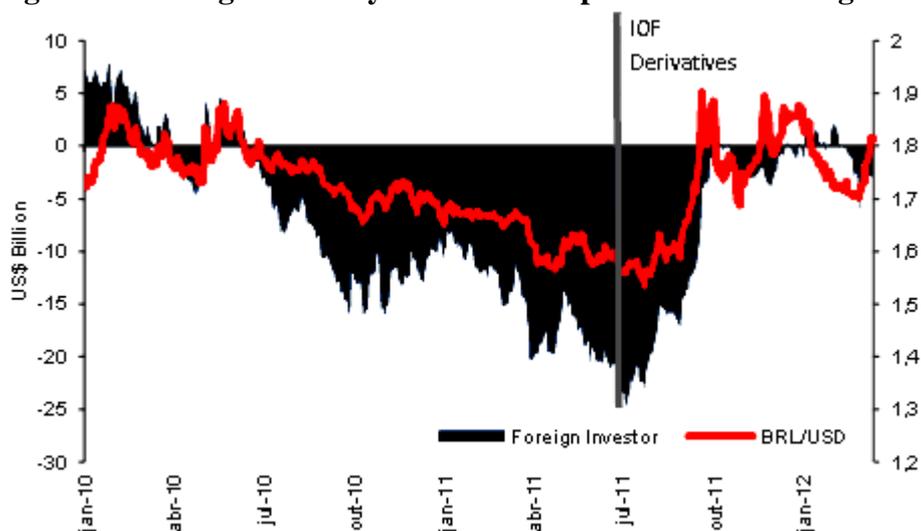
<sup>26</sup> In line with Silva and Harris (2012), as stated by the Brazilian regulations on the foreign exchange market: banks open a short cash position when they sell foreign currency borrowed abroad. Similarly, when a bank contracts a direct loan or issues securities, it opens a long position.

<sup>27</sup> The authors (Roure et al. 2013) argue that the specific policy had no impact on the real economy, since commercial behaviour remained stable.

<sup>28</sup> According to Fritz and Prates (2014), during periods of low risk aversion both before and after the global financial crisis, foreign institutional investors, primarily hedge funds, have been the most important investor group in the Brazilian FX future market, fostering the appreciation of the domestic currency through carry trade.

12 illustrates that following the IOF tax announcement on July of 2011, FX derivatives exposure and exchange rate sharply returned to standard levels.

**Figure 12: Foreign currency derivatives exposure and exchange rate.**



Source: Siva and Harris (2012)

In summary, judging from the analysis of varied tools implemented to every possible weakness of the domestic economy, macroprudential policy in Brazil could be characterized as relative intensive and properly organized. According solely to the Figures and statistics presented in this section of the paper, the majority of the tools implemented by the Brazilian policymakers during the crisis have been roughly efficient to accomplish the overall goal of diminishing financial exposure. The following section, empirically analyzes the effectiveness of those instruments in terms of vulnerability of capital flows. Finally, Table 6 in the next page historically reviews the exact dates of implementation and shortly describes all the measures analyzed in the particular section.

**Table 6: Macroprudential instrument in Brazil (Specific dates)**

<b><i>Instrument</i></b>	<b><i>Date</i></b>	<b><i>Description</i></b>
IOF Tax	20/October/2009	2% Tax on non-resident equity and fix income portfolio inflows.
IOF Tax on FX	1/October/2010	Increase in IOF on margin requirements for FX derivatives transactions from 0.38 to 6%.
IOF Tax	5/October/2010	4% Tax on fixed-income portfolio investment and equity funds.
IOF Tax	18/October/2010	6% Tax on fixed-income investments.
Reserve Requirements	6/January/2011	Unremunerated reserve requirements of 60% on bank's gross FX position beyond 3 billion US\$.
IOF Tax	29/March/2011	6% Tax on new foreign loans with maturity below one year.
IOF Tax	7/April/2011	Extension of 6% Tax on new foreign loans with maturity below two years.
Reserve Requirements	8/June/2011	Unremunerated reserve requirements of 60% on bank's gross FX position beyond 1 billion US\$.
Tax on currency derivatives	27/June/2011	Implementation of a 1% financial tax on all agents' excessively long positions on Brazilian Real.
IOF Tax	1/December/2011	Reduction of IOF on equity and fix-income portfolio inflows to 0%.
IOF Tax	1/March/2012	Extension of 6% Tax on new foreign loans with maturity below 3 years.
IOF Tax	9/March/2012	Extension of 6% Tax on new foreign loans with maturity below 5 years.
IOF Tax	13/June/2012	Decrease of 6% Tax on new foreign loans with maturity below 2 years.
IOF Tax	4/1December/2012	Decrease of 6% Tax on new foreign loans with maturity below 1 year.
Tax on currency derivatives	18/December/2012	Unremunerated reserve requirements of 60% on bank's gross FX position beyond 3 billion US\$.

## **VI. Data and Model specification.**

As mentioned already, since the paper reproduces the empirical formation from an existing paper, the data review and empirical specification that follows are in accordance with Bruno and Shin (2013).

### **A. Data description:**

Aiming to analyze the effectiveness of Brazil's Map measures in comparison with a variety of countries, the sample consists of 46 economical significant countries<sup>29</sup>. Meaning that all the selected economies have been chosen in such a way that each country's financial system can be considerable subjective by bank counterparties

<sup>29</sup> In contrast with Claessens et. al.(2008) database ,Egypt and Vietnam have been excluded from the sample due to data unavailability on local factors (RER/GDP/Debt to GDP).

abroad. In particular, all advanced economies have been included (28), the five big ASEAN countries (5), and a variety of emerging and developing countries (13). The range of the last group of countries that have been included is in accordance with a database of foreign banks (see, Claessens et. al. 2008). Besides, in order to avoid biased results, world-wide off-shore financial centers (such as, Luxemburg, Liechtenstein and Singapore) have been dropped from the sample.

The complete catalog of countries' sample is the following: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Indonesia, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Malaysia, Malta, Mexico, Netherlands, Norway, Philippines, Poland, Portugal, Russia, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Kingdom and Uruguay.

**Table 7: Summary Statistics: The variables in terms of theirs mean, standard deviation, minimum and maximum.**

	Observations	Mean	Maximum	Minimum	Std. Dev.
<b>BIS loans growth</b>	3312	0.021443	0.699696	-0.778180	0.101266
<b>Interoffice</b>	72	0.268932	0.785756	-0.67924	0.347339
<b>VIX</b>	72	3.040451	3.78736	2.432736	0.346168
<b><math>\Delta</math>VIX</b>	72	-0.001109	0.848863	-0.497536	0.213896
<b>RER</b>	3312	0.001264	0.405660	-0.639268	0.039624
<b>GDP</b>	3312	2.681111	3.189342	-1.100182	0.68993
<b>Money Stock</b>	72	0.012626	0.079404	-0.034715	0.016249
<b>Debt To GDP</b>	828	0.024519	2.0769847	-0.395241	0.186586

Next, after the description of the sampled countries follows an explicit report of the main explanatory and control variables that have been incorporated. First of all, as provided by the BIS locational statistics<sup>30</sup>, the key determinant of capital flows (BIS loans growth) employed, is calculated based on the quarterly log difference in external claims of BIS- reporting country banks. Furthermore, as already explained in previous section, the two major independent variables are (i) the growth in interoffice assets of foreign banks in the United States ( $\Delta$ Interoffice)<sup>31</sup> and (ii) the log value of VIX volatility index from Chicago Board Options Exchange Market (VIX)<sup>32</sup>. It is well-known that the VIX rate is an approximation for the leverage of global banks. Furthermore, the quarterly log difference of the VIX ( $\Delta$ VIX) is also considered, as proxy for leverage variation and hence the pace at which lending rises based on the existing level of equity.

Apart from those main variables as potential indications of capital flows, a number of international and domestic controls have been implemented. Taken from the IMF's International Financial Statistics (IFS) database, the log value of real exchange rates ( $\Delta$ RER)<sup>33</sup> for all the 46 countries have been included. Next, the second control

<sup>30</sup> See Table 7A, in BIS locational statistics webpage.

<sup>31</sup>  $\Delta$  interoffice is taken from the Federal Reserve series H8 on commercial banks. Precisely, the series is given by the negative of the "net due to foreign-related offices".

<sup>32</sup> The quarterly values have been computed as the average value of end-of day data taken from CBOE official webpage.

<sup>33</sup> Real exchange rate is computed as the log of nominal exchange rate\* (US CPI/local CPI), where CPI denotes consumer price index.

variable is the quarterly growth in the global money supply ( $\Delta$ money stock)<sup>34</sup>, from IFS database. Given that the available series in IFS were in local currency, they have been converted to US dollars by multiplying each one with the corresponding exchange rate. Third, taken again from the International Financial Statistics database, gross domestic product growth ( $\Delta$ GDP) is the country percentage change in GDP from the previous quarter<sup>35</sup>. Finally, from World Economic Outlook database, the last control variable is the annual growth in government gross debt to GDP ( $\Delta$ Debt to GDP) due to lack of quarterly data for all the included countries. Regarding the sample period, the analysis begins on the first quarter of 1996<sup>36</sup> until the last quart of 2013. As a final point, it should be noted that in line with Bruno and Shin (2013) and aiming to alleviate endogeneity issues, all quarter variables are lagged by one quarter (apart from  $\Delta$ VIX).

## B. Empirical Specification:

As already mentioned, the empirical research and specification that follows is based on a benchmark panel regression conducted by Bruno and Shin (2013):

### Equation (1)

$$\Delta L_{c,t} = \alpha + \beta_1 \Delta \text{Interoffice}_{t-1} + \gamma_1 \text{VIX}_{t-1} + \delta_1 \Delta \text{VIX}_t + \Delta \text{RER}_{t-1} + \Delta \text{money stock}_{t-1} + \Delta \text{GDP}_{t-1} + \Delta \text{Debt to GDP}_t + e_{c,t}$$

The above form of panel regression, equation (1), corresponds to the first column of Table 9, where the dependent variable  $\Delta L_{c,t}$ , is banking sector capital inflow into country  $c$  in period  $t$ , as given by the quarterly log difference in the external claims of BIS-reporting country banks on country  $c$  between quarters  $t$  and  $t-1$ ;  $\text{VIX}_{t-1}$  is the log of end-quarter VIX index lagged by one quarter and  $\Delta \text{VIX}$  the quarterly log difference of VIX;  $\Delta \text{Interoffice}_{t-1}$  is the growth in interoffice assets of foreign banks in the United States from the quarter before given the percentage growth and lagged by one quarter (Bruno and Shin, 2013). On the subject of the control factors, indications and explanation have been explicitly analyzed in the previous paragraph.

Furthermore, country fixed effects have been implemented on panel regressions and a set of year dummies as well. Precisely, the specification includes, a dummy variable (“Post 2010”) equal to 1 (0 otherwise) for the period from the third quarter of 2010 until the end of 2012<sup>37</sup> and a dummy variable (“Brazil”) equal to 1 (0 elsewhere) aiming to capture the specific effect on Brazil. Subsequently, the two dummies have been interacted firstly with the key independent variables ( $\Delta$  Interoffice/ VIX and  $\Delta$ VIX) and secondly with the controls. The main concern of the empirical part is to identify the impact of the triple interaction terms specified by:

$$\text{Global factor} * \text{Brazil} * \text{Post 2010},$$

<sup>34</sup>  $\Delta$ money stock transformed in US dollars and is computed as: the quarterly log difference of the sum of M2 stock in the United States, Eurozone, and Japan, and M4 in the United Kingdom.

<sup>35</sup> Quarterly data have been applied, in contrast with Bruno and Shin (2013) who applied annual data of the specific control variable.

<sup>36</sup> Based on the availability of BIS locational data, (Table 7A), which starts from the first quarter of 1996.

<sup>37</sup> The specific period from October 2010 until December 2012 is chosen according to the implementation of various macroprudential measures presented on Table 6.

which indicates the sensitiveness of capital flows to Brazil according to each factor after October 2010. Consequently, the coefficients of the two double interaction terms have also been examined:

Global factor\*Brazil and Global factor\* Post 2010,

given that the comparison between the triple interactions terms and the double interaction terms, are adequate indicators to identify if the alternation in sensitivity of the triple interaction term is attributable to the specific country policies or a broad shift over time (Bruno and Shin 2013).

Precisely, global factor stands for  $\Delta\text{Interoffice}$ , VIX and  $\Delta\text{VIX}$  in the context of examining how a country is particular sensitive to global conditions. Thus the augmented panel regressions with country interaction terms, aim to capture the impact of global factors on the Brazilian economy. The following specifications (2) and (3) represent the augmented panel regressions regarding the interaction between  $\Delta\text{Interoffice}$  and the (i) whole sample, (ii) Brazil and (iii) Brazil after the introduction of Map policy.

Equation (2):

$$\Delta L_{c,t} = \alpha + \beta_1 \Delta\text{Interoffice}_{t-1} + \beta_3 \Delta\text{Interoffice}_{t-1} * \text{Brazil} + \gamma_1 \text{VIX}_{t-1} + \delta_1 \Delta\text{VIX}_t + \text{controls} + e_{c,t}$$

Equation (3):

$$\Delta L_{c,t} = \alpha + \beta_1 \Delta\text{Interoffice}_{t-1} + \beta_2 \Delta\text{Interoffice}_{t-1} * \text{Post2010} + \beta_3 \Delta\text{Interoffice}_{t-1} * \text{Brazil} + \beta_4 \Delta\text{Interoffice}_{t-1} * \text{Post2010} * \text{Brazil} + \gamma_1 \text{VIX}_{t-1} + \delta_1 \Delta\text{VIX}_t + \text{controls} + e_{c,t}$$

Coefficient  $\beta_1$  in (2) is designed to capture the impact of  $\Delta\text{Interoffice}$  on capital flows for the full sample of countries. Whereas, coefficient  $\beta_3$  on the Interaction term ( $\Delta\text{Interoffice}_{t-1} * \text{Brazil}$ ) is designed to indicate the additional impact of  $\Delta\text{Interoffice}$  variable specifically on the case of Brazil. Next, regarding the augmented specification that corresponds to equation (3), coefficient  $\beta_2$  measures the impact of  $\Delta\text{Interoffice}$  on capital flows after the introduction of the measures and  $\beta_4$  gives Brazilian sensitivity to  $\Delta\text{Interoffice}$  regarding the specific period of interest (3<sup>rd</sup> quarter of 2010 until the end of 2012). The idea is to identify potential shift in the sensitivity of capital flows prior and after the implementation of the measures. Thus, a potential shift in the sign (from positive before to negative after October 2010) might be an indication of capital inflows constraint which consequently reflects efficacy of Macroprudential policy in terms of banking capital flows. Besides, one of the main concerns of the specific paper is the exact impact of  $\Delta\text{Interoffice}$  on the Brazilian economy prior and ahead of Q3-2010 and is captured by the coefficients  $\beta_3$  and  $\beta_3 + \beta_4$ , respectively. Next, for the case of  $\Delta\text{Interoffice}$ , Table 8 below depicts the interactions structure which gives the total effects between Brazil and the rest countries of the sample before and after October 2010.

**Table8: Coefficients interactions.**

	Pre 2010	Post 2010
Brazil	$\beta_1+\beta_3$	$\beta_1+\beta_2+\beta_3+\beta_4$
Rest 45 Countries	$\beta_1$	$\beta_1+\beta_2$

The initial concept of the particular Table is to highlight the distinction between each global factor prior and after 2010 for Brazil and secondly how differently was the impact on the rest of the sample in comparison with Brazil according to the following hypothesis:

1. The null hypothesis ( $\beta_2+\beta_4=0$ ), represents the statement that: there has been no change in the sensitivity of Brazil to  $\Delta$ Interoffice before and after 2010.
2. The null hypothesis ( $\beta_3+\beta_4=0$ ), represents the statement that: there is no difference in Brazil and the rest of the sample to  $\Delta$ Interoffice after 2010.
3. The null hypothesis ( $\beta_1+\beta_2=0$ ), represents the statement that: there has been no change in the sensitivity of the whole sample to  $\Delta$ Interoffice before and after 2010.
4. The null hypothesis ( $\beta_1+\beta_2+\beta_3+\beta_4$ ), represents the statement that: global bank activities no longer influence capital flows to Brazil.

Analogously, the set of interaction series related to the additional two global factors is presented by ( $\gamma$ ) coefficients for the second independent variable (VIX) and by ( $\delta$ ) coefficients for  $\Delta$ VIX (see Table 9). The specific equations, not only for those two variables, but also for the control variables are presented in the Appendix since the analysis is identical to the preceded analysis of  $\Delta$ Interoffice. The expected signs both for VIX and  $\Delta$ VIX are negative since an increase in the specific index is linked to deleveraging process of the banking sector and hence capital flows through the particular sector. The specific pattern that table 8 illustrates holds for the rest of the variables (VIX and  $\Delta$ VIX) and provides the overall effects as a consequence of the impact of each key variable with Brazil specifically. In that spirit, the set of null hypothesis that have been reported above considering solely the impact of  $\Delta$ Interoffice are assumed to hold for coefficients  $\gamma$  and  $\delta$  as well.

## **VII. Empirical Findings.**

Table 9 below depicts the initial set of panel regressions. In accordance with the previous section of empirical specification column 1, 2 and 3 corresponds to equation 1, 2 and 3 respectively, while the exact specification for columns 4 and 5 are presented in the Appendix. First of all,  $R^2$  levels across the five columns are almost equal to the levels of  $R^2$  that Bruno and Shin (2013) report (11% on average). That is a first indication that the applied methodology is in accordance with their study. Moving to coefficients interpretation, the impact of  $\Delta$ Interoffice before the 3<sup>rd</sup> quarter of 2010 on capital flows for all countries, apart from Brazil, is captured by the coefficient  $\beta_1$  in Table 9. At the same time,  $\beta_2$  depicts how the specific impact for the rest of the countries alerts after October 2010.

On the subject of global factors sensitivity, Column 1 provides the benchmark regression with highly significant and predicted sign coefficients, which is a second strong indication that the specific paper is in line with Bruno and Shin (2013). Specifically,  $\beta_1$  ( $\Delta$ Interoffice coefficient) is positive while the coefficients  $\gamma_1$  and  $\delta_1$

of VIX in levels and log difference are both negative and point out that the actions of international banks (mostly in Europe) are linked with the capital inflows into the selection of countries. Given the reasoning mentioned before, variations in the VIX and  $\Delta$ VIX are related with changes in the leverage of global banks and so the capital movements throughout the banking sector. However, in contrast with the paper of Bruno and Shin (2013) all the control variables (apart from  $\Delta$  Debt to GDP) are statistically insignificant.

The augmented estimation included the two dummy variables and their interactions with  $\Delta$ Interoffice are reported in columns 2 and 3 of Table 9. Aiming to identify the specific effect for Brazil using the interaction terms our analysis is focused on the coefficients  $\beta_3$  and  $\beta_4$ . What is clear from the comparison between those two coefficients is that Brazil both before and after the introduction of the measures is not sensitive to global factors (instead of positive, coefficients are negative) However, the results considering those coefficients are statistically insignificant (see Table 9, column 3). A fact that prevents, the process of deriving conclusions on the topic of macroprudential policy effectiveness related to capital flows into Brazil. However, comparing with the rest of the sample, coefficient  $\beta_2$  in column 3 is statistical significant and positive, indicating that the effect of  $\Delta$ Interoffice is stronger after the third quarter of 2010. Finally, even though the coefficients in the narrowed analysis are insignificant, it is observable that there is no swift in the coefficients before and after the implementation of the macroprudential measures (negative in both cases).

Once again, the regressions outcome presented in columns 4 and 5 included the interactions with VIX and  $\Delta$ VIX and the (2010/Brazil) dummies are statistically insignificant. The negative coefficients ( $\gamma_1$  and  $\delta_1$ ) indicate bigger sensitivity on capital flows since VIX index and leverage are reversely correlated. According to the regressions output (column 5) this statement holds for the whole sample but not specifically for the case of Brazil. Despite the statistical insignificance, in economic terms, the two positive signs ( $\gamma_4$  and  $\delta_4$ ) in column 5 reflect larger inflows related to VIX and  $\Delta$ VIX fluctuations.

Next, a number of F-tests (Wald-coefficient tests) have been conducted in the context of the overall impact across time and for different time period. Table 10 below, presents the p-values on each null hypothesis according to the global factors reported in columns of Table 9. What is straightforward from Table 10 is that the null hypothesis (apart from the 3<sup>rd</sup>) reported in the previous section, are rejected even at 10% level of significance. Meaning that, the specific analysis implemented on the case of Brazil, that the particular paper seeks to identify, is incapable to derive conclusions regarding the sensitivity of Brazil to global banking activities (i.e. swifts in  $\Delta$ Interoffice fail to explain the dependent variable of the model). Concerning the fourth null hypothesis, ( $\beta_1+\beta_2+\beta_3+\beta_4$ ) which corresponds to the statement that activities of global banks no longer influence the capital flows to Brazil, the reported p-value suggest that is not statistical significant. Identical hypothesis and the respectively tests for VIX and  $\Delta$ VIX ( $\gamma$  and  $\delta$  coefficients) have been conducted and are reported in Table 10. Each reported p-value corresponds to the respectively column specification of Table 9. Again changes in VIX index and the log difference in VIX cannot interpret the Brazilian inflows according to the specific model. Lastly, as Table 10 illustrates, the only p-values that are statistically significant correspond to null hypothesis regarding the whole sample ( $\beta_1+\beta_2$ ), ( $\gamma_1+\gamma_2$ ) and ( $\delta_1+\delta_2$ ).

**Table 9: Panel regressions.**

Coeff.	Variable	1	2	3	4	5
$\beta_1$	$\Delta$ Interoffice	0.000613*** [0.000204]	0.000644*** [0.000207]	-7.21E-06 [0.000270]	0.000613*** [0.000205]	0.000216 [0.000211]
$\beta_2$	$\Delta$ Interoffice*Post 2010			0.001640*** [0.000439]		
$\beta_3$	$\Delta$ Interoffice*Brazil		-0.001378 [0.001373]	-0.001078 [0.001769]		
$\beta_4$	$\Delta$ Interoffice*Post2010*Brazil			-0.000719 [0.002894]		
$\gamma_1$	VIX	-0.047347*** [0.006062]	0.001373*** [0.006062]	-0.043429*** [0.006140]	-0.047299*** [0.006119]	-0.047455*** [0.006067]
$\gamma_2$	VIX*Post2010					-0.012767*** [0.001796]
$\gamma_3$	VIX*Brazil				-0.002135 [0.041896]	-0.006044 [0.041725]
$\gamma_4$	VIX*Post2010*Brazil					0.024339 [0.013879]
$\delta_1$	$\Delta$ VIX	-0.040680*** [0.008589]	-0.040674*** [0.008589]	-0.037698*** [0.008608]	-0.040948*** [0.008674]	-0.044659*** [0.009607]
$\delta_2$	$\Delta$ VIX*Post2010					-0.002991 [0.020114]
$\delta_3$	$\Delta$ VIX*Brazil				0.014298 [0.063217]	0.012892 [0.070443]
$\delta_4$	$\Delta$ VIX*Post2010*Brazil					0.040473 [0.142921]
	$\Delta$ RER	0.075222 [0.054330]	0.073327 [0.054363]	0.069761 [0.054300]	0.074816 [0.054689]	0.073237 [0.054274]
	$\Delta$ Money Stock	0.125713 [0.117142]	0.125667 [0.117142]	0.168621 [0.117454]	0.125436 [0.117201]	0.155539 [0.116539]
	GDP growth	3.37E-05 [2.50E-05]	3.37E-05 [2.50E-05]	3.29E-05 [2.50E-05]	3.37E-05 [2.50E-05]	3.48E-05 [2.48E-05]
	$\Delta$ Debt to GDP	-0.078140*** [0.010875]	-0.078126*** [0.010875]	-0.080038*** [0.010864]	-0.078183*** [0.010888]	-0.074008*** [0.010813]
	Constant	0.164811*** [0.018083]	0.164879*** [0.018083]	0.153820*** [0.018285]	0.164772*** [0.018094]	0.170412*** [0.017957]
	Number of Observations	3312	3312	3312	3312	3312
	R <sup>2</sup>	0.086816	0.087143	0.091671	0.086839	0.103625
	Number of countries	46	46	46	46	46
	Country fixed effects	Y	Y	Y	Y	Y

Note: The table presents panel regression for bank capital flows to 46 countries. The dependent variable is bank capital flows measured by the quarterly log difference of external loans. Explanatory variables include the growth in net interoffice assets, the VIX and the change in VIX and their interactions with two dummy variables as explained in the main text. Standard errors are reported in parenthesis. The date spans from 1996Q1-2013Q3. \*\*\*, \*\* and \* denote statistical of significance at the 1,5 and 10 percent levels, respectively.

In other words, there has been no change in the sensitivity of the sample countries to  $\Delta\text{Interoffice/VIX}$  and  $\Delta\text{VIX}$  prior and ahead of the third quarter 2010, which is line with the expected outcome<sup>38</sup>.

**Table 10: Wald tests for coefficient restrictions in Table 9.**

Null Hypothesis (p-values reported)	1	2	3	4	5
$\beta_2+\beta_4=0$			0.7477		
$\beta_3+\beta_4=0$			0.4230		
$\beta_1+\beta_2=0$			0.0000		
$\beta_1+\beta_3=0$		0.5889	0.5348		
$\beta_1+\beta_2+\beta_3+\beta_4=0$			0.9411		
$\gamma_2+\gamma_4=0$					0.4014
$\gamma_3+\gamma_4=0$					0.6685
$\gamma_1+\gamma_2=0$					0.0000
$\gamma_1+\gamma_3=0$				0.2340	0.1960
$\gamma_1+\gamma_2+\gamma_3+\gamma_4=0$					0.3222
$\delta_2+\delta_4=0$					0.7912
$\delta_3+\delta_4=0$					0.6755
$\delta_1+\delta_2=0$					0.0084
$\delta_1+\delta_3=0$				0.2937	0.6490
$\delta_1+\delta_2+\delta_3+\delta_4=0$					0.9639

Overall, the empirical part focusing on the global banking activities does not provide sufficient evidence for a shift in Brazil's sensitivity to the factors of interest. In other words, the above analysis cannot statistically explain a potential decrease in the channeling of global banking funds into Brazil. That is, macroprudential measures related to capital flows introduced in Brazil after the third quarter of 2010 cannot be interpreted based on the key independent variables that Bruno and Shin employed in the case of South Korea. Consequently, the supplementary method<sup>39</sup> of leverage measurement that has been accessed in the case of Brazil stands at low levels, potential due to the stricter accounting rules in comparison with global standards. The statistical insignificance of the outcome is not translated as "wrong". In spite, it documents a positive aspect of Brazilian economy (since there is no correlation between the dependent and the key explanatory variables which are associated with leverage activities), while supports the view that global environment is highly affected by deleveraging runs.

Furthermore and beyond the examination of the possible linkage between global banking activities and their interaction with capital inflows in Brazil, my analysis investigates the fluctuations in sensitivity to supplementary factors (controls) as possible determinants of capital mobility. In contrast with Bruno and Shin, the set of regressions output presented in Table 11 (apart from  $\Delta\text{Debt}$  to GDP) are statistically

<sup>38</sup> The specific date has been selected according to the Brazilian conditions and is not associated with global scale occasions.

<sup>39</sup> The traditional method of leverage measurement is given by the ratio between total assets over equity.

insignificant (see, in Table 11 coefficient 1 at columns 1/2/3 and 4). Interestingly, when the same control variables are implemented without being lagged by one quarter they turn to be highly significant and with the predicted signs (as holds for  $\Delta$ Debt to GDP).

Although, when the specific variables are lagged the outcome turns to be statistically insignificant. Normally,  $\Delta$ RER was expected to capture the shifts in the dependent variable since potential appreciation of the Real against the dollar from quarter t to quarter t+1, induces increase in the level of capital flows into the country from quarter t+1 to quarter t+2. The specific aspect is generally true under the framework of local banks borrowers facing a currency mismatch which in turn increases the capacity of local banks to lend (for a thorough analysis see Shin 2012). The particular mechanism is the reasoning behind the amplified capital inflows but is not confirmed by the empirical findings that column 1 of Table 11 reports.

The next two control variables that are applied in the model, but again do not correspond to statistically significant results are firstly the quarterly growth in global money stock and secondly the growth in countries' GDP. Table 11 in the next page presents the analysis related to capital flows with respect to RER, an approximation of global money stock, GDP growth and finally the growth in Debt to GDP following exactly the same structure as in Table 9 before. Analogously, one triple and two double interaction terms have been generated using the same dummy variables that have been analyzed earlier for each local factor (see model specification in Appendix). Once more, only the coefficients that correspond to the whole sample of countries turn to be significant, leaving no option of interpretation and further discussion in the case of Brazil solely.

In addition, Table 12 provides the corresponding<sup>40</sup> p-values of similar F-tests with respect to each of the four control variables. For instance, (3) + (4) null hypothesis represents the existence of difference between Brazil and the rest of the countries after October 2010.

**Table 12: Wald test for coefficient restrictions in Table 11.**

	Variable/Column			
	1	2	3	4
Null Hypothesis	$\Delta$ RER	$\Delta$ Money stock	GDP growth	$\Delta$ Debt to GDP
(2)+(4)=0	0.6680	0.4105	0.4255	0.8334
(3)+(4)=0	0.7320	0.7922	0.4280	0.8577
(1)+(2)=0	0.3373	0.0000	0.1254	0.0000
(1)+(3)=0	0.5565	0.9633	0.8549	0.5485
(1)+(2)+(3)+(4)=0	0.6038	0.5070	0.4277	0.7528

The specific null is not rejected for all the control variables, suggesting the linkage between capital flows and those controls is different for Brazil relative to the rest 45 countries. Taking everything under consideration, the above empirical study included dummy interactions, firstly with key and secondly with control variables, accompanied by a complete set of F-tests do not succeed to specify whether Brazil's macroprudential measures manage to curb capital flows related to the banking sector.

<sup>40</sup> Where columns (1),(2),(3) and (4) correspond to the coefficients listed in Table 10 for each of the four variables  $\Delta$ RER,  $\Delta$  Money Stock, GDP growth and  $\Delta$ Debt to GDP growth.

**Table 11: Panel regressions with interaction dummies for local variables.**

	Coeff.	1	2	3	4
	Δ Interoffice	0.000602*** [0.000205]	0.000120 [0.000219]	0.000622*** [0.000205]	0.000567*** [0.000205]
	VIX	-0.047184*** [0.006070]	-0.046570*** [0.006027]	-0.047574*** [0.006060]	-0.048765*** [0.006080]
	ΔVIX	-0.041241*** [0.008628]	-0.041076*** [0.008544]	-0.040608*** [0.008593]	-0.042570*** [0.008597]
1	ΔRER	0.061304 [0.058621]	0.075001 [0.054474]	0.077108 [0.054350]	0.080075 [0.054432]
2	ΔRER* Post 2010	0.158420 [0.236253]			
3	ΔRER* Brazil	0.048164 [0.194923]			
4	ΔRER*Post 2010*Brazil	0.397168 [1315064]			
1	Δ Money stock	0.123781 [0.117303]	0.256435 [0.118799]	0.125964 [0.117103]	0.131987 [0.117024]
2	Δ Money stock* Post 2010		-1.829.645*** [0.299063]		
3	Δ Money stock*Brazil		-0.310237 [1.174982]		
4	Δ Money stock*Post 2010*Brazil		0.755145 [1.276155]		
1	GDP growth	3.37E-05 [2.50E-05]	3.47E-05 [2.49E-05]	6.26E-05** [2.78E-05]	3.50E-05 [2.50E-05]
2	GDP growth* Post 2010			-0.000150** [6.36E-05]	
3	GDP growth* Brazil			0.000827 [0.004865]	
4	GDP growth * Post 2010 * Brazil			-0.124789 [0.156766]	
1	Δ Debt to GDP	-0.078801*** [0.010923]	-0.075935*** [0.010820]	-0.077991*** [0.010869]	-0.068994*** [0.011177]
2	Δ Debt to GDP* Post 2010				-0.150944*** [0.043846]
3	Δ Debt to GDP* Brazil				-0.096141 [0.275016]
4	Δ Debt to GDP* Post 2010* Brazil				-0.194866 [1.644753]
	Constant	0.164375*** [0.018105]	0.164815*** [0.017975]	0.165427*** [0.018075]	0.169828*** [0.018152]
	Number of observations	3312	3312	3312	3312
	R2	0.087043	0.098904	0.088831	0.090708
	Number of countries	46	46	46	46
	Country fixed effects	Y	Y	Y	Y

Note: The table depicts a summary of panel regressions for bank capital flows to 46 countries. The dependent variable is bank capital flows measured by the quarterly log difference of external loans. Explanatory variables include the local “demand pull” factors, money stock growth and interactions with two dummy variables. Standard errors are reported in parentheses. The date spans from 1996Q1-2013Q3.\*\*\*,\*\* and \* denote statistical significance at the 1,5 and 10 percent levels, respectively.

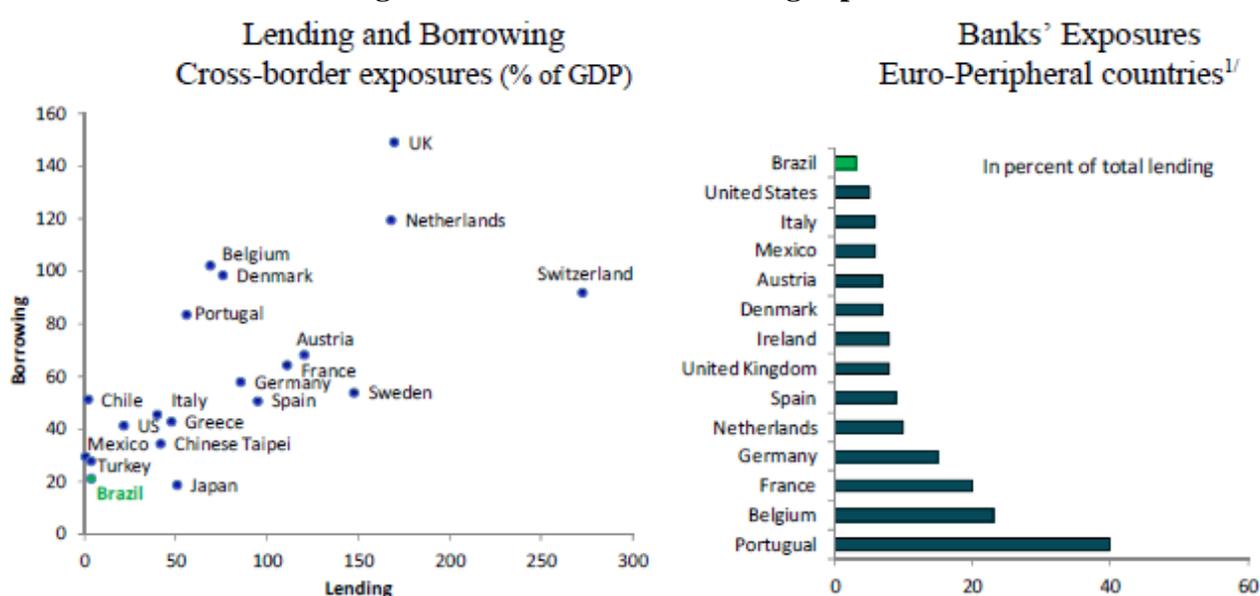
The next section seeks to identify potential reasons explaining why the particular approximation did not managed to provide statistically significant results and discusses further the overall case of Brazil.

## VIII. Further Discussion on the case of Brazil.

### A. Indications related to empirical findings:

Even though the Brazilian economy has been exposed to global banking interaction channels as this has been explained in detail in the earlier sections of the paper, the exact size of Brazil’s interconnectedness, in comparison with other countries, could be a strong indication why the empirical analysis did not explain Brazilian banking capital flows. In particular a study by IMF argues that cross-border financial interconnectedness and the associated risk are limited by the moderate share of foreign banks in the financial system and low foreign exposures (IMF, 2013)<sup>41</sup>. Therefore, in accordance with BIS statistical report on banks, the dependent variable that has been employed, “cross-border claims of Brazilian banks”, reflects no more than the 5% of GDP. As the right panel in figure 13 illustrates, the Brazilian cross-border banking exposure (on other countries) in September 2011 was lower than 4% in comparison with the European-periphery countries. Moreover, cross-border claims correspond to 8.6% of Brazilian banks’ overall lending.

**Figure 13: Cross-border banking exposure.**



Source: IMF country’s report (2013).

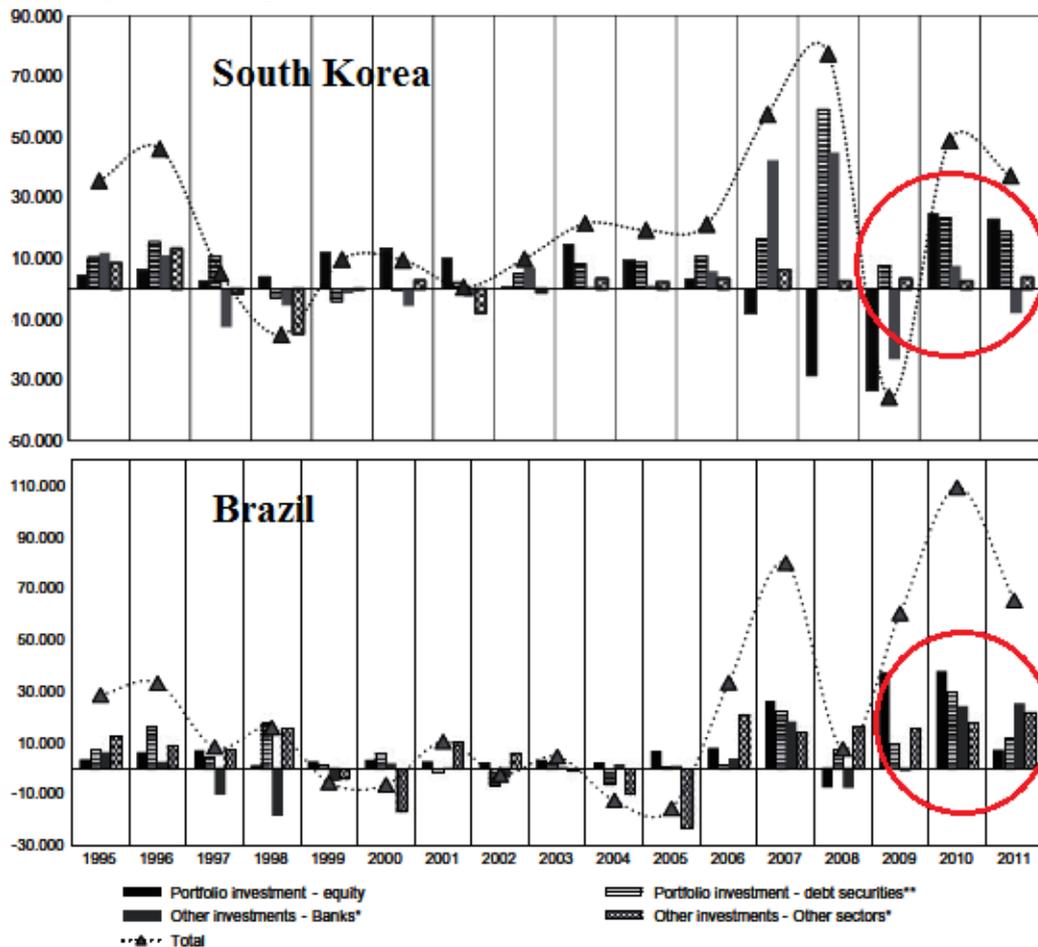
Given that the key explanatory variables were closely related to leverage actions and in accordance with the above rationale, it seems relatively normal why they fail to explain the dependent variable of the model. Overall, the Brazilian economy could be characterized as self-secured during the specific dates, since the financial system is mainly funded by domestic deposits and repos. Thus, in comparison with other

<sup>41</sup> Brazil: A Technical Note on Macprudential Policy Framework. IMF Staff Country Reports Number 13/148.

countries, financial institutions' exposure to cross-border capital flows and foreign currency liabilities (9%) was fairly low (see, left panel of figure 13). The combination of (i) small share of foreign banks presence, (ii) relatively low dependence on external funds and (iii) limited foreign exposures reveals a financial system that is not correlated with the global factors that has been examined in the previous stage.

Next, on the subject of capital flows, it is worth to mention and compare for a second time, Figure 8 which was presented in section IV. The reason is to investigate and pay special attention on the composition of capital flows and their variation after 2010. Figure 14 below, reveals the difference between the two countries related to the third bar (grey color) which represents banking flows. In the top graph (Korea), it can be observed that the specific variable shifts negatively at the beginning of 2011 as a consequence of Korea's Map policy. Whereas, in the bottom graph the same bar (grey color) for the case of Brazil remains relatively stable and unaffected throughout the specific period even though the total capital flows sharply decrease. That is a second strong indication that could merely enlighten the empirical findings in the previous section.

**Figure 14: Capital Flows in South Korea and Brazil (in million US\$)**

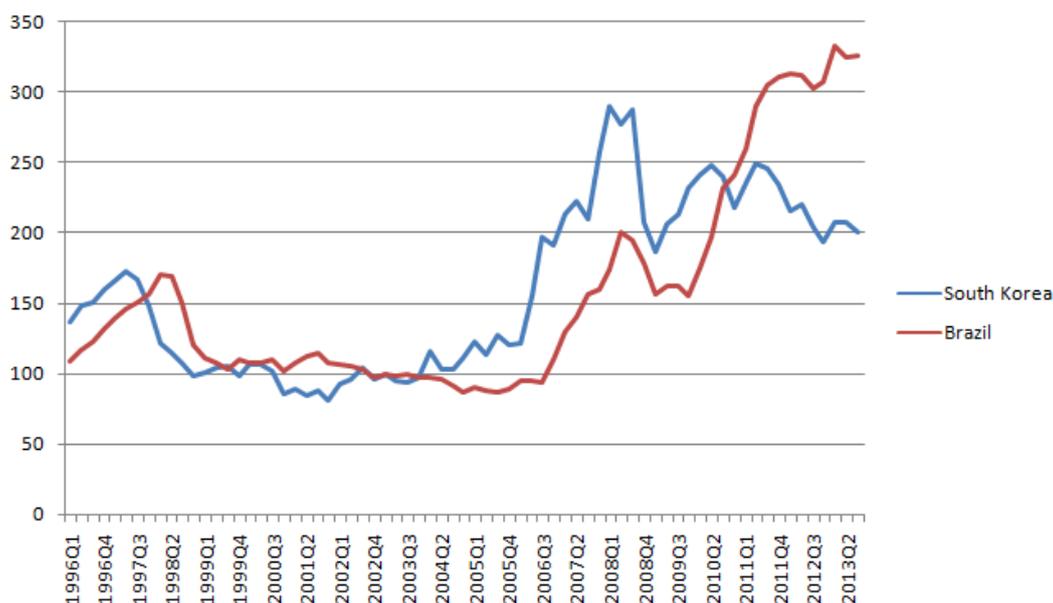


Source: Fritz and Prates (2014), modified by the author.

Finally, since the initial comparison and replication of the paper was conducted aligned with the case of South Korea, Figure 15 below plots the dependent variable which has been applied to both countries. The specific assessment aims to identify the existence of a common trend or not, related to the same proxy for capital flows. The

two series are normalized to 100 in the first quarter of 2003. In line with section III of the paper, what is clear for both countries is the harmonized increase in cross-borders lending before 2008 and the sudden drop afterwards. While, what is mostly apparent from the comparison of the two series is the change of directions that took place exactly in the period of interest. In one case, macroprudential tools introduced by the Korean authorities in June 2010 seem to affect (reduce) the foreign claims of Korea (this capital inflows), while in the second case Brazilian claims remain unchanged and continue to rise in a steady pose. Effectively, relating to the case of Brazil this could be an additional suggestion regarding the implications of the empirical part when the interactions were included. Since all the potential aspects and features related to the empirical investigation have been reported, the following subsection presents a couple of suggestions (Map measures) that could be applied in the Brazilian economy.

**Figure 15: BIS Bank capital flows in Brazil and South Korea.**



Source: BIS (Table 7A) – Locational Banking Statistics.

## **B: Towards a continuous macroprudential framework:**

In line with the existing literature<sup>42</sup> broadly related to macroprudential measures and in accordance with the case of Brazil, the following sub-section points out potential macroprudential instruments and summarizes the next steps of Map policy in Brazil. Before analyzing those measures, it should be noted that the existing tools which have been analyzed in the particular paper, have been modified across time analogously to the occasion that required. Therefore, alerting our attention apart from the framework of capital flows and returning back to the analysis of the whole domestic economy, Brazil has overly reduced the impact of various macroprudential measures. For example, along with government measures to stimulate the domestic economy, by the end of 2011, the Central bank of Brazil allowed the expansion of consumer loans (reported in Table 5). The Risk Weight Factor has been reduced from 150% back to the earlier value of 75%, employed on capital requirement calculation on all collateralized car loans with maturities below sixty months, regardless of loan

<sup>42</sup> And more precisely studies of: Galati and Moessner (2012), IMF (2013) Brazil: A technical note on macroprudential framework and Holland (2013).

to value ratio (Silva and Harris, 2012). Next, by the same period, the Tax on Financial Transactions (IOF) for individual loans has also been reduced from 0.0082% previously to the initial rate of 0.0068% and later (May-2012) even lower at 0.0041% per day.

Aside from those adjustments, there is always space in Map toolkit for developments related to systemic risk monitoring. Firstly, replicating existing and fairly efficient measures from other countries experience, limits on loan to values (LTV) and debt to income ratios (DTI) might enhance the framework against systemic risk expansion<sup>43</sup>. The specific set of Macroprudential measures, should be targeted against the mortgage loans expansion and appreciation of housing prices that took place after 2010. Furthermore, the combination of LTV and DTI is complementary since those instruments address both the wealth and income aspect, respectively. However, a hypothetical implementation of those tools, lurks high observance cost (collection of transactions based data) and complex calibration. Secondly, in accordance with Basel III directions, the introduction of countercyclical capital buffers may function as an absorb factor of future financial imbalances. The usage of credit to GDP gap is suggested by the Basel Community on Banking Supervision as a conditional variable that governs the required level of capital buffers. In fact, this measure may work as a cushion since it automatically stabilizes financial exposures and imbalances.

Finally, approaching the concluding section of this study, the current and future steps of Brazilian economy related to macroprudential issues are summarized in the following lines. Objectives such as, stabilization of capital flows, restraint of credit booms, prevention of asset price bubbles and management of foreign exchange volatility, constantly continue to alarm the prudence of local authorities. Calibration, on a precautionary basis, of the existing Map toolkit is on top priority actions in policymakers' agenda. Deeper understanding of the interactions between the financial system and the real economy could be accomplished throughout the development of targeted macroprudential tools. In parallel, the prevention of distortions and the subsequent side-effects could maintain the sound and secure domestic economy.

Given the magnitude of the crisis, as has explicitly analyzed in earlier sections of the paper, Brazil's reaction in terms of macroprudential policy proved more than adequate. Complacency is not an option, since additional challenges on the subject of interconnectedness between the real economy and the financial system are debouching constantly. In the future, under a consistent macroprudential outlook, the foremost tasks are primarily to enlarge the supervisory scale (including non-banking financial institutions) and to enhance stress tests on vulnerable banks. Besides, closer communication between different domestic<sup>44</sup> and international supervisory agencies should be geared towards clarity, transparency and predictability, in order to enhance the effectiveness of macroprudential policy (Born et.al 2012). In that spirit, the Central Bank should continue to execute its macroprudential supervisory role ensuring currency stability and overall soundness of domestic economy.

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<sup>43</sup> International experience suggests that credit crunches related to housing price busts have been followed by the most destructive recessions.

<sup>44</sup> In appendix Table 4A illustrates the exact interactions between various supervisory institutions of Brazilian economy.

## **IX. Conclusions.**

What the recent financial crisis has made clear, is that as the global financial system evolves in a more sophisticated and complex direction, the necessity for additional regulation is mandatory. The existing microprudential structure proved inadequate to handle the magnitude of the crisis. Macroprudential policy is the new approach, that the global community has directed its attention, intending to fill the gap of an overall prudential framework targeted on the financial system as a whole. In this paper, I have explicitly reported all the recent developments in terms of macroprudential policy. In parallel, a detailed analysis on the driving forces governing the global banking system has been performed and it has been carefully linked with the empirical investigation that followed. Based on an existing methodology that have been applied in the case of Korea by Bruno and Shin (2013), the initial aim of the paper was to investigate the Brazilian macroprudential framework in terms of capital flows. The transmission of global liquidity towards the domestic economy, and the constraint of the associated capital inflows was the main concern of the Brazilian authorities.

In that context, aiming to identify the performance of Brazil's macroprudential instruments, a panel study has been conducted, where Brazil is the country of interest among a sample of 46 countries. Even though, my analysis managed to replicate the exact methodology by Bruno and Shin (2013), the empirical outcome turns to be statistical insignificant for the case of Brazil. Precisely, the coefficients of the interaction terms which have been designed to capture potential shift in Brazilian capital inflows were statistically insignificant. Consequently, the explanatory variables that succeeded to explain the decrease in Korea's capital inflows after the introduction of the measures are not associated with banking capital flows of Brazil.

Potential reasons, explaining the specific outcome could be the combination of (i) small share of foreign banks presence, (ii) relatively low dependence on external funds and (iii) limited foreign exposures. Besides, the composition of capital flows between the two countries seemed to have affected the output of the empirical investigation. Eventually and in accordance with the major question that my study meant to answer, the empirical outcome suggests that in comparison with the rest of the countries in the sample, Brazilian vulnerability to global banking factors is statistical insignificant both prior and after the introduction of the measures. However, considering the whole sample, empirical findings indicate that global banking factors affected the volatility of capital inflows. In line with Bruno and Shin (2013), the specific evidence supports the view that banking sector capital flows determine fluctuations in the global financial system.

Summarizing, most empirical studies on the topic of Map policy found that when an instrument or a combination of instruments was implemented according to the required situation, it managed to reduce systemic risk quite effectively. At the end of 2010, under a relatively strong regulation and supervision of the financial system, Brazilian authorities relied on a broad textbook framework to cope with the rising risks of macroeconomic and financial disorder. In that context, beyond the purely empirical investigation, my study analyzed under a theoretical perspective the broad effectiveness of Macroprudential policy, implemented in various frictions of the

domestic economy. Thus, given that macroprudential policy seeks to restrain systemic risk, the paper identifies and documents potential indicators of systemic risk concluding that, Brazilian authorities managed to overcome the severe turmoil of the global financial crisis in a quite sufficient way.

Further research on the subject of macroprudential policy, questioning the effectiveness of its implementation in other advanced, emerging or developing countries, needs to be conducted. In particular, special interest presents the assessment of Map policy in emerging countries such as China, Russia or Turkey. In that spirit, the particular study on the case of Brazil might be a useful contribution on future investigations concerning the effectiveness of macroprudential policy. Finally, the current context of the global economy has triggered a new thinking among regulators and policymakers not in terms of what actions should be taken after the next episodes of financial distress, but mainly what actions should be taken in advance in order to prevent these and the accompanied negative impact on the side of the real economy.

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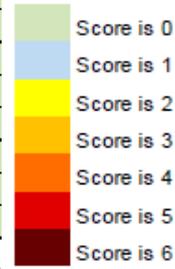
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Caps on loan-to-value ratios  
 Caps on debt/loan-to-income ratios  
 Caps on foreign currency lending  
 Ceiling on credit or credit growth  
 Limits on net open currency positions/ currency mismatch  
 Limits on maturity mismatch  
 Reserve requirements  
 Countercyclical capital requirement  
 Time-varying/ dynamic provisioning  
 Restrictions on profit distribution

# Appendix

**Table 1A**

Note: 0 represents no use of instruments, and 1 denotes the use of a single instrument. For each of the following attributes, i.e., multiple, targeted, time-varying, discretionary and used in coordination with other policies, the value of 1 is added.



**Western Hemisphere**

Argentina										
Brazil										
Canada										
Chile										
Colombia										
Mexico										
Peru										
US										
Uruguay										

**Asia Pacific**

Australia										
China										
Hong Kong										
India										
Indonesia										
Japan										
Korea										
Malaysia										
Mongolia										
New Zealand										
Philippines										
Singapore										
Thailand										

**Europe**

Austria										
Belgium										
Bulgaria										
Czech Republic										
Croatia										
Finland										
France										
Germany										
Hungary										
Ireland										
Italy										
Netherlands										
Norway										
Poland										
Portugal										
Romania										
Russia										
Serbia										
Slovakia										
Spain										
Sweden										
Switzerland										
Turkey										
UK										

**Africa**

Nigeria										
South Africa										

**Middle East & Central Asia**

Lebanon										
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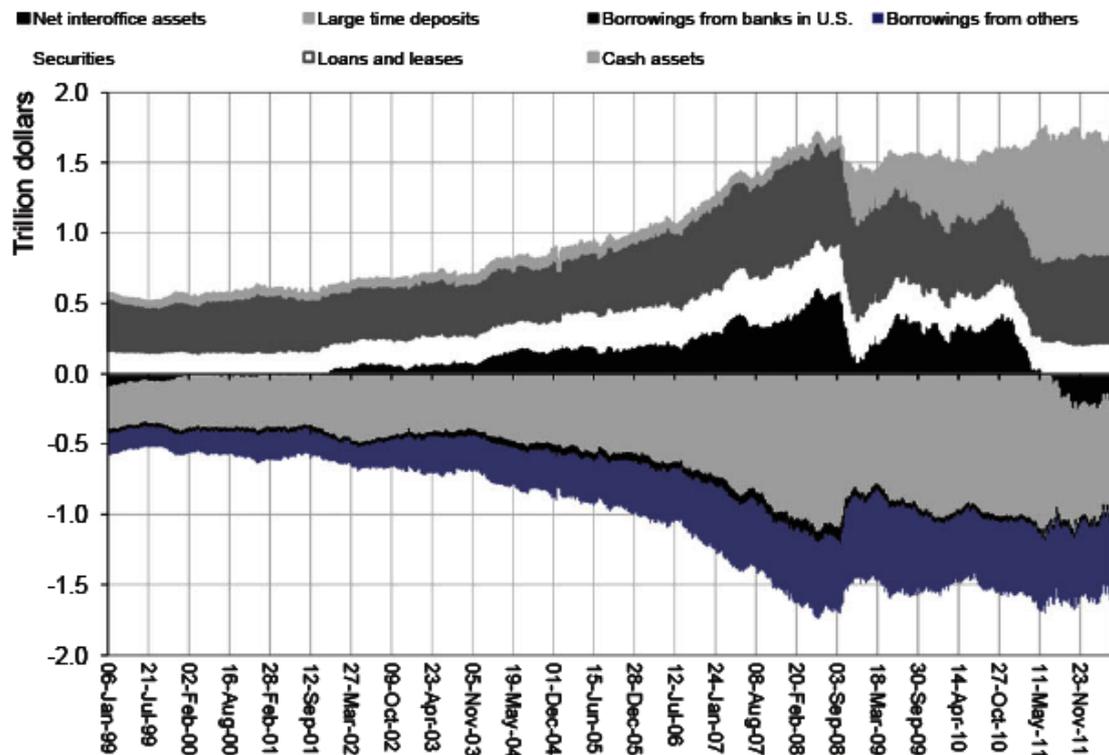
Total number of countries using instruments	20	13	9	7	19	13	19	11	14	7
Percent of the sample	41%	27%	18%	14%	39%	27%	39%	22%	29%	14%

**Table 2A: Distinction between macroprudential and microprudential policy.**

	<b>Macroprudential</b>	<b>Microprudential</b>
Proximate objective	limit financial system-wide distress	limit distress of individual institutions
Ultimate objective	avoid output (GDP) costs	consumer (investor/depositor) protection
Model of risk	(in part) endogenous	exogenous
Correlations and common exposures across institutions	important	irrelevant
Calibration of prudential controls	in terms of system-wide distress; top-down	in terms of risks of individual institutions; bottom-up

Source: BIS Working Paper No 128.

**Figure 1A: Assets and liabilities of the branches and subsidiaries of foreign banks in the US on their parent.**



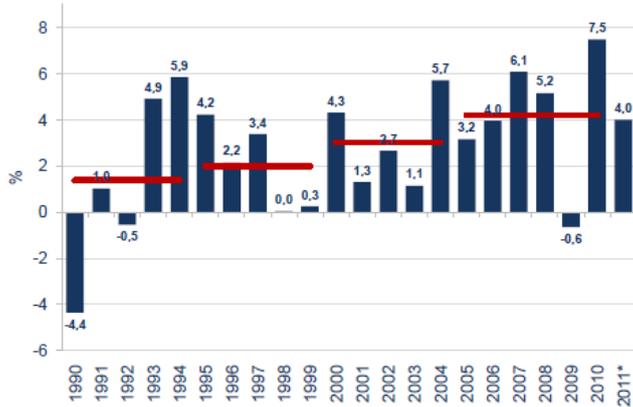
Source: Bruno and Shin (2013)

**Table 3A**

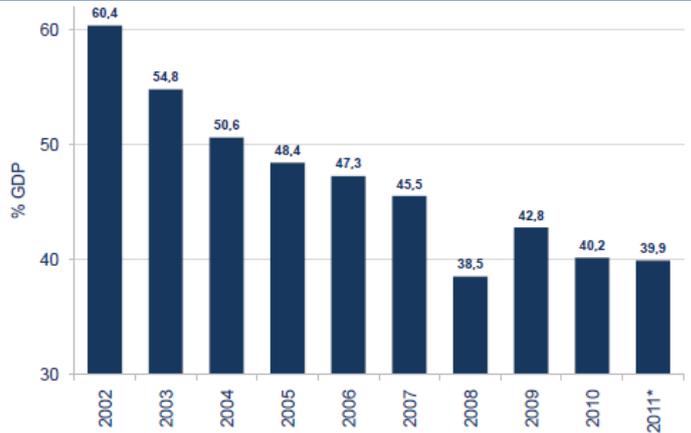
**Brazilian Macroeconomic Indicators.**

Source: Central Bank of Brazil, Mendes (2011)

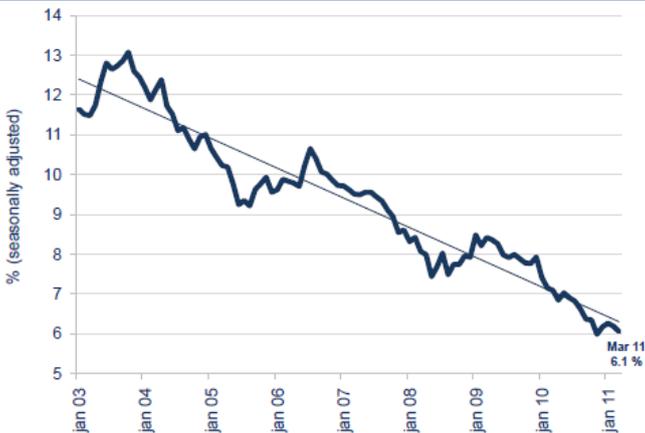
**GDP Growth**



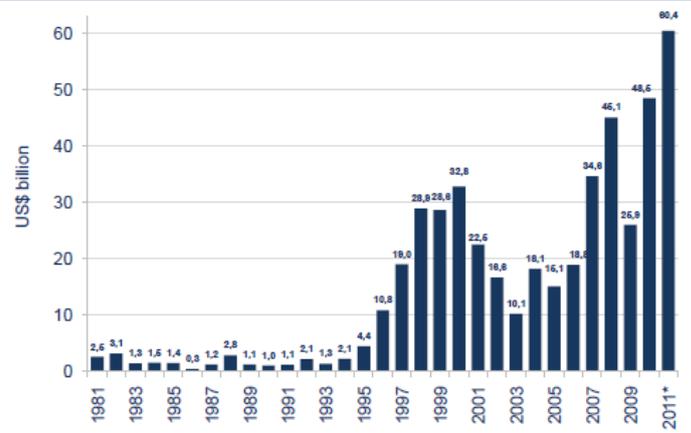
**Net Public Debt**



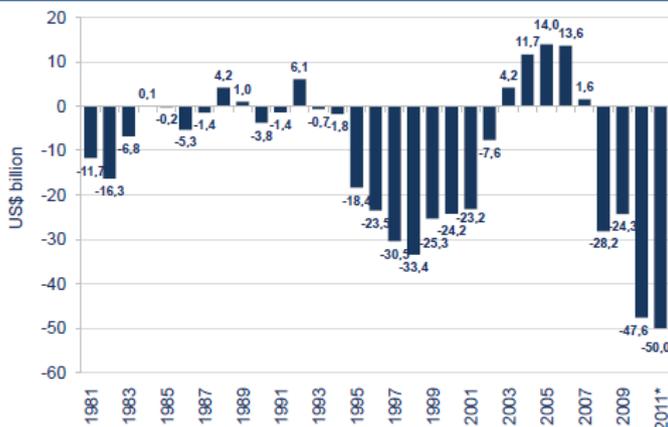
**Unemployment Rate**



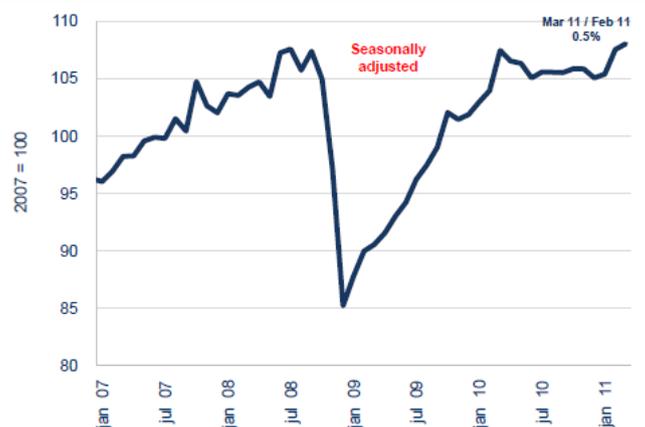
**Foreign Direct Investment**



**Current Account**



**Industrial Production**



### **Model Specification:**

Equations (4) and (5) below correspond to columns 4 and 5 of Table 9, while equations (6), (7), (8) and (9) correspond to columns 1,2,3 and 4 of Table 11, respectively.

#### Equation (4)

$$\Delta L_{c,t} = \alpha + \beta_1 \Delta \text{Interoffice}_{t-1} + \gamma_1 \text{VIX}_{t-1} + \gamma_3 \text{VIX}_{t-1} * \text{Brazil} + \delta_1 \Delta \text{VIX}_t + \delta_3 \Delta \text{VIX}_{t-1} * \text{Brazil} + \text{controls} + e_{c,t}$$

#### Equation (5)

$$\Delta L_{c,t} = \alpha + \beta_1 \Delta \text{Interoffice}_{t-1} + \gamma_1 \text{VIX}_{t-1} + \gamma_2 \text{VIX}_{t-1} * \text{Post2010} + \gamma_3 \text{VIX}_{t-1} * \text{Brazil} + \gamma_4 \text{VIX}_{t-1} * \text{Post2010} * \text{Brazil} + \delta_1 \Delta \text{VIX}_t + \delta_2 \Delta \text{VIX}_t * \Delta \text{Post2010} + \delta_3 \Delta \text{VIX}_t * \text{Brazil} + \delta_4 \Delta \text{VIX}_t * \text{Post2010} * \text{Brazil} + \text{controls} + e_{c,t}$$

#### Equation (6)

$$\Delta L_{c,t} = \alpha + \beta_1 \Delta \text{Interoffice}_{t-1} + \gamma_1 \text{VIX}_{t-1} + \delta_1 \Delta \text{VIX}_t + \text{RER}_{t-1} + \text{RER}_{t-1} * \text{Post2010} + \text{RER}_{t-1} * \text{Brazil} + \text{RER}_{t-1} * \text{Post2010} * \text{Brazil} + \text{controls} + e_{c,t}$$

#### Equation (7)

$$\Delta L_{c,t} = \alpha + \beta_1 \Delta \text{Interoffice}_{t-1} + \gamma_1 \text{VIX}_{t-1} + \delta_1 \Delta \text{VIX}_t + \text{RER}_{t-1} + \text{Money stock}_{t-1} + \text{Money stock}_{t-1} * \text{Post2010} + \text{Money stock}_{t-1} * \text{Brazil} + \text{Money stock}_{t-1} * \text{Post2010} * \text{Brazil} + \text{controls} + e_{c,t}$$

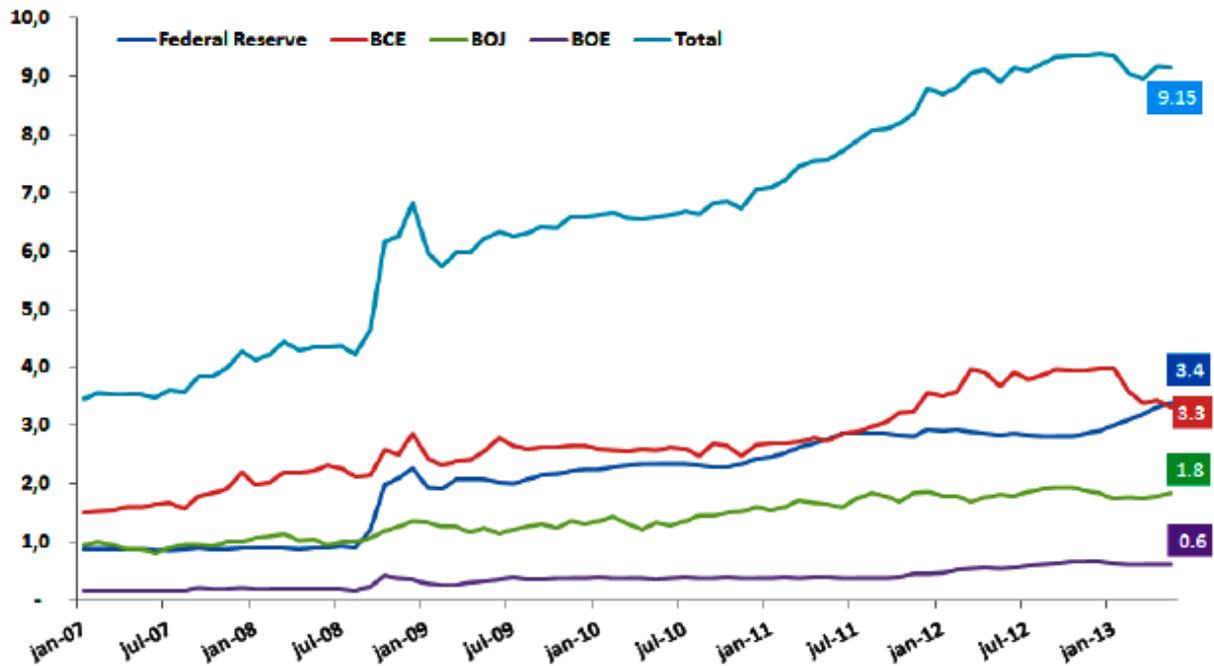
#### Equation (8)

$$\Delta L_{c,t} = \alpha + \beta_1 \Delta \text{Interoffice}_{t-1} + \gamma_1 \text{VIX}_{t-1} + \delta_1 \Delta \text{VIX}_t + \text{RER}_{t-1} + \text{Money stock}_{t-1} + \text{GDP}_{t-1} + \text{GDP}_{t-1} * \text{Post2010} + \text{GDP}_{t-1} * \text{Brazil} + \text{GDP}_{t-1} * \text{Post2010} * \text{Brazil} + \text{controls} + e_{c,t}$$

#### Equation (9)

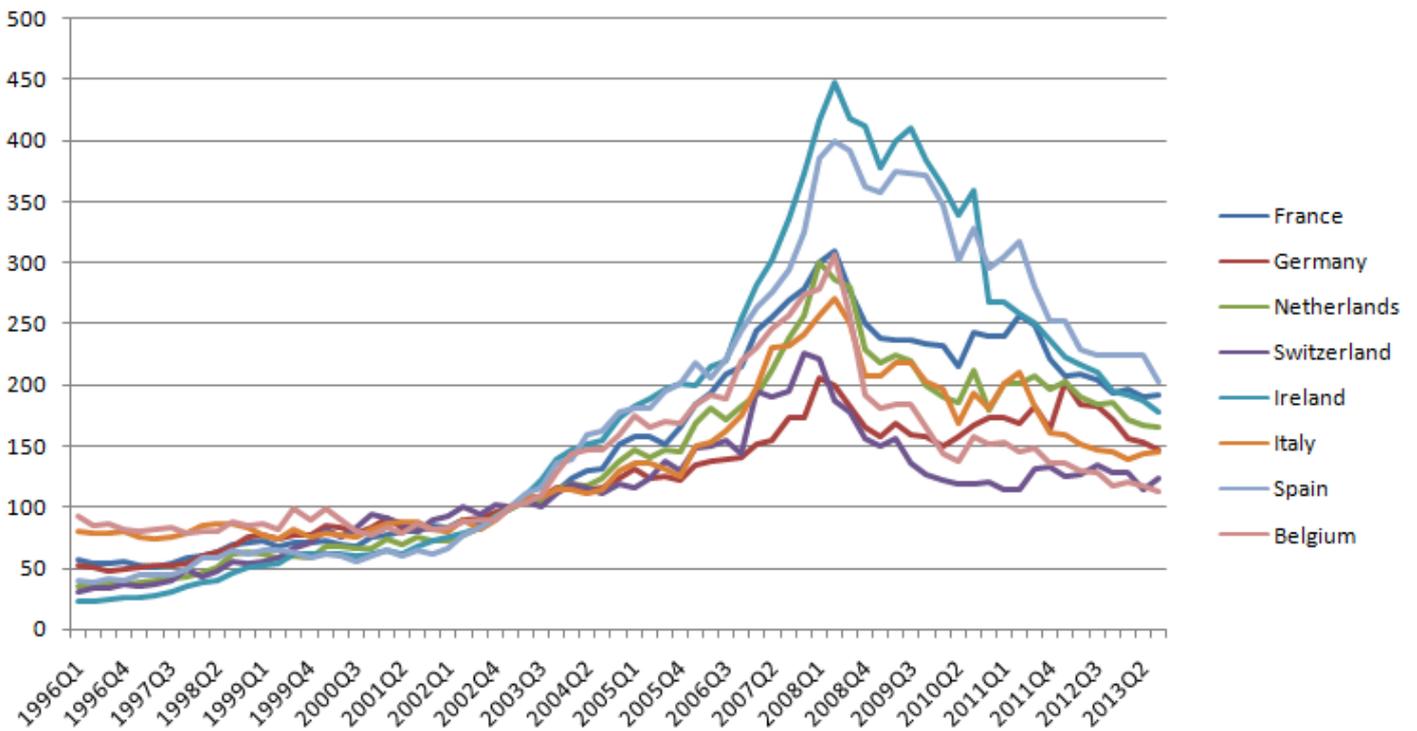
$$\Delta L_{c,t} = \alpha + \beta_1 \Delta \text{Interoffice}_{t-1} + \gamma_1 \text{VIX}_{t-1} + \delta_1 \Delta \text{VIX}_t + \text{RER}_{t-1} + \text{Money stock}_{t-1} + \text{GDP}_{t-1} + \text{Debt to GDP}_t + \text{Debt to GDP}_t * \text{Post2010} + \text{Debt to GDP}_t * \text{Brazil} + \text{Debt to GDP}_t * \text{Post2010} * \text{Brazil} + e_{c,t}$$

**Figure 2A: Global money stock from 2007 to 2014**



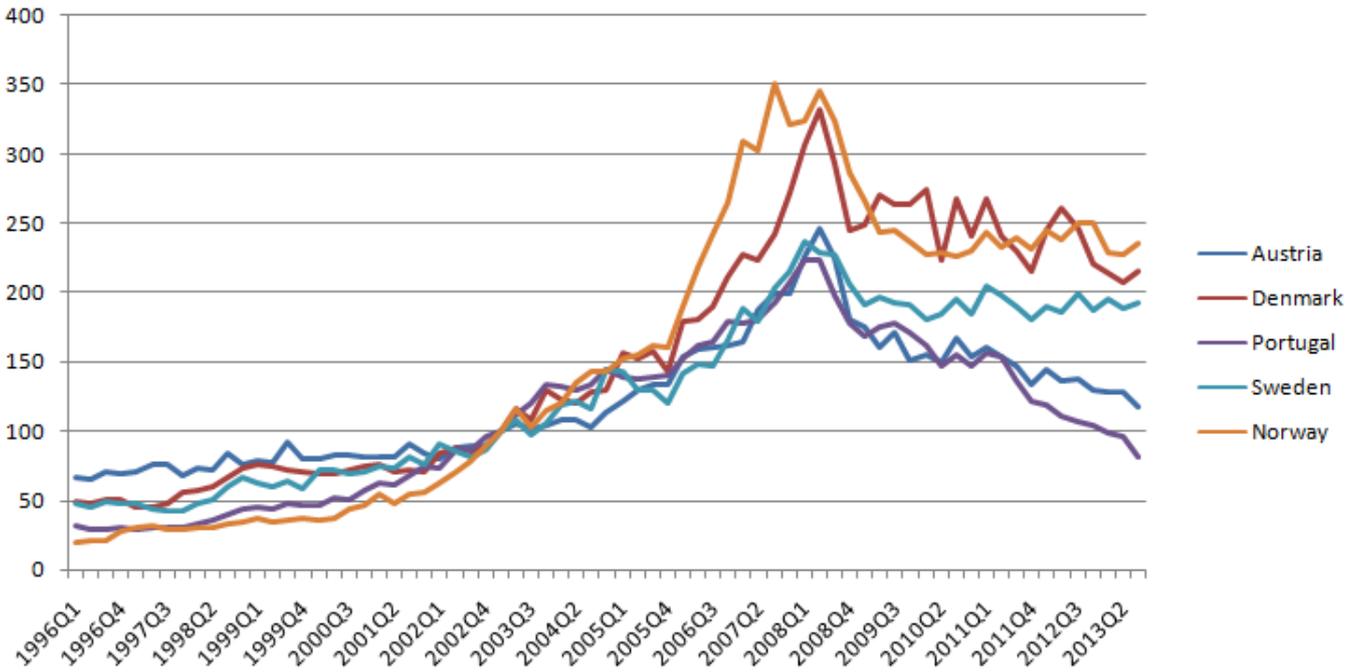
Source: IMF's IFS database

**Figure 3A: External claims (loans and deposits) of BIS reporting countries on borrowers in a selection of the "Big" European countries.**



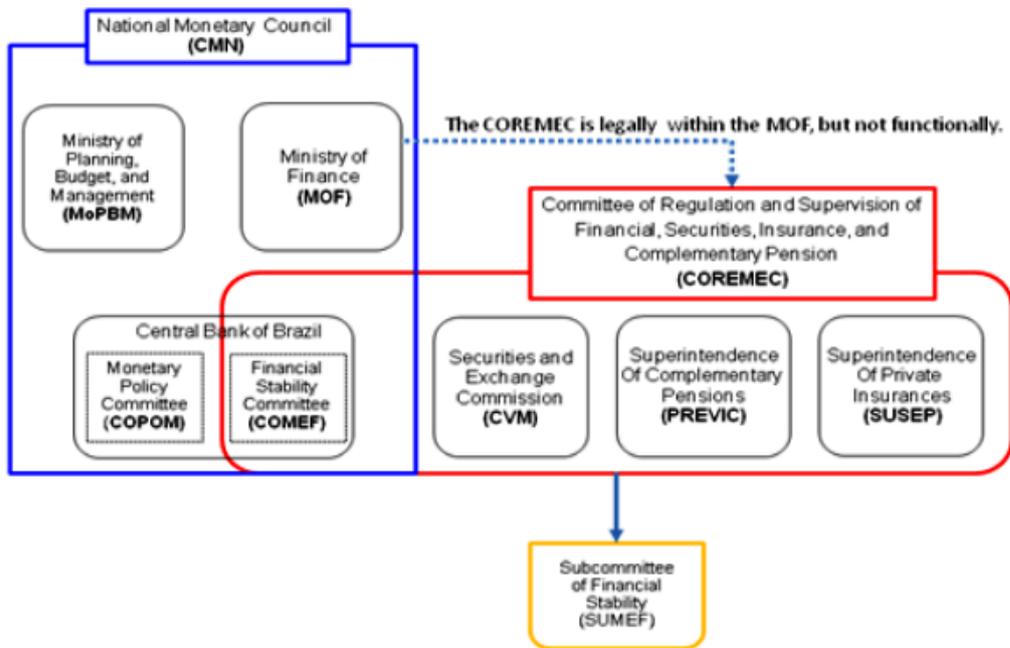
Note: The series have been normalized to 100, on the first quarter of 2003  
 Source: BIS (Table 7A) – Locational Banking Statistics.

**Figure 4A: External claims (loans and deposits) of BIS reporting countries on borrowers in a selection of the “Small” European countries.**



Note: The series have been normalized to 100, on the first quarter of 2003  
 Source: BIS (Table 7A) – Locational Banking Statistics

**Table 4A: Supervisory Institutional Architecture in Brazil.**



Source: IMF country's report (2013)