Currency crisis and external fragility: a Minskyan interpretation applied to the Brazilian economy between 1999 and 2013

Crises cambiais e fragilidade externa: uma interpretação minskyana aplicada à economia brasileira entre 1999 e 2013

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Abstract

This work has two goals. The first one is to develop an interpretation for open economies founded on Minsky's financial fragility hypothesis about the process of a currency crisis and its determinants. The deterioration of an economy's external financial structure is identified as the reason for the increase of its crisis susceptibility. With this approach, we create external fragility indexes intending to measure an economy's crisis susceptibility. Our second objective is to evaluate the Brazilian external fragility between 1999 and 2013 using the index and the interpretation previously developed. The results suggest that Brazilian's external fragility suffered a gradual and significant decrease and tends to follow stable trend in the coming years.

Keywords

Minsky; currency crisis; external fragility; Brazilian economy.

JEL Codes F31; F32; F34; F40.

Resumo

Este trabalho possui dois objetivos. O primeiro é desenvolver uma interpretação sobre o processo gerador de crises cambiais e seus determinantes, tendo como base a hipótese de fragilidade financeira de Minsky. A deterioração da estrutura financeira externa de uma economia é identificada como o fator responsável por elevar sua suscetibilidade a crises cambiais. A partir desta interpretação, são construídos indicadores de fragilidade externa visando mensurar a suscetibilidade de uma economia sofrer uma crise cambial. O segundo objetivo deste estudo é avaliar a evolução da fragilidade externa da economia brasileira entre 1999 e 2013 por meio da aplicação dos indicadores e da interpretação desenvolvidos na primeira parte do trabalho. Os resultados sugerem que a fragilidade externa brasileira sofreu gradual e significativa redução e tende a seguir trajetória estável nos próximos anos.

Palavras-chave

Minsky; crises cambiais; fragilidade externa; economia brasileira.

Códigos JEL *F31; F32; F34; F40.*

1 **Introduction**

In the last thirty years, currency crisis has become a frequent phenomenon in both developed and emerging nations, with effects that have been gaining more power to generate damages in the financial and production systems of these nations, and a growing potential of global contamination. (Arestis; Paula, 2008; Griffith-Jones; Ocampo; Stiglitz, 2010).

For these reasons, studies dedicated to measure the tendency for countries to suffer with currency crisis have earned the spotlights in the literature, especially after the 2008 international crisis.

In Brazil, the debate about the national external fragility can be divided, generally speaking, in two opposing strands. On one side, there are arguments in defense of the proposition that the Brazilian economy acquired, in the last decade, a bigger resistance to currency crisis. This would be the result of structural and macroeconomic reforms adopted since 1994, an appropriate management of macroeconomic policy and a quality external insertion before a global economy with a new setting to the country.

These factors made the external account more solid, especially with commodities external trade and better access to external funding, with the high influx of long-term investments attracted by omit domestic dynamism, macroeconomic soundness and the country's credibility earned with the international market. (Barros, 2008a; 2008b; Franco, 2008; Lacerda, 2009; Coutinho, 2010; BCB, 2013a).

Generally, defenders of this proposition lean their arguments on the combination of three evidences: the improvement of traditional indexes of foreign debt since 1999; the sharp drop movement of the risk-Brazil from 2003 and obtaining investment grade rating by international agencies since 2008; and the unprecedented ability demonstrated by the country in resisting the turbulence generated by the international crisis of 2008, when the economy experienced a modest decline in Gross Domestic Product (GDP) in 2009, with rapid recovery in 2010 (Prates; Cunha; Lélis, 2011; BCB, 2013a; 2013b).

The second strand defends that the country presents high external fragility, pronounced in recent decades by the commercial and financial liberalization process. From this point of view, the above evidence is insufficient, for reflecting the improvement of the external conjuncture situation of the economy only, ignoring its most relevant aspect, its structural external fragility. It

translates the capacity for long-term resistance of the country, expressed by specific features, such as the productive structure[1], foreign trade standard, systemic efficiency, technological dynamism and financial and institutional strength (Carneiro, 2010; Carcanholo, 2010; Gentil; Araújo, 2012).

For this line of argument, the assembly of these structural features, in Brazil, produces a pattern of poor external insertion manifested in three ways. First, with the tendency to Current Account (CA) deficits. Second, the deterioration of the composition of foreign debts by the increasing share of short-term capital and high liquidity. And third, the high volatility of exchange rates and interest rates. To its proponents, the international crisis of 2008 made clear the high Brazilian external fragility, given the clear manifestation of these three sets of factors after its advent (Gonçalves, 2012).

This work aims to contribute to the literature about currency crisis, and to the empirical debate about the recent evolution of Brazilian external fragility in two ways. First, we elaborate on an interpretation for open economies of the financial fragility hypothesis, of Minsky, about the generating process of these crises and their determinants. To fulfill this goal, the author's ideas are brought to the reality of international economy. The quantitative and qualitative deterioration of external wealth of an economy is identified as the factor responsible for raising its susceptibility to currency crises, when affecting international funding conditions available for the fulfillment of its commitments to non-residents.

Based on this interpretation, external fragility indexes are constructed to cover as much cyclical and short-term features of a country's external sector, comprehended in the results of its Balance of Payments (BOP), as the structural and long-term features manifested in the composition of its debts and foreign assets.

Our second goal consists in assessing the Brazilian external fragility between 1999 and 2013 by the application of the indexes and the interpretation previously developed to that referred country.

This work is structured in three other sections besides this introduction. Section 2 is dedicated to the theoretical study proposed in the first goal. In section 3, the evolution of Brazilian external fragility is evaluated. Finally, for the conclusion, in Section 4, are woven some concluding remarks.

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1 In this line of research, there are growth models with restriction on BOP, which relate domestic productive structural problems to the external sector of the economy. About this line of research, see Smith (2012).

2 The financial fragility hypothesis of Minsky and the external sector of national economies

This section aims to develop an interpretation for open economies of the financial fragility hypothesis of Minsky about the generating process of currency crisis and its determinants.

For that, initially, we work with some basic concepts of the financial fragility hypothesis (2.1). In the following subsection (2.2), the concept of external fragility and the Minskyan interpretation proposed by this work are developed. From that, we build two general indexes of external fragility, and they unfold in two other specific indexes, the first one cyclical and, the second, structural, described, respectively, in omit subsections 2.2.1 and 2.2.2.

2.1 Financial fragility hypothesis

Minsky (2010) develops the concept of financial fragility as a measure of the capacity of an economy to face shocks in financing conditions without a widespread dislocation of payment flows between agents. This definition comes from the notion of fragility as a result of the set of features of the financial structures of units comprising the economy, generically defined by (Tonveronachi, 2006, p. 24):

> *According to Minsky, every economic unit is characterized by a set of features inherited from the past, possessing significant degrees of rigidity. This inheritance may be summed up as consisting, on the one hand, of the stocks of physical, financial and immaterial capital, and on the other side, of contractual obligations, among which is a given debt structure. The various forms of capital are the source of future expected incomes (here considered net of the costs necessary to sustain the position), while the debt is the source of financial outflows.*

The financial structure of a unit is a consequence of its historically accumulated cash flow result, which can be expressed by the following equation (ibid.):

$$Y_{ni} + Y_{fi} + \Delta L_{i-1} \lessgtr r_i D_{i-1} + MD_i \qquad (1)$$

$$i = 1,...,n$$

where, Y_n is net operating revenue (*quasi-rents*);

Y_f are the net returns from owing financial assets;

L are net assets that are held in excess within normal operations;

r is the interest rate that affects debts D;

and MD are expenses with D amortizations.

The values obtained in equation (1) for each period result from the combination of planning and expectation, as economic units operate through the system money-today / money-tomorrow. Money-today, obtained to finance the purchase of goods or activities, must be validated by future income expected from the ownership of these assets, which, in turn, depends on the performance of the unit and the economy.

Therefore, whenever operating income and net returns from the ownership of assets exceed the interest expenses and amortization of assumed debt, the unit is in a liquid position, with surpluses and accumulation of new assets. When the opposite occurs, the situation of illiquidity requires the sale, with the corresponding value, of stocks from previously accumulated assets or the acquisition of new loans in the financial market.

The capacity of a unit to sustain its financial structure for each period is defined by its solvency positions, expressed by the equation (2) (ibid.):

$$NC_i = K_i Y + L_i - K_i D \tag{2}$$

where, NC is the net value of the forms of capital;

KY is the present value of the expected total net gains (quasi-rents);

and KD is the present value of the forms of debt.

The unit is in its solvent position while NC is positive, a situation which depends on the terms of financing offered by the markets, which, in turn, vary depending on the expected return on assets of this unit. According to Minsky (2010, p. 284), "[...] prospective profitability of collections of capital assets under the control of a firm is critical in determining investment, for it determines whether the production and ownership of capital assets are financed".

Capital assets are valuable because they generate profits. So, its market price and the interest of agents in acquiring it, enabling the financing and the solvency position of the respective unit which owns them, reflect the present expectations on future profits and how these profits are transformed into present values.

In this sense, a unit becomes insolvent when its structure cannot be funded neither by internal nor by external borrowing resources, given the unwillingness of markets in financing structures in which prospective profitability, costs and risks produce the expectation of not receiving the expected returns over the values applied. This results in a cash flow crisis at the unit and is a key-element for understanding the process of unleashing financial instability in capitalist economies[2].

The characteristics of the financial structures of the units, defining their liquidity and solvency status, depend on the financial arrangements adopted by them. The Minskyan taxonomy defines three types of schemes: hedge, speculative and Ponzi.

Units that use hedge financing: "[...] expect the cash flow from operating capital assets (or from owning financial contracts) to be more than sufficient to meet contractual payment commitments now and in the future" (ibid., p. 287).

Hedge positions are subjected only to operational risks. Difficulties to honor their debts might result from a revenue decline or increased costs in relation to what was expected[3]. Thus, their safety margins are sufficient to ensure the liquidity position at all times.

Units using the speculative financing: "[...] expect the cash flows to the unit from operating assets (or from owning financial contracts) to be less than the cash payment commitments in some, typically near-term, periods" (ibid., p. 287).

Speculative positions are subjected to both financial and operational risks. These units expect their receipts in periods subsequent to the initial phase of illiquidity to exceed their acquired obligations. In the meantime, the funds to pay off outstanding debts come from refinancing. The conditions offered by the markets in the contract of these new debts influence the future payments and, therefore, unexpected changes in them can turn illiquidity into insolvency, depending on the unit's safety margins. The size of these margins also affect the financing conditions, as they influence risk and return expectations of investment projects.

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2 In Minsky's words (1982b, p. 13): "[...] the critical element in explaining why financial instability occurs is the development over historical time of liabilities structures that cannot be validated by market-determined cash flows or asset values."

3 By equation (1), this means that the values of r and L are predetermined. The first two because the contracts are set at fixed interest rates and the latter because its value is independent of the prices of financial markets.

Finally, units using Ponzi financing (ibid., p. 288):

> *[...] for at least some near-term periods, the cash payment commitments on income account exceed the expected cash payment receipts on income account. [...] for Ponzi finance units financing costs are greater than income, so that the face amount of outstanding debt increases.*

Ponzi positions are the most vulnerable to financial market conditions, because they need to refinance their positions more frequently. Unfavorable changes in the pattern of payment terms or on credit standards offered by the markets more easily undertake the feasibility of this type of financial arrangement (ibid.).

The evolution of financial structures towards fragilization depends on opportunities and profit expectations that induce the use of riskier financial arrangements, which boost the capital gains, the pace of investment and thus the expansion of the economy.

Financial institutions, also motivated by optimism about profits, react to this process validating agents' decisions of becoming increasingly involved in these schemes, by creating new sources of funding. Indeed, it creates the conditions for development of a euphoric economy.

The resulting investment boom overloads the national financial system by speculative and Ponzi schemes, which increase the amount of investments financed by loans, expanding the share of debt in the financial structure of the units, and drive the market for loans based on the exchange of long-term debt for short-term financing of ownership of assets and investments maturing. In other words, banks and companies are induced to a higher debt in the short term on favorable expectations about the ways the economy will behave (Minsky, 1982a; 2010).

The fragilization becomes unstable before the mismatch between supply and demand for funding on the economy, due to the rate of expansion of higher demand to supply. In a down economy, the growth of the risks of lenders and borrowers modify expectations about the ability of investments to generate the expected profits and, therefore, bankers and their clients alter the structure of obligations deemed acceptable for the financing of positions in capital assets. Thus, uncertainty about the future of the economy lead markets to restrict the means of financing and customers to retain currency by refusing to purchase less liquid assets, preventing risky financial practices (Minsky, 1982a).

In this scenario, the units see their ability to validate obligations dispelled, being forced to liquidate their capital assets. Therefore, a general fall in the value of these assets starts to derail new investments and profits, leading the economy to a financial crisis.

2.2 The financial fragility hypothesis in open economies: the external fragility

The biggest contributions of Minsky are from studies of closed economies, although the author himself considers the importance of interpretations, from his approach, to open economies (Arestis; Sawyer, 2000). Indeed, several studies have sought to use such an approach to understanding the causes of currency crises, especially in developing countries (Gray; Gray, 1994; Lopez, 1997; Dymski, 1998; Paula; Alves Jr., 1999; Arestis; Glickman, 2002; Kregel, 2004; Tonveronachi, 2006; Resende; Amado, 2007).

Relations between economic agents acquire greater complexity in an open environment. The solvency position of units that relate to foreigners, whether countries or active members of an economy, is not only related to its ability to honor its commitments, but to its ability to generate foreign debts to enable this payment, a problem that has a macroeconomic nature and transcends the issue of vulnerability analysis in the individual project (Resende; Amado, 2007). Under these conditions, international creditors observe both the project cash flow as what they perceive as the external vulnerability of the country on the availability of hard currency and, from there, establish their offer of resources and define the required profitability (Correa; Mollo; Biage, 2008).

Similar to the concept applied to the closed economy, the external fragility comes from the financial structures of the units that compose an open economy and maintain relations with foreign countries. The results of these interactions, historically accumulated, define the external wealth of the economy by the formation of stocks of assets and debts in foreign currency. Thus, the external sector of a country can be understood as a single economic unit, where BOP is its cash flow and external wealth defines its financial structure.

As in any unit, the shaping of its financial structure is influenced by the characteristics of the economic system in which it is inserted. In this par-

ticular case, cyclical and structural changes in the domestic economy and the international system are reflected on the external financial structure of the evaluated country.

At the same time, the characteristics of the above structure provide rigidity for its operation. The degree of rigidity of this structure varies according to the degree of external fragility:

> *External vulnerability [or external fragility] means a low resilience of national economies facing destabilizing pressure factors or external shocks. The vulnerability has two equally important dimensions. The first involves the response options with the policy instruments available, and the second incorporates coping or adjustment costs in the face of external events (Baumann; Canuto; Gonçalves, 2004, p. 229).*

In other words, the external fragility is the ability of a country to sustain its external financial structure in time without a generalized disarticulation of BOP flows. The difficulties in that vary according to its potential to raise the funds needed to meet its commitments to non-residents, a feature related to the size and composition of its financial structure, which determine its degree of sensitivity to the financing conditions offered by international markets for rolling its debts.

The balance of the external sector is ensured whenever the total demand for foreign currency is met by an offer at least equivalent to BOP's requirements in each period. Instabilities in BOP result from a process in which the external financing offer is insufficient to meet a demand generally expanding. This is a situation which features the problem of Minsky's fragility financial hypothesis (2010) on the BOP of a country.

According to Mollo (1988, p. 108) "The problem for Minsky is nothing more than a demand problem of financing means increasing in the face of an inelastic supply of financing.". Thus, the inability to raise sufficient amounts of resources to meet demand is the factor responsible for triggering instabilities and crises in the external sector of the economy.

As it turns out, if the maintenance of this structure cannot be financed by the foreign exchange generated in the economy itself, its units may resort to foreign financing. The availability of these funds depends on the subjective preferences of the agents in the external financial markets, defined in terms of their expectations on profit opportunities in the economy and the solvency condition of its external sector. Such expectations are constructed and influenced by cyclical and structural features of the economy and assessed by exogenous factors. In other words, in forming

their expectations of an economy, the agents consider all those domestic and international elements that affect or may affect the risk return ratio expected from the acquisition or financing of assets in it. Admitting Minsky's argument about money supply endogenously determined by markets, through financial innovations, we have that, while investor optimism about BOP's ability to produce expected foreign exchange persists, there will be no restrictions on the supply of financing, even in the face of an expanding demand.

Initially, as suggested by equation (2) applied to our analytical model, in periods of high confidence of foreign investors on the present value of the expected returns of their investment in a country, the BOP refinancing of the latter by foreign capital lies assured and thus the balance between supply and demand for foreign exchange is guaranteed.

By this interpretation, the mismatch between supply and demand for the amount of foreign currency needed to balance the BOP accounts results from changes in the subjective preferences of their foreign financiers. The degree of optimism of these agents should deteriorate due to the growth of external fragility of the reporting country, especially when associated with any domestic or international disturbing event capable of arousing their suspicion on this economy.

Greater external fragility changes the expectations of the agents involved in the financing of BOP because, before the worsening of the solvency condition of the external sector, the lender's and debtor's risks rise while the return prospects on capital are reduced in this country. The result is a worsening of financing conditions in terms of costs and availability of funds, just as the deteriorating external financial structure demands foreign refinancing in larger quantities. Hence, as it decreases the country's ability to sustain its external accounts, the BOP imbalances become more likely and their real and financial consequences tend to be bigger. The latter can manifest through capital flight, macroeconomic instability and, ultimately, by currency crises.

Our interpretation of the generating process of instability and crisis in BOP justifies the importance of studies dedicated to measuring the external fragility of economies. For this purpose, Paula and Alves Jr. (. 1999, p 79) created an external fragility index (EFFI):

> *We can define, from the information on the balance of payments of a country, the degree of external financial fragility; the larger (or smaller) are the needs of*

> *an economy that has to resort to the international financial market to renegotiate open financial position (that is to say, that cannot be immediately paid), even if with unfavorable interest rates and terms.*

For open financial positions, the authors understand those obligations they named as real and virtual, present at each period:

> Real *payment obligations reunite expenses with imports and services plus the loan repayments.* Virtual *obligations include stocks of short-term capital and portfolio investments [...] These obligations may be "faced" through reserves, export revenues (interest and other services), medium and long term loans and direct investments (ibid., p. 79).*

EFFI measures the real and potential needs of an economy to renegotiate its financial external open positions by the ratio between their immediate obligations, or short-term, and the foreign exchange available to meet them. Its calculation is performed by the equation:

$$EFFI = (M + D_j + D_{OS} + A + CST_{-1} + PLA_{-1}) / (X + R_j + R_{OS} + RE_{-1} + I_d + E_{m1}) \tag{3}$$

where, M = imports;
X = exports;
D = expenses with interest "j" and other services (OS);
R = revenue with interest "j" and other services (OS);
A = loan repayments
CST_{-1} = stock of short-term capital, outdated by one period;
PLA_{-1} = stock of liquid investment in portfolio, outdated by one period;
RE_{-1} = international reserves accumulated until the previous period;
I_d = foreign exchange input corresponding to direct investment;
E_{m1} = medium and long term investments.

The higher the index, the lower the country's ability to meet the most immediate external financial commitments, which puts it in a situation of greater dependence on foreign refinancing[4], increasing their propensity to be affected by changes in the international environment that alter the external financing conditions.

That way, EFFI works as a tendency indicator that seeks to assess the

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4 By the interpretation developed along this work, an economy's bigger or smaller dependence on foreign refinancing is not only the result of its CA balances. As demonstrated by equation (3), it is also associated with the financial account influxes and to the external assets and debts stocks of the country.

increase or decrease the importance of the subjective evaluations of agents that hold rights and/or obligations in foreign currency in determining the outer frame of the economy (ibid.).

This interpretation allows a rank for financial position assumed by a country on its external accounts similar to the one developed by Minsky. The country assumes a hedge position whenever the most immediate financial commitments are compatible with current revenues, the long-term liabilities and reserve assets available. In turn, the position is speculative or Ponzi if real and potential financial commitments with nonresidents exceed their ability to pay. In the latter case, foreign capital attraction policies become necessary to ensure the balance of BOP, subjecting the economy, largely, to the absorption of speculative flows (ibid.).

The great accomplishment of EFFIlies in the fact of it being able to assess, jointly, the two aspects of the financial structure described by Minsky (2010) able to modify their level of fragility, namely, the amount of current expenditure by the revenue generated each period and the quality of the acquired refinancing that composes its liability structure in relation to the forms of capital available. It is, thus, a measure that considers size and composition of the forms of capital in relation to forms of foreign debt of a country.

As one of the contributions of this work, it is intended to complement the study of Paula and Alves Jr. (1999), analyzing separately, in the following subsections, the two aspects covered by the index. Thus, the goal is to identify the importance of each aspect to the weakening of the external sector of the economy, justifying the aggregate results found in EFFI.

Finally, it was argued in this subsection that the degree of external fragility affects the relationship between demand and supply of foreign funds made available to the economy, the size and frequency of the imbalances in the flows of its BOP and its shock resistance capacity. Such dislocations of financial flows are crucial for Minsky's analysis because they illustrate the key moments of the business cycle where the fragility turns into instability and, potentially, into crisis.

Indeed, we adapt an index capable of measuring the three aforementioned implications, through the ratio between total outflows and foreign exchange input of the economy in each period. This index of current external fragility (current EFFI) is calculated by the method proposed by Martins (2007) and Lacerda and Oliveira (2009):

$$Current\ EFFI = \sum DECME / \sum DICME \qquad (4)$$

where, $DECME$ = Current demand for resources in foreign currency;

$DICME$ = Current availability of resources in foreign currency.

Current EFFI values higher than one indicate instability moments for external accounts, where demand exceeds availability of resources in foreign currency.

According to the interpretation developed in this subsection, the convergence between the two fragility in dices presented here is expected. Moments of greater deterioration of the external financial structure of a country should correspond to moments of mismatch between demand and supply of foreign exchange, greater instability of BOP flows and lower resilience of the external sector to shocks. This relationship is evaluated in subsection 3.2.3.

2.2.1 *Operational external fragility: current accounts and net foreign debts*

By operational external fragility, we understand the one that arises from changes on dimensions of capital and/or debt forms of the external financial structure of an economy, that is to say, of quantitative changes in its net foreign wealth.

In an analysis of BOP flows of a country, the behavior of its net foreign debts (NFD) can be assessed in terms of CA results[5] (Tonveronachi, 2006):

$$NFD - NFD_{-1} \equiv -(CA) \equiv -NX - NFI - UT \qquad (5)$$

where, CA is Current Account,

NX is net exports of goods and services;

NFI are net revenues of foreign assets and debts;

and UT are Unilateral Transfers.

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5 Strictly speaking, the variation of NFD does not depend only on BOP flows. Other factors influence their size, such as changes in the market value (price) of assets and debts stocks and their expression in dollars (parities), the latter being directly impacted by variations in nominal exchange rate (BCB, 2008).

By the equation (5), CA deficits increase NFD in the same proportion (ibid.).

CA result define the liquidity position of an economy in foreign currency in each period. Illiquidity at one point indicates that, in the local exchange market, foreign currency revenues of a country are lower than its compensation expenses of foreign debts.

Successive periods of illiquidity can be sustained indefinitely, provided there is sufficient supply of foreign funds to cover the service of foreign debts and other debts generated in the capital and financial account, ensuring the overall closure of BOP's accounts. The financing offer persists as long as there is the expectation that, in the future, illiquidity will revert to ensure creditors expected return.

The expression (5) can be modified and extended, allowing a more precise definition on liquidity and solvency positions of an economy compared to the rest of the world (ibid.):

$$NX_j + r_j^{FA} FA_{j-1} + UT_j + \Delta FR_j \gtreqless r_j^{FA} FD_{j-1} + MD_j \qquad (6)$$

$$i = 1, \dots, n$$

where, r^{FA} is the return rate for foreign assets FA;

FR is the variation in international reserves, used to temporarily smooth the illiquidity of the external sector;

r^{FD} is the interest rate of foreign debts FD, or, more broadly, the costs of remuneration of capital that compose this liability;

and MD is the debt generated by the amortization of debts in their due date phase.

The country is in liquidity position when the current revenue from net exports, the net income from the ownership of foreign assets and unilateral transfers are sufficient to honor the $r^{FD}FD$ payment. The rest of the expenses (MD) can be refinanced with international markets. In the process of refinancing, changes in the conditions offered by the markets affect CA from the following period by $r^{FD}FD$.

With the concepts to identify the operational fragility of a country's external sector developed, now follows the interpretation of them, according to Minskyan taxonomy. Table 1 contains the criteria used to classify

financing regimes, defined according to the behavior of CA and NFD in the medium and long term perspectives:

Table 1 **Classification criteria of financing regimes**

Country Position	NFD	Characteristics	Safety Margins
Hedge	Zero.	CA balanced, with small and temporary deviations.	-International Reserves; - Monetary and Fiscal Policy; - Prudent evolution of NX.
Speculative	Positive, butstable.	Current revenue sufficient to remunerate foreign debts: CA in balance.	-International Reserves; - Monetary and Fiscal Policy; - Prudent evolution of NX.
Ponzi Sustainable	Positive and growing, but at a small and constant rate.	Current revenue insufficient to remunerate foreign debts: constant deficit in CA.	-International Reserves; - Low NFD expansion rate.
Ponzi Unsustainable	Positive and growing at increasing rates.	Current revenue insufficient to remunerate foreign debts: constant deficit in CA.	None.

Source: Elaborated from Tonveronachi (2006).

An economy finds itself in a *hedge* position when it is capable of maintaining NFD zero and, hence, CA in balance. Small and temporary deviations from this balance are natural and can be administrated by exchange reserve policy combined with small adjustments in fiscal and monetary policies. The latter, by modifying the growth pace of domestic income, are capable of rebalancing CA by their effects over NX. The prudent evolution of NX is considered another important safety instrument of a country.

In the *speculative* position, NFD is positive, but stable, and CA is in balance. In this condition, a more expressive volume of NX is necessary to pay the most meaningful expenses with debts revenue and prevent deficits in CA. Furthermore, the refinancing of debts repayments in the maturation phase and other debts generated by NFD depends, to a greater extent, on external resources. About the safety margins, restrictive fiscal and monetary policies, the accumulation of reserves and prudent evolution of NX are able to contain any imbalances in CA, however, the effectiveness of these interventions tends to be lower than in hedge position, due to the greatest dimension of these imbalances facing shocks.

The Ponzi position is characterized by the successive incapacity of the economy to generate revenues in an amount sufficient to pay the debts, which implies deficits in CA and thus positive and expanding NFD. In this regime, the unit is dependent on an increasing supply of refinancing to ensure the balance of BOP. This position is divided between sustainable and unsustainable (ibid.). The country is classified as sustainable Ponzi if it is able to keep a small and steady growth pace in NFD. For this, revenues, particularly NX, must have the same rate of growth of expenditure on compensation of NFD. Restrictive actions of monetary and fiscal policy are no longer effective to contain the most significant imbalances in CA. High stock reserves and prudent evolution of NX are the safety margins of this position.

When NFD expansion occurs with increasing rates, *Ponzi* position is classified as unsustainable. Its fast deterioration, provides that it persists in medium and long term, should eliminate the efficacy of all its safety margins. In this process, market expectations about the solvency condition of the unit suffers a gradual deterioration, making it difficult to refinance to the extent that access to foreign funds is made impossible, at which time their total discredit to the creditors makes default an inevitable consequence.

2.2.2 *External structural fragility: foreign financing quality and external financial structure composition*

By structural external fragility, we understand the one that arises from changes in the composition of capital and/or debt forms of the external financial structure of an economy, that is to say, of qualitative changes in its net foreign wealth, defined in terms of degree of liquidity[6], and maturation time of the capital that composes it.

In an open economy, external fragility can be manifested when there are domestic units that finance themselves in foreign currency with lower deadlines than the maturity of the financed project (Paula; Alves Jr., 1999). From the adoption of these speculative arrangements stems the increase in short-term obligations for readily available assets and, therefore, for the degree of liquidity of foreign debts in relation to that of national foreign assets.

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6 By degree of liquidity, we understand the concept developed by Keynes (1964).

Kaltenbrunner and Paincera (2009) point out that Minsky introduced the concerns regarding the composition of the financial structure of the units in the analysis of Keynesian liquidity, showing how changes in qualitative aspects of these structures increase the risks to which the units are submitted before the investors' portfolio allocation decisions:

> According to Minsky, however, capital asset pricing and portfolio decision theories should take into account the debts positions of economic units, which are interrelated with their assets positions as "…a portfolio decision has two interdependent facets. The first relates to what assets are to be held, controlled, or acquired; the second relates to how the position in these assets – i.e., their ownership or control – is to be financed" (Minsky, 1975: 70) (ibid., p. 3).

Following this line, several authors associate the accumulation of short-term or highly liquid foreign exchange to the expansion of external. These capitals with high potential for reversion require recipient countries to a constant search for refinancing among foreign markets to offset their destabilizing effects, real and potential, on the external accounts and on the economy as a whole. The need of foreign investors to relocate their portfolios can generate a liquidation process of household assets, motivated by factors that can even be fully unharnessed from the local economic situation (Paincera, 2009; Paula; Alves Jr., 1999; Correa; Mollo; Biage, 2008; Corrêa; Munhoz; Pereira, 2012).

For a study based on Minsky, to measure the "weight" of capital with speculative profile in the composition of the financial structure of any unit requires the consideration that their liability positions are interrelated to their active positions. In other words, it makes sense to evaluate the external fragility of a country considering only the highly liquid stock present in their debt forms, because the importance of the latter can only be estimated when it is related to the forms of capital available for the unit.

To measure the external structural fragility of an economy, this work evaluates the components of its external wealth, according to its degree of liquidity defined in Corrêa, Munhoz and Pereira (2012, p. 3)[7]:

> [...] we regard as capital flows "with short-term bias,"those which have a great potential for rapid reversion. They are: Investments in Portfolio (Equity and Fixed Income Securities, short-term and long term), the Currency and Deposits, short-term Loans to Suppliers, short-term Loans in general, and Derivatives.

....

7 This classification is based on empirical tests applied to emerging economies, including Brazil between 1995 and 2010. Besides this study, Correa's works, Mollo and Biage (2008) and Munhoz, Kobayashi and Correa (2010), also applied to emerging economies and Brazil, found similar results.

This group of capitals represents the external wealth component of a country, with direct and immediate impact on their external structural fragility[8]. However, we should also consider some of their peculiarities, especially when it comes to short-term foreign assets.

Faced with a currency crisis, the aversion to risk behavior, distinctive of these capitals, should produce a flight from these passive positions abroad and the permanence of these private active positions in foreign markets[9], where they already were. Hence, the country cannot count on its private resources invested abroad, but only on its reserve assets under the control of the monetary (Gentil; Araújo, 2012).

The importance in considering the reserve assets in the analysis of external structural fragility lies in the fact that, in the formation of expectations of foreign investors, a relevant indicator they consider is the stock of hard currency readily available to meet the current and emergency obligations and ensure the stability of the exchange rate[10].

Thus, in our Minskyan perspective, the deterioration of the composition of the external financial structure of a country occurs through the growth of its obligations or debts with "short-term bias" in relation to its assets of immediate liquidity:

$$External\ Structural\ Fragility = \frac{Short - Term\ Liabilities}{Reserve\ Assets} \qquad (7)$$

Results of this measure of fragility allow a rank, in Minskyan terms, of the financial position of an economy external sector. Hedge position occurs when reserve assets overcome short-term debts, a situation in which the country finds itself "covered" on the hypothesis of a massive capital flight abroad. On the other side, whenever the stock of obligations with high reversal potential exceeds the reserves, the country is in a speculative or Ponzi position, a characteristic that increases the odds of getting involved in currency crises.

8 It became evident in the above studies that the other groups of capital that compose the external wealth of an economy are considered capital with long-term bias. Thus, they influence the external weakness only for their effects on flows of BOP.

9 By definition, foreign assets accumulated by private companies in the acquisition of shares do not have immediate liquidity and cannot be used to honor other private agents' commitments.

10 The exchange rate directly affects the external wealth of the country, its ability to generate foreign exchange and return rate on foreign investment. For this reason, its instability tends to negatively influence the formation of expectations of international creditors.

3 Brazilian external fragility: a Minskyan interpretation of the period – 1999-2013

This section aims to measure the susceptibility to currency crises of the Brazilian economy between 1999 and 2013, through the application of the theoretical and empirical instruments developed in the previous section. Thus, the external fragility is evaluated from an operational point of view (3.1), structural (3.2) and by combining the two previous measures (3.3). Finally, the assessed findings are evaluated in the light of an indicator that seeks to measure the fragility level impact on the external sector of the Brazilian economy[11].

In order to facilitate the analysis, this time frame is divided into three periods, 1999-2002, 2003-2007 and 2008-2013, according to the behavior of Brazilian external accounts[12].

3.1 External operational fragility

The equation (6), detailed in subsection 2.2.1, is built for Brazil from its BOP information, according to Table 2:

Table 2 **BOP Information to external operational fragility measures**

	Availability of Current Resources
NX	Trade Balance (FOB); Service Balance
$r^{FA}FA$	Revenue – Income Account
UT	Current Unilateral Transfers (Net)
	Total Demand for Current Resources
$r^{FD}FD$	Expense - Income Account
MD	Foreign Direct Investment Debt; Foreign Portfolio Direct Investment Debt; Commercial Loan Amortization – LT Suppliers; IMF Amortization; Amortization of Other regularization operations; Amortization of Other LT Loans; Amortization of Loans and Financing – other LT sectors

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11 The data used for the construction of these indicators for Brazil are listed in the Appendix of this work.

12 For an analysis about these three periods, see Prates, Cunha and Lélis (2011).

	Total Demand for Current Resources
Other Financial Account debts *	Brazilian Direct Investment Balance; Brazilian Portfolio Direct Investment Balance; Other Brazilian Investments Balance; Derivatives (net); Currency and deposits (net); Other LT and ST debts (net)

Source: Banco Central do Brasil.Self-Elaboration

* This item measures other components of the financial account of BOP that register debts.

An Figure 1 shows the relationship between current revenues, excluding reserves, and the remuneration costs of foreign debts ($r^{FD}FD$) each trimester between 1999 and 2013. The red vertical bars illustrate periods and dimensions of illiquidity in the external accounts, represented by CA deficits, while green bars show moments of liquidity:

Figure 1 **Liquidity x illiquidity of Brazilian external sector**

Debt Remuneration Expenses (US$ Million)   Current Revenue (US$ Million)
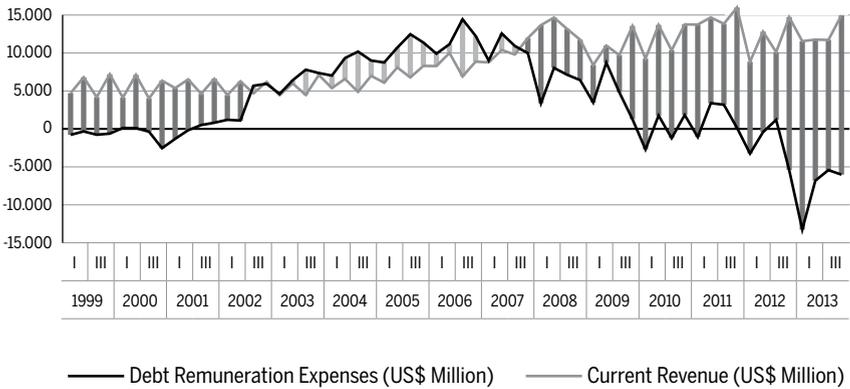
Source: Banco Central do Brasil. Self-Elaboration.

According to Figure 1, revenues exceeded expenses with the remuneration of the foreign debts only between 2003 and 2007. During this period, NDF decreased[13]. On the other hand, between 1999 and 2002 and between 2008 and 2013, these costs could not be fully paid with current revenues, moments where the difference had to be covered by foreign refinancing and NFD grew. Therefore, the results suggest that, under the operational perspective,

13 This conclusion is based only in the analysis of liquid credit flows (CA balances) over the country's NFD.

the external sector of the country presented Ponzi position between 1999 and 2002 and between 2008 and 2013 and speculative from 2003 to 2007. Financing regimes classification continues by analyzing the NFD expansion pace in Figure 2, according to equation (5) described in subsection 2.2.1, and its trend curve:

Figure 2 **NFD variation**

| NFD Variation (US$ Million) - - - - Tendency Curve NFD Variation
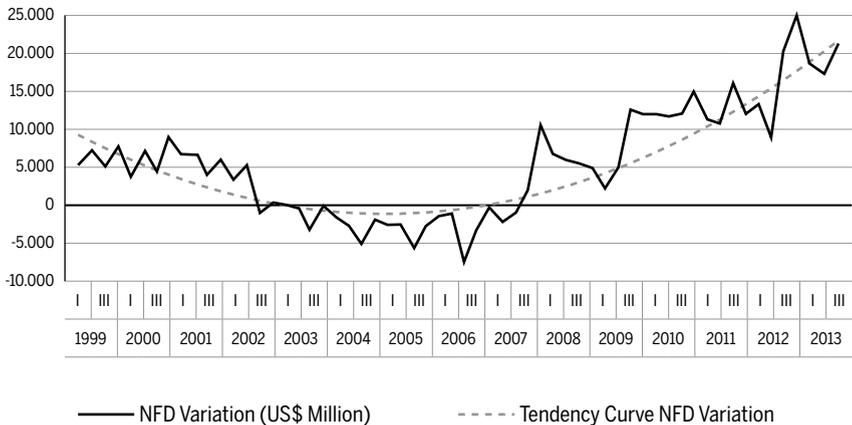
Source: Banco Central do Brasil. Self-Elaboration.

The behavior of the NFD variation indicates that the operational fragility of the Brazilian external sector followed a cyclical pattern over the period analyzed, in which we can identify three phases. Between 1999 and 2002, NFD has grown, on average, at stable rates, which allows us to qualify the external sector of the country as sustainable Ponzi. From 2003 to 2007, the NFD expansion movement was reversed and fragility was reduced, characterizing a Speculative position. Finally, between 2008 and 2013, the resumption of NFD growth represented a second period of operating fragilization, which occurred, however, at increasing rates, a feature that qualified the external sector as unsustainable Ponzi.

Unsustainable Ponzi position is a warning sign to the country. At any future time, the trend of NFD should be contained, either by voluntary adjustment of the external accounts, through the available action margins, or by an imposing adjustment in the face of its unsustainability, an alternative already experienced by the Brazilian economy with the advent of currency crisis 1999.

Figure 3 illustrates the effects of operational fragility of two of the country's safety margins: the volume of international reserves and the performance of net exports. For Brazil, the results of their net exports depend mainly on exports of goods recorded in the trade balance. As the volume of reserves, the ability to generate autonomous currency in foreign currency through this account is considered an important factor for the formation of expectations of foreign investors. The effects of the fragility of these margins were estimated by the ratio between the stock of NFD and exports of goods and stocks of NFD and international reserves[14]:

Figure 3 **NFD x Brazilian safety margins**
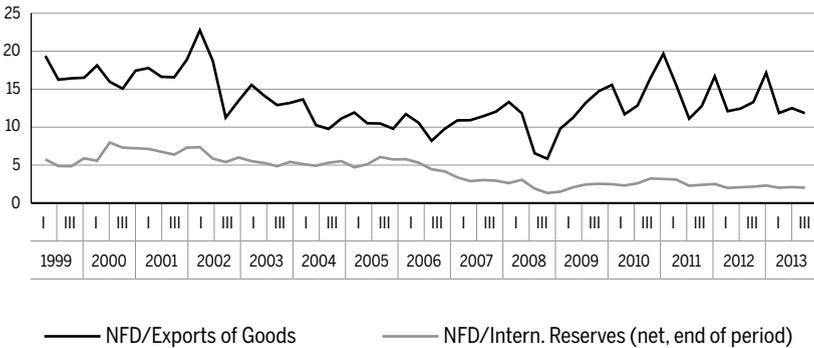
Source: Banco Central do Brasil. Self-Elaboration.

The dimension of NFD is one of the factors responsible for determining the value of national income drained abroad at each period to serve external commitments. Thus, the ratio between NFD and GDP illustrates a third safety instrument of the external sector of the economy. Its growth should negatively affect the expectations of creditors on the returns on their investments and on the external solvency position of the country. Figure 4 illustrates this ratio, from the available annual data between 1999 and 2013, and its trend curve:

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14 Between the last quarter of 2001 and 2013, NFD value was obtained by PII of Brazil data. Previous values are estimates, obtained, for each period t, through the difference between the stock of NFD in t+1 and balance of CA in t+1. The value of international reserves is given by the liquidity concept (end of period).

Figure 4 **NFD x Brazilian safety margin**
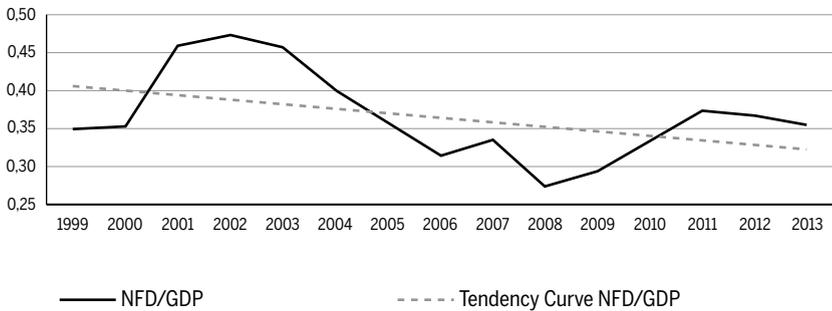
Source: Banco Central do Brasil and Instituto Brasileiro de Geografia e Estatística. Self-Elaboration.

Table 3 summarizes the results of Figures 3 and 4, using the average values of all the ratios for each of the three analyzed periods:

Table 3 **BOP Information to external operational fragility measures**

Period	1999-2002	2003-2007	2008-2013
NFD/Average Export. Goods	16.950	11.441	12.920
NFD/Average Intern. Reserves	6.353	4.783	2.351
NFD/Average GDP	0.408	0.372	0.332

Source: Banco Central do Brasil and Instituto Brasileiro de Geografia e Estatística. Self-Elaboration.

Values from Figures 3 and 4 and from Table 3 indicate that all safety margins had their worst results concerning NFD during the first period, became robust concerning NFD in the second period and maintained their path of relative improvement in the third period, the exception being only in the third period for exports of goods, that suffered a minor setback in their path of relative improvement, but presented a performance close to that of the previous period and thus much more satisfactory than the one observed in 1999-2002.

These results suggest that Brazil, since 2003, is gradually acquiring greater ability to sustain its external accounts. Although, in the third period, the external sector has submitted its worst operating results, characterizing the unsustainable Ponzi scheme, the accelerated growth of NFD was not enough to spoil their Safety Margins.

Finally, Figure 5 shows the relationship between current revenues, the total demand for foreign exchange and the participation of foreign financing in the balance of BOP accounts, the latter calculated in accordance

with Table 4. The Figure also shows the trend curve of this last:

Table 4 **BOP Information that compose Foreign Financing**

Foreign Financing	
Foreign direct investment credit; Foreign portfolio direct investment credit; Commercial Credit Inflow – LT Suppliers; IMF Inflow;	Inflow of Other regularization operations Inflow of Other LT Loans; Inflow of Loans and Financing – other LT sectors.

Source: Banco Central do Brasil. Self-Elaboration.

Figure 5 **Current revenue, total demand and foreign financing for BOP closure (US$ Million)**
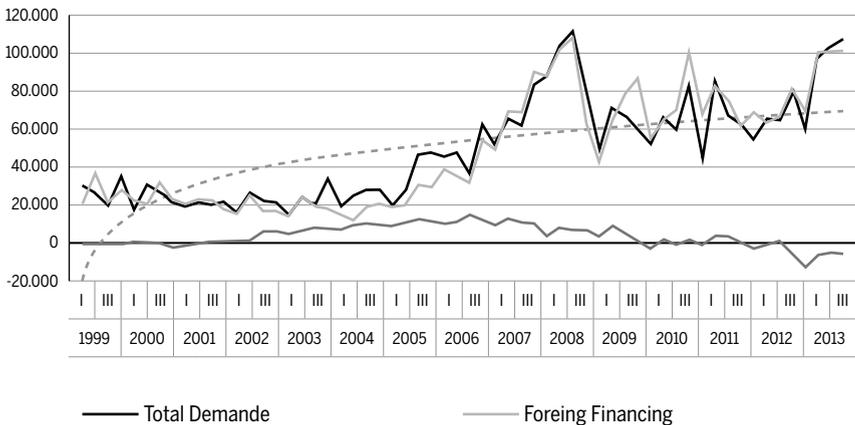
Source: Banco Central do Brasil. Self-Elaboration.

Across all years analyzed, there was a significant disparity between income and demand for current resources. For that reason, external financing has always had a majority stake in the role of ensuring the provision of foreign currency resources to the global closure of BOP. Since this participation is directly affected by the expansion of operational fragility, it realized, in the last period, its highest growth compared to the previous periods.

Results presented so far induce a question on the sustainability of BOP in the two periods in which the external sector was classified as Ponzi. The 1999 and 2001 crisis marked the only moments during the analyzed time frame in which the increased demand for foreign resources was not accompanied by a proportional supply of external financing. This mismatch

between supply and demand has forced the country to use much of its foreign exchange reserves and to adopt a forced adjustment process of its external accounts to rebalance BOP and restore the confidence of foreign markets in the Brazilian economy. Therefore, the two currency crises leave no doubt about the inability of the country to ensure the balance of its external accounts during the period 1999-2002.

On the other hand, in the second Ponzi period, the rapid expansion of operational fragility led the country to an average demand for external resources 3 times higher than that of the first Ponzi period. However, unlike what happened in 1999 and in 2001, this time, the financial markets made an offer of foreign capital which, at various times, surpassed in large measure, the amount required for closing the BOP[15]. Thus, in this second Ponzi moment, the balance of the BOP was easily reached, showing that the progress of operational fragility was not enough to shake the confidence of international markets on the economy.

Explanations for the differences in the behavior of the external financial market in both Ponzi periods are developed throughout this section. For now, it was argued that the performance of the safety margins in relation to operational external fragility of the country was much higher in the second Ponzi period, which contributed to the more favorable expectations of creditors in the last period, ensuring better external financing conditions.

3.2 Structural external fragility

Table 5 presents the categories of capital from International Position of Brazilian Investment (PII) between December 2001 and December 2013[16]:

We start evaluating Gross Foreign debt (GED) from item OFI, where the bigger part of the foreign debt is. From 2001 to 2013, OFI increased 104%, going from US$97.1 billion to US$198.2 billion. Despite the expansion path, OFI have been losing share in GED. In 2002, they represented 30.9% of GED, against 39.5% of FPI and 29.5% of FDI. In 2013, their participation dropped considerably, reaching 13.2%, against 38.2% of FPI and 48.2% of FDI.

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15 The excess supply of foreign currency was so expressive that it enabled an extraordinary accumulation of foreign exchange reserves, the subject matter in the next subsection, reaching, in 2012, US$379 billion, a historical record for Brazil.

16 Information available only from December 2001 on.

Table 5 **International position of Brazilian investment (PII) - US$ Billion**

Discrimination	Dec /01	Dec /02	Dec /03	Dec /04	Dec /05	Dec /06	Dec /07	Dec /08	Dec /09	Dec /10	Dec /11	Dec /12	Dec /13
Foreign Direct Inv.	121.9	100.9	132.8	161.3	181.3	220.6	309.7	287.7	400.8	682.3	695.1	718.9	728.9
Foreign Portfolio Inv.	151.5	135.1	165.8	184.6	232.2	304.2	508.4	287.5	562.6	668.5	600.8	638.8	577.6
Derivatives	0.0	0.2	0.1	0.3	0.2	0.4	1.8	2.5	3.4	3.8	4.7	3.0	6.3
Other Foreign Inv.	97.1	105.5	105.3	97.1	67.8	78.1	95.5	109.8	107.9	152.7	186.0	195.7	198.2
Commercial Credit	6.2	9.1	8.7	4.5	4.7	4.8	10.7	16.6	2.1	2.0	1.9	1.9	1.7
Longterm	5.2	6.7	8.2	4.3	4.5	4.7	10.6	16.1	1.9	1.9	1.8	1.9	1.7
Shortterm	1.0	2.4	0.5	0.2	0.2	0.1	0.1	0.5	0.2	0.1	0.1	0.0	0.0
Loans	84.2	87.4	91.4	83.6	55.6	66.8	76.7	84.7	100.6	145.8	179.0	188.5	191.3
Monetary Auth.	9.2	21.5	28.9	25.4	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government	22.1	22.4	20.7	19.4	18.0	18.2	18.2	19.2	20.5	24.0	20.0	25.5	28.2
Banks	31.9	24.2	27.0	24.1	23.8	25.6	43.5	48.3	42.4	65.2	89.8	91.4	86.3
Longterm	12.0	7.3	9.7	7.3	7.5	9.0	12.7	17.6	17.0	22.0	52.6	59.8	54.5
Shortterm	19.9	17.0	17.3	16.9	16.3	16.6	30.9	30.8	25.4	43.2	37.1	31.6	31.8
Other Sector	21.0	19.2	14.9	14.6	13.4	22.9	15.0	17.2	37.7	56.6	69.2	71.6	76.7
Longterm	18.7	18.9	14.6	14.1	13.2	22.2	14.6	16.8	36.4	51.4	67.4	71.4	76.7
Shortterm	2.3	0.3	0.3	0.5	0.2	0.6	0.4	0.5	1.4	5.2	1.8	0.2	0.0
Currency / deposits	0.2	0.4	0.2	0.4	0.6	0.8	1.2	0.6	0.7	0.5	0.6	0.9	0.9
Other Debts	6.6	8.7	4.9	8.6	6.9	5.8	6.9	7.9	4.5	4.4	4.4	4.4	4.4
Foreign debts	**370.6**	**341.8**	**404.0**	**443.3**	**481.5**	**603.4**	**915.4**	**687.5**	**1074.7**	**1507.3**	**1486.6**	**1556.4**	**1511.1**
Brazilian Direct Invest.	49.7	54.4	54.9	69.2	79.3	113.9	141.9	157.8	167.1	191.3	206.2	270.9	293.3
Brazilian Portfolio Invest.	6.4	5.8	7.0	9.4	10.8	14.4	19.3	14.6	16.5	38.2	28.5	22.1	26.6
Derivatives	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.6	0.4	0.8	0.7	0.6	0.6
Other Brazilian invest.	16.9	16.4	25.3	20.1	28.0	29.1	42.9	45.4	44.1	51.6	54.8	64.0	67.8
Reserve Assets	35.9	37.8	49.3	52.9	53.8	85.8	180.3	193.8	238.5	288.6	352.0	373.1	358.8
Foreign Assets	108.9	114.6	136.5	151.7	172.0	243.4	384.5	412.2	466.7	570.5	642.1	730.7	747.0
Net Foreign debt	261.7	227.2	267.5	291.6	309.5	360.0	530.8	275.3	608.0	936.8	844.5	825.6	764.0

Source: Banco Central do Brasil. Self-Elaboration.

A second feature of the composition of OFI that stuck throughout all analyzed time frames was the majority of Long Term (LT). Short Term (ST) OFI never represented more than 6.3% of GED, lying, must of the time, below 4% and, in 2012 and 2013, in 2.1% and 2.2%, respectively. On an annual average, from 2001 to 2013, LTOFI[17] represented 13% of GED, while STOFI represented only 3.7% of GED.

Information OFI participation in GED can be found in Table 6, which illustrates the percentage composition of the main items of debts and foreign assets in Brazil:

Table 6 **Percentage composition of the international investment position of Brazil**

Discrimination	Dec /01	Dec /02	Dec /03	Dec /04	Dec /05	Dec /06	Dec /07	Dec /08	Dec /09	Dec /10	Dec /11	Dec /12	Dec /13
Foreign Direct Inv.	32.9	29.5	32.9	36.4	37.7	36.6	33.8	41.8	37.3	45.3	46.8	46.2	48.2
Foreign Portfolio Inv.	40.9	39.5	41.0	41.6	48.2	50.4	55.5	41.8	52.3	44.3	40.4	41.0	38.2
Derivatives	0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.4	0.3	0.3	0.3	0.2	0.4
Other Foreign LTInv.	19.9	25.0	21.5	17.9	10.5	9.9	6.9	11.3	7.5	6.9	9.8	10.5	11.0
Other Foreign STInv.	6.3	5.9	4.6	4.1	3.6	3.0	3.6	4.7	2.6	3.2	2.7	2.1	2.2
Foreign debt	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Invest. Abroad	67.1	67.0	63.9	65.1	68.7	64.7	53.1	53.0	48.9	49.4	45.2	48.9	52.0
Reserve Assets	32.9	33.0	36.1	34.9	31.3	35.3	46.9	47.0	51.1	50.6	54.8	51.1	48.0
Foreign Assets	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
LTGED/GED	52.8	54.5	54.4	54.2	48.1	46.5	40.7	53.1	44.8	52.2	56.6	56.7	59.2
STGED/GED	47.2	45.5	45.6	45.8	51.9	53.5	59.3	46.9	55.2	47.8	43.4	43.3	40.8
STGE/Res. Ass.	4.88	4.11	3.74	3.83	4.64	3.76	3.01	1.66	2.49	2.50	1.83	1.81	1.72
ST GE/GDP	0.32	0.31	0.33	0.31	0.28	0.30	0.40	0.20	0.37	0.34	0.26	0.30	0.27

Source: Banco Central do Brasil. Self-Elaboration.

The most representative accounts of GED during the analyzed time frame were FPI and FDI. In the first two phases, their stocks followed their growth

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17 Item LTOFI includes the sub-accounts: long-term commercial credit; loans to the monetary authority, government loans, loans to long-term banks; loans to other long-term sector and other liabilities. Item STOFI includes the sub-accounts: short term commercial credit; loans to short-term banks; loans to other short-term sector and currency and deposits.

trajectories. However, the first item expanded, in general, at greater speed when compared to the second. Therefore, in every year between 2001 and 2007, the FPI values exceeded those of FDI and the difference between them increased year by year. On the other hand, from 2008 to 2013, there was a change in the behavior of these series. While the FDI followed a general trend of growth, the FPI alternated years of growth and downturn. As a result, in this third phase, the stock of FDI not only surpassed that of FPI, with one exception in 2009, but also grew at higher rates. Table 7 can evidence this change in the behavioral pattern of the stocks:

Table 7 **FPI and FDI stock differences**

Discrimination	Dec /01	Dec /02	Dec /03	Dec /04	Dec /05	Dec /06	Dec /07	Dec /08	Dec /09	Dec /10	Dec /11	Dec /12	Dec /13
FPI-FDI	29.5	34.3	33.0	23.3	50.8	83.6	198.7	-0.2	161.8	-13.9	-94.3	-80.1	-151.4

Source: Banco Central do Brasil. Self-Elaboration.

At the end of Table 6, the accounts that compose the Brazilian foreign debt were grouped, according to their bias of short term (ST GED) or long term (LTGED), and presented according its participation in GED[18]. The evolution of these series is in Figure 6, quarterly valued. The green bars show periods and dimensions in which LTGED/GED exceeded ST GED/GED, while red bars show the opposite:

Figure 6 **Brazilian external debt composition**
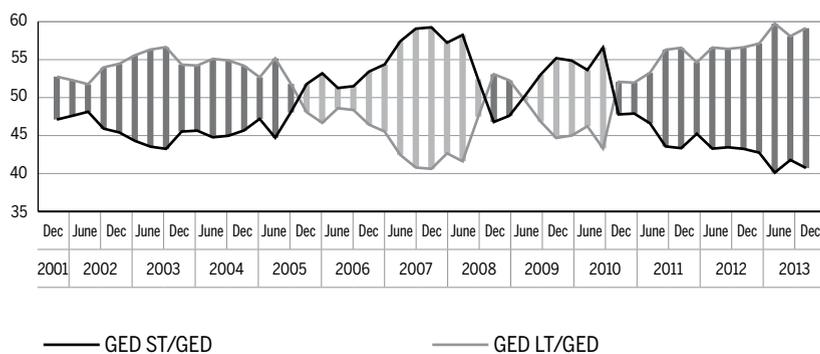
Source: Banco Central do Brasil. Self-Elaboration.

18 STGED accounts are: FPI, derivatives and STOFI. LTGED accounts are: FDI and LTOFI.

Generally, short-term capital participation in GED was higher during the period characterized as euphoria of international markets and strong recovery of Brazilian macroeconomics indexes. On the other side, this participation falls during the period when there is a greater mistrust of those markets on the country, in 2001 and 2002, as well as during the post-crisis scenario of 2008, that was characterized by domestic measures of speculative capital control and by the increasing influx of FDI in the country[19].

With Brazilian GED already described, now presented is the foreign assets item[20] that is relevant for the measuring of the external structural fragility, reserve assets.

Between 2001 and 2005, reserve assets had a small ascendant trajectory, going from US$35.9 billion to US$53.8 billion, a movement strongly accelerated from 2006 on, with the beginning of the aggressive policy of reserve composition. These interventions, motivated by the necessity of diminishing excessive currency volatility and reducing the country's external fragility, resulted in as even-fold increase of the reserves, if compared to 2005, reaching the mark of US$358.8 billion in 2013. Therefore, this item gained, gradually, greater participation in the country's foreign assets, going from 32.9% in 2001 to 54.8% in 2011 and 48% in 2013, as shown in Figure 7. The green bars show periods and the dimension in which the reserves have exceeded other investments in the composition of foreign assets, while red illustrate the opposite.

From equation (7), described in the subsection 2.2.2, Figure 8 shows the evolution of Brazilian structural external fragility, quarterly valued, between 2001 and 2013, and its trend curve.

A first observation of the ratio STGED/Reserve Assets is that, along all time frames, forms of debt with short-term bias exceeded the assets of immediate liquidity. This means that in the event of a severe currency crisis, with the entire liabilities of greater volatility escaping to the exterior, the country would be "uncovered." Thus, in relation to structural external fragility, it is clear that the country has always been in speculative or Ponzi position.

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19 The performance of FDI in the last period served as a major damper to the economy against the contagion effect produced by financial instability in developed countries due to the euro crisis deepening, counterbalancing the unstable trajectory of speculative capital. (Prates; Cunha, 2013).

20 External asset consists of the items: Brazilian direct investment abroad, portfolio investments, other investments, derivatives and reserve assets. In Table 6, the item "investments abroad" is the sum of the first four items, i.e., external assets minus reserve assets.

Figure 7 **Brazilian foreign assets composition**
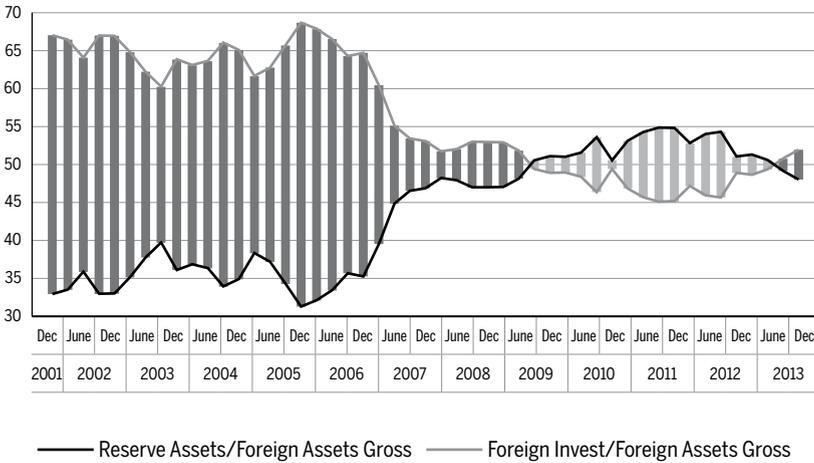
Source: Banco Central do Brasil. Self-Elaboration.

Figure 8 **Structural external fragility of Brazil**
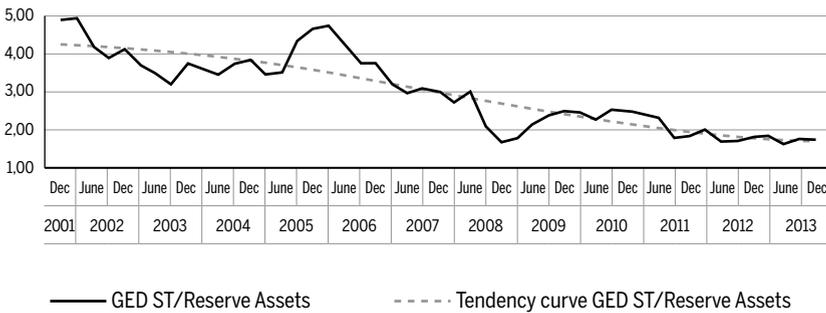
Source: Banco Central do Brasil. Self-Elaboration.

On the other hand, a comparative assessment shows that the structural fragility showed, in general, a sharp downward trend from 66% during the years analyzed. Between 2001 and 2013, although the STGED has grown 3.5 times, foreign exchange reserves increased 10 times. As a result, the ratio plummets from a value of almost 5 in 2001 and 2002 to 1.62 in 2013.

Therefore, despite the insufficiency of the movement to disfigure the speculative or Ponzi position adopted by the Brazilian external sector, the fact is that the latter is structurally less vulnerable in these recent years than it was thirteen years ago.

3.3 External fragility: joint assessment of the operational and structural fragilities and its consequences on the Brazilian external sector

The first index analyzed here is the one proposed in equation (3), which was developed in subsection 2.2. This equation is built for the Brazilian economy, according to Table 8:

Table 8 **BOP information that compose EFFI**

Open Financial Positions	
Real	
M: imports	Imports of goods
D_j: interest expenses	Income Expenses
D_{os}: other services expenses	Services Expenses; Current Unilateral Transfers Expenses; Unilateral Transfer of Capital Expenses
A: amortizations	Amortization of commercial credit – LT suppliers; Amortization IMF; Amortization of others regularization operations; Amortization of others LT loans; Amortization of loans and financing–other LT sectors; Foreign direct investment debt
Virtual	
CST: short-term capitals[1]	Stock of derivatives; Stock of other foreign investments - short-term trade credit; Stock of other foreign investments - short term loans to banks; Stock of other foreign investments - loans to other short-term sectors; Stock of other foreign investment - Currency and deposits
PLA: liquid investment in portfolio[2]	Stock of foreign portfolio investments
Available Resources	
Current Revenue and International Reserves	
X: exports	Exports of goods
R_j: interest revenue	Income Expenses
R_{os}: other services revenue	Services Expenses; Current Unilateral Transfers Expenses; Unilateral Transfer of Capital Expenses
RE: international reserves	Stock of International Reserves – liquidity concept

Loans and Financing of Medium and Long Term	
I_d: foreign currency Direct investments	Credit of foreign direct investment
E_{ml}: medium andlongterm loans	Inflow of commercial credit – LT suppliers; Inflow IMF; Inflow of other regularization operations; Inflow of other LT loans; Inflow of loans and financing – other LT sectors

Source: Banco Central do Brasil. Self-Elaboration.

1 Values from December 2001 on were extracted from the International Position of Brazilian Investment (PII do Brasil). Previous values come from the series "Gross Short-Time External Debt", made available by BCB.

2 Values from December 2011 on were extracted from PII of Brazil. Previous data were calculated from the sum, since 1990, of FPI flows (net) of the BOP.

Figure 9 shows the quarterly evolution of the EFFI between 1999 and 2013 and its trend curve:

Figure 9 **External financial fragility index**

External Financial Fragility Index ----- Tendency curve EFFI
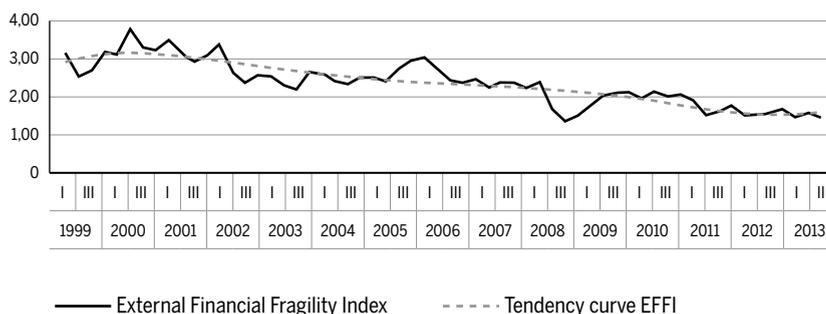
Source: Banco Central do Brasil. Self-Elaboration.

According to Figure 9, EFFI was always over 1 (one), which indicates that real and virtual obligations in foreign currency exceeded the country's payment capacity throughout the entire evaluated time frame. Therefore, Brazil has always depended on refinancing in the external markets to fulfil a part of its most immediate financial commitments with non-residents, assuming, hence, a speculative or *Ponzi* position.

On the other hand, it appears that the external fragility followed, generally, a downward path of 61% between 1999 and 2013, ranging from a ratio that went from 3.79, in 2000, to 1.47. Thus, the real and virtual

external obligations of the economy were increasingly being covered by a combination of current income, LT external financing sources and foreign exchange reserves.

According to the EFFI, the Brazilian foreign sector was more vulnerable to destabilizing factors, precisely during the period comprising the two currency crises suffered by the country between 1999 and 2002. At this stage, the high operational imbalances amounted to the worst composition of the external financial structure observed throughout the time frame.

In the next phase, between 2003 and 2007, the external fragility has decreased, being at an intermediate level in respect to the other two periods. This was due to the significant recovery of CA surpluses associated with the fall of the ratio between the stocks of short-term liabilities and assets with immediate liquidity.

Finally, between 2008-2013, the financial structure of the Brazilian external sector was in its least fragile condition of the entire series. While under the operational perspective the fragility has submitted its worst results of all the time frame, under the structural perspective the fragility was the lowest among all the periods, with structural results more than enough to offset the operating deficits.

Assessing the EFFI trend curve, it is evident that its overall downward trend slows in 2012 and stabilizes in 2013, suggesting that it should remain more or less stable, that is, with values hovering around 1.5, over the coming years in the short term.

Thus, if the fragility of the external sector followed a downward path, then the balance of the BOP was reached gradually with greater ease. The most robust external financial structure resulted in increased credibility of the economy with international markets, better return expectations of applied investments and greater optimism about its ability to remain solvent. Therefore, there was an increase in supply of external financing available to the country, which facilitated the closure of BOP accounts. As a result of better financing conditions, BOP instabilities became gradually less likely and frequent, as well as their real and financial consequences being lower.

The second index built in this subsection seeks to evaluate the interpretation developed in the previous paragraph. Its calculation is made from equation (4), developed in subsection 2.2. BOP accounts in Brazil that compose the current EFFI are listed in Table 9:

Table 9 **BOP information that compose current EFFI**

Current demand for foreign currency (DECME)	Current availability of foreign currency (DICME)
Imports of goods	Exports of goods
Services expenses	Services revenues
Income expenses	Income revenues
Current unilateral transfers expenses	Current unilateral transfers revenues
Unilateral capital transfers expenses	Unilateral capital transfers revenues
Debt with Brazilian direct investment	Credit with Brazilian direct investment
Debt with foreign direct investment	Credit with foreign direct investment
Brazilian portfolio investment application	Brazilian portfolio investment return
Debt with foreign portfolio investment	Credit with foreign portfolio investment
Derivatives - liabilities (net)	Derivatives - assets (net)
Disbursement with LT loans and financing	Amortization received from LT loans and financing
Other LT and ST liabilities (net)	Other LT and ST assets (net)
Commercial credit – LT Suppliers - Amortization	Commercial credit – LT Suppliers - Inflow
IMF – Amortization	IMF – Inflow
Other regularization operations - Amortization	Other regularization operations – Inflow
Other LT loans – Amortization	Other LT loans– Inflow
Loans and financing - other LT sectors - Amortization	Loans and financing - other LT sectors - Inflow

Source: Banco Central do Brasil. Self-Elaboration.

Figure 10 shows results of current EFFI applied to Brazilian economy:

Figure 10 **Current external financial fragility index**
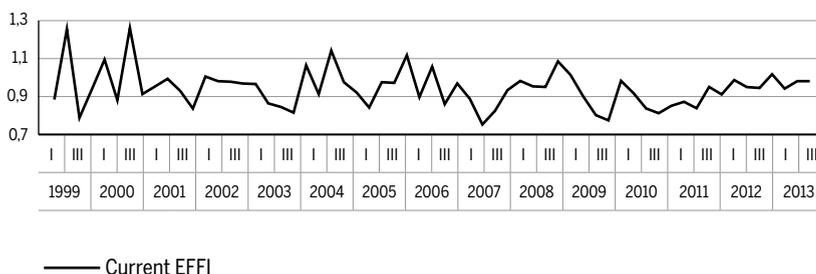
Source: Banco Central do Brasil. Self-Elaboration.

The results of the oscillation amplitudes indicate that the BOP flows have had, over the years, less and less frequent levels of instability, while the

average values of the current EFFI show that the average availability of foreign capital was gradually higher than demand. Both findings are highlighted in Table 10, by calculating the standard deviation and the average current EFFI for each period:

Table 10 **Current EFFI – Standard deviation and average values**

Period	1999-2002	2003-2007	2008-2013
Standard Deviation	0.128	0.104	0.077
Current Average EFFI	0.984	0.931	0.926

Source: Banco Central do Brasil. Self-Elaboration.

The reduction of extreme values of Figure 10 over the three phases is another parameter for evaluating that domestic and/or international shocks have produced, with the passage of time, capital leakage to the exterior, that were diminishing in intensity, possibly triggering less damage effects to the economy. Table 11 compares the highest peaks of current EFFI in each period and points to their main generator event:

Table 11 **Current EFFI – Extreme values per period**

Period	1999-2002	2003-2007	2008-2012
Triggering Factor	1999 Brazilian and 2000 Argentine Crises	Pay Foreign debt IMF 2004	International Financial Crisis 2008
Current EFFI	1.254 and 1.259	1.141	1.085

Source: Banco Central do Brasil. Self-Elaboration.

Therefore, current EFFI results converge with the conclusions developed from the first EFFI on the gradual reduction of Brazilian external fragility between 1999 and 2013.

4 **Concluding remarks**

In this work, we sought to accomplish two goals. The first was to develop an interpretation to open economies of the financial fragility hypothesis of Minsky on the generating process of currency crises and its determinants. From that, indexes were devised to evaluate the propensity of an economy to suffer a currency crisis.

We argued that currency crises are products of changes in international financing conditions responsible for the mismatch between supply and demand of foreign currency in the BOP of a country. Admitting money supply as endogenously determined in foreign markets, its variation depends on the expectations of foreign investors about the profit opportunities offered by the economy and the solvency condition of its external sector, both conditioned by their external financial structure. Thus, its operational and structural deterioration, which are necessarily evaluated jointly, is the factor responsible for raising the level of external fragility of a country and thus its propensity to crises.

Our contribution to the literature on currency crisis sought to demonstrate the importance of a comprehensive analysis in the investigation of external fragility on countries. We sought to highlight the insufficient character of those studies that focus exclusively on the operating results of the BOP, particularly on the CA balances, or only on the composition of foreign debt, understood in isolation. For this work, the resilience of the external sector to disruptive events depends on the combination of both factors and their relationship to the foreign assets and the country's safety margins.

This interpretation associated with the set of indicators developed was used to fulfill the second goal proposed by this research, which sought to evaluate the evolution of external fragility of the Brazilian economy between 1999 and 2013.

Overall, the results suggest that the Brazilian external fragility followed a downward path, falling by half over the estimated time frame. The key element to support this view was the performance of foreign exchange reserves, which, between 1999 and 2013, grew much more rapidly than the operating deficits of the BOP and short-term and high volatility external liabilities. A second contributing factor was the significant inflow of FDI in the country, especially from 2006, reducing the need to attract speculative capital to ensure the closure of its external accounts. Additionally, one should take into account the set of regulatory measures implemented by the government after the international crisis of 2008 to discourage the inflow of FPI.

Finally, the analysis of the trend curve of external fragility in recent years suggests the end of his long downward trend and the beginning of a stable trajectory, at least for the next few years in the short term.

Theoretical and empirical results of this research are considered satisfactory, because they were able to explain the behavior of the Brazilian external sector in a convergent way to the main events that have affected it between 1999 and 2013, in particular the currency crisis of 1999 and 2001 and the unprecedented resistance capacity of the country to the international financial crisis of 2008. In addition, the interpretation developed here and applied to the Brazilian economy is in line with the traditional indicators of foreign debt and the ratings and perspectives of foreign markets for the country, expressed by the risk-Brazil and the rating set by international credit agencies, all signaling a trend of reduction in external vulnerability.

Despite the convergence with traditional external indicators, considered insufficient by studies of critical aspects, our analysis method is not restricted to cyclical or short-term aspects of the country and its external sector. Instead, it has considered the structural and long-term features of an economy, which, according to the defenders of their importance to the analysis of external fragility, manifest themselves on national foreign accounts by the tendency to imbalances in CA and the deterioration of composition of its foreign debts and assets.

In this sense, if the deficiencies on the Brazilian economic structure produce a tendency to flow and stock imbalances of its BOP, as argued by those authors dedicated to the structural issue, then the results of this research sought to show that between 1999 and 2013, this trend was not expressed in sufficient intensity to destroy the safety margins of the country's external sector and increase its external fragility.

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Appendix

Appendix A

Table A1 **Data used for calculating external operational fragility measures – US$ Million**

Period	NX	r^{FA}FA	UT	r^{FD}FD	MD	Other Debts Financial Account	NFD	Foreign Finan- cing
1999 T1	-1988	712	479	4690	23319	2159	194446	20886
1999 T2	-1631	870	415	6767	18857	541	201559	37216
1999 T3	-2052	881	400	4158	13692	1308	206489	21120
1999 T4	-2505	1472	395	7167	22955	5190	214294	27735
2000 T1	-1392	1152	348	4094	12875	185	218280	22329
2000 T2	-1014	723	387	7089	22741	960	225273	20449
2000 T3	-1689	952	362	3990	19516	3197	229637	31583
2000 T4	-3765	793	424	6334	11827	2851	238519	23349
2001 T1	-2530	823	389	5350	12927	909	245187	20642
2001 T2	-1584	1019	389	6497	14947	249	251860	22993
2001 T3	-639	733	406	4592	10273	4790	255953	22456
2001 T4	-355	705	453	6583	14301	739	261734	17754
2002 T1	-64	885	366	4435	9991	803	270505	15115
2002 T2	13	517	557	6233	17962	1864	246354	24903
2002 T3	4041	921	699	4663	14429	3377	207752	16695
2002 T4	4173	974	768	6155	14408	950	227200	16544
2003 T1	3045	921	616	4418	8587	1452	233877	14118
2003 T2	5127	653	611	5957	17303	901	253825	24101
2003 T3	5978	903	879	4445	14221	1100	255282	19132
2003 T4	5713	862	760	7071	20950	5891	267509	17916
2004 T1	5491	760	738	5352	12027	1433	265478	14278
2004 T2	7671	779	845	6555	19251	1197	245244	11963
2004 T3	8700	674	772	4854	14262	8637	263323	19064
2004 T4	7101	986	880	6959	16722	3932	291607	20483
2005 T1	7128	750	838	6060	12566	1249	291515	19043
2005 T2	8965	859	845	8076	18730	410	306940	19878
2005 T3	10754	756	916	6755	32523	7067	345845	30235
2005 T4	9548	830	959	8270	39248	46	309495	28999

Period	NX	r^FAFA	UT	r^FDFD	MD	Other Debts Financial Account	NFD	Foreign Financing
2006 T1	7606	1327	943	8252	28568	8660	345324	38716
2006 T2	7730	2295	1094	9970	39452	2317	333489	35475
2006 T3	11832	1382	1175	6886	22468	7009	327469	31329
2006 T4	9649	1457	1095	8833	31917	21754	360011	54307
2007 T1	6005	2013	961	8738	39404	3096	370027	48987
2007 T2	8561	2989	983	10352	42735	12397	427789	69677
2007 T3	6940	2934	1015	9763	45847	5889	496520	68747
2007 T4	5308	3557	1071	11931	67117	4043	530844	90442
2008 T1	-561	2934	987	13620	69276	4625	514654	88116
2008 T2	3720	3396	899	14626	82857	6193	615184	101934
2008 T3	3565	2556	985	13118	85787	12591	394419	108600
2008 T4	1422	3626	1353	11709	66075	2222	275312	63452
2009 T1	150	2436	862	8386	40065	337	305510	42371
2009 T2	5643	2254	802	10938	49453	10778	436213	63312
2009 T3	1971	1900	924	9679	53138	4086	554002	78372
2009 T4	-1720	2236	750	13507	50289	4238	608001	87128
2010 T1	-5045	1571	769	9211	33920	8669	610800	54794
2010 T2	-606	1553	794	13644	39992	12303	583475	64496
2010 T3	-3807	1910	672	10308	36870	12043	715625	69793
2010 T4	-1229	2372	667	13729	44778	25070	936819	101420
2011 T1	-4573	2603	892	13703	39055	8906	1006177	66853
2011 T2	-468	3155	684	14633	54278	16396	1041994	83103
2011 T3	30	2426	713	13801	40335	13193	797159	75086
2011 T4	-3128	2568	696	15936	39494	6764	844454	61527
2012 T1	-6951	3008	692	8813	44101	1511	919072	69222
2012 T2	-5568	4392	754	12765	47689	4595	751877	62756
2012 T3	-1243	1756	673	10084	41042	13362	788406	66531
2012 T4	-7885	1732	727	14673	53148	13359	825637	81405
2013 T1	-15648	1496	896	11509	42787	5839	871673	69079
2013 T2	-9420	1961	645	11726	77348	8117	754545	100686
2013 T3	-11354	5248	676	11683	73375	18435	790551	100630
2013 T4	-8544	1366	1147	14926	76273	16599	764022	101259

Source: Banco Central do Brasil. Self-Elaboration.

Appendix B

Table A2 **Data used for calculating external structural fragility measures – US$ Million**

Period	STGED	Reserve Assets	Period	STGED	Reserve Assets
2001 T4	174880	35 866	2008 T1	526561	195 232
2002 T1	181175	36 721	2008 T2	602880	200 827
2002 T2	175135	41 999	2008 T3	437297	206 494
2002 T3	149039	38 381	2008 T4	322230	193 783
2002 T4	155463	37 823	2009 T1	338426	190 388
2003 T1	157242	42 335	2009 T2	429940	201 467
2003 T2	166159	47 956	2009 T3	526655	221 629
2003 T3	168020	52 675	2009 T4	593692	238 520
2003 T4	184287	49 296	2010 T1	597745	243 762
2004 T1	185340	51 612	2010 T2	576678	253 114
2004 T2	171451	49 805	2010 T3	695815	275 206
2004 T3	184381	49 496	2010 T4	721247	288 575
2004 T4	202871	52 935	2011 T1	769041	317 146
2005 T1	214245	61 960	2011 T2	774996	335 775
2005 T2	209601	59 885	2011 T3	626182	349 708
2005 T3	246544	57 008	2011 T4	645231	352 012
2005 T4	249741	53 799	2012 T1	729866	365 216
2006 T1	283090	59 824	2012 T2	626078	373 910
2006 T2	267416	62 670	2012 T3	646738	378 726
2006 T3	274946	73 393	2012 T4	674444	373 147
2006 T4	322822	85 839	2013 T1	687978	376 934
2007 T1	352048	109 531	2013 T2	596682	369 402
2007 T2	434251	147 101	2013 T3	644806	368 654
2007 T3	500455	162 962	2013 T4	616574	358 808
2007 T4	542718	180 334			

Source: Banco Central do Brasil. Self-Elaboration.

Appendix C

Table A3 **Data used for calculating EFFI - US$ Million**

Período	M	D_j	D_{os}	A	CST	PLA	X	R_i	R_{os}	RE	I_d	E_{ml}	EFFI
1999 T1	10861	4690	3018	9798	23783	140692	10045	712	2447	33848	9068	5317	3.139
1999 T2	12206	6767	3431	9770	23088	146112	12406	870	2089	41346	7616	15093	2.536
1999 T3	12731	4158	3740	8273	23634	146343	12581	881	2315	42562	10650	4820	2.695
1999 T4	13412	7167	4283	15650	27392	151255	12979	1472	2673	36342	8920	6598	3.177
2000 T1	12067	4094	3564	5707	27444	154605	12048	1152	2612	39200	8192	3618	3.105
2000 T2	13300	7089	4053	16915	27287	155857	14105	723	2694	28265	7961	5409	3.795
2000 T3	15356	3990	4514	7466	29325	159576	15246	952	3360	31431	11734	4080	3.297
2000 T4	15061	6334	4863	6707	27420	159906	13687	793	2960	33011	12404	5495	3.223
2001 T1	14467	5350	4432	6073	27243	162788	13788	823	3046	34407	6537	4369	3.499
2001 T2	14527	6497	4558	5537	26937	161994	15139	1019	2819	37318	6962	7415	3.114
2001 T3	14115	4592	4086	6174	27064	164152	15447	733	2596	40054	7484	8715	2.935
2001 T4	12463	6583	4667	6039	23402	151477	13849	705	3122	35866	9034	3832	3.081
2002 T1	10863	4435	3756	5918	24615	156560	11891	885	3108	36721	6233	2148	3.380
2002 T2	11603	6233	3783	11367	28811	146323	13161	517	2891	41999	7234	12498	2.658
2002 T3	13200	4663	3596	8050	21736	127304	18466	921	3191	38381	6518	7522	2.381
2002 T4	11575	6155	3643	8306	20316	135147	16844	974	3434	37824	6476	6276	2.578
2003 T1	11240	4418	3442	5498	20135	137108	15045	921	3390	42335	3688	6261	2.538
2003 T2	11364	5957	3925	12617	18459	147701	17957	653	3187	47956	4114	12386	2.319
2003 T3	12396	4445	3975	7041	16541	151479	19788	903	3570	52675	5185	7112	2.195
2003 T4	13290	7071	4339	13687	18510	165777	20294	862	3967	49296	6250	2924	2.664

Período	M	D_l	D_{os}	A	CST	PLA	X	R_l	R_{os}	RE	I_d	E_{ml}	EFFI
2004 T1	13324	5352	3841	6125	18199	167140	19448	760	4146	51612	4064	1858	2.613
2004 T2	14996	6555	4168	8070	18598	152853	23858	779	4038	49805	3295	3098	2.418
2004 T3	16906	4854	4734	6706	17685	166695	26972	674	3933	49496	10515	1501	2.337
2004 T4	17609	6959	5258	6750	18281	184590	26197	986	4812	52935	7926	2916	2.500
2005 T1	16151	6060	5225	5966	20224	194020	24451	750	5070	61960	5167	1426	2.506
2005 T2	17877	8076	6121	7184	15425	194177	29226	859	4801	59885	6975	1662	2.407
2005 T3	20068	6755	6246	13815	16266	230278	33042	756	5131	57008	9382	1847	2.738
2005 T4	19509	8270	7500	23380	17574	232167	31589	830	6002	53799	8538	3781	2.950
2006 T1	20130	8252	6661	6234	16208	266881	29458	1327	6075	59825	6581	3562	3.036
2006 T2	21394	9970	6991	7799	15258	252159	31599	2295	5846	62671	7589	4200	2.746
2006 T3	25218	6886	7916	5131	16084	258862	39900	1382	6434	73393	7731	2816	2.431
2006 T4	24609	8833	8304	12949	18580	304242	36851	1457	7050	85839	10499	17482	2.372
2007 T1	25275	8738	8744	10936	31567	320481	34002	2013	7187	109531	9205	2234	2.471
2007 T2	27355	10352	8983	8324	41736	392515	39212	2989	6795	147101	17920	2247	2.262
2007 T3	33025	9763	9638	5655	38577	461878	43385	2934	7453	162962	10473	6353	2.391
2007 T4	34962	11931	11084	8365	34341	508377	44050	3557	8565	180334	12635	6859	2.379
2008 T1	35929	13620	11008	7025	34557	492004	38690	2934	8842	195232	13902	5767	2.239
2008 T2	43414	14626	12172	8182	37135	565745	51955	3396	8448	200827	13737	6435	2.392
2008 T3	51860	13118	13388	8859	43325	393972	60215	2556	9889	207494	20260	7728	1.702
2008 T4	41904	11709	12116	12702	34732	287499	47082	3626	10070	206806	23937	3875	1.356
2009 T1	28189	8386	9925	9377	33352	305073	31178	2436	8288	202460	12035	3180	1.519

Período	M	D_j	D_{os}	A	CST	PLA	X	R_j	R_{os}	RE	I_d	E_{ml}	EFFI
2009 T2	27854	10938	11704	8137	35820	394120	38774	2254	7470	208425	11239	4963	1.789
2009 T3	34572	9679	12720	11601	36651	490004	41846	1900	8546	224213	12314	4090	2.032
2009 T4	37090	13507	14323	15537	31082	562610	41197	2236	9588	239054	17919	10992	2.100
2010 T1	38349	9211	14125	8194	36054	561691	39230	1571	9204	243953	10320	9419	2.128
2010 T2	42958	13644	15156	13348	46344	530334	49958	1553	8600	253114	15743	8272	1.962
2010 T3	50937	10308	16644	13477	55418	640397	55742	1910	8982	275206	18858	7487	2.138
2010 T4	49524	13729	18687	13227	52753	668494	56986	2372	10993	288575	33723	11573	2.020
2011 T1	48091	13703	17397	10969	52848	716192	51233	2603	10863	317146	22208	10796	2.071
2011 T2	57260	14633	19966	21449	56505	718491	67071	3155	10765	335776	27272	16330	1.930
2011 T3	61587	13801	20449	16251	48962	577220	71695	2426	11519	349708	28383	19124	1.529
2011 T4	59309	15936	20733	14574	44402	600829	66041	2568	12031	352012	23856	10228	1.619
2012 T1	52661	8813	19908	8990	41187	688679	55079	3008	11604	365216	18651	7983	1.777
2012 T2	57494	12765	20714	10434	40115	585963	62133	4392	11787	373910	19015	6456	1.523
2012 T3	54745	10084	23665	8059	40714	606024	63383	1756	11214	378726	20649	8106	1.536
2012 T4	58284	14673	22356	19780	35650	638794	61984	1732	11893	378614	25941	17864	1.585
2013 T1	55993	11509	21077	8604	49127	638851	50837	1496	11757	376934	16074	9976	1.681
2013 T2	61506	11726	21951	17833	37974	558708	63588	1961	11472	371109	21904	10187	1.478
2013 T3	61761	11683	22429	22368	38211	606594	63226	5248	10549	376040	19508	11682	1.569
2013 T4	60360	14926	23732	18170	38988	577586	64528	1366	12425	375794	28931	15842	1.471

Source: Banco Central do Brasil. Self-Elaboration.

Appendix D

Table A4 **Data used for calculating Current EF**

Period	Σ DECME (US$ Million)	Σ DICME (US$ Million)	Current EFFI = Σ DECME/ Σ DICM
1998 T4	48441	54800	0.884
1999 T1	46314	36936	1.254
1999 T2	42641	54110	0.788
1999 T3	35048	37297	0.940
1999 T4	49948	45658	1.094
2000 T1	33903	38495	0.881
2000 T2	48217	38278	1.260
2000 T3	48713	53388	0.912
2000 T4	39775	41765	0.952
2001 T1	39199	39486	0.993
2001 T2	42777	46007	0.930
2001 T3	35333	42247	0.836
2001 T4	40559	40372	1.005
2002 T1	31296	31909	0.981
2002 T2	41491	42436	0.978
2002 T3	39101	40393	0.968
2002 T4	37564	38902	0.966
2003 T1	29503	34152	0.864
2003 T2	40210	47616	0.845
2003 T3	36971	45382	0.815
2003 T4	47311	44478	1.064
2004 T1	36383	39856	0.913
2004 T2	47830	41910	1.141
2004 T3	51663	52973	0.975
2004 T4	50340	54668	0.921
2005 T1	43257	51405	0.842
2005 T2	54674	56070	0.975
2005 T3	68523	70511	0.972
2005 T4	77806	69662	1.117
2006 T1	69695	77722	0.897
2006 T2	82654	78237	1.057
2006 T3	69643	81013	0.860

Period	Σ DECME (US$ Million)	Σ DICME (US$ Million)	Current EFFI = Σ DECME/ Σ DICM
2006 T4	97855	101020	0.969
2007 T1	89587	100921	0.888
2007 T2	93753	124484	0.753
2007 T3	107145	130062	0.824
2007 T4	144758	155081	0.933
2008 T1	139477	142108	0.982
2008 T2	162960	170993	0.953
2008 T3	178205	187526	0.950
2008 T4	142613	131452	1.085
2009 T1	90246	89085	1.013
2009 T2	108041	119875	0.901
2009 T3	111212	138663	0.802
2009 T4	120262	155283	0.775
2010 T1	107750	109700	0.982
2010 T2	121144	132075	0.917
2010 T3	122742	146641	0.837
2010 T4	148285	182613	0.812
2011 T1	135067	158818	0.851
2011 T2	154976	177666	0.872
2011 T3	141319	168614	0.838
2011 T4	143965	151522	0.950
2012 T1	135828	149123	0.911
2012 T2	147479	149541	0.986
2012 T3	135915	143165	0.949
2012 T4	157783	167054	0.945
2013 T1	141957	139593	1.017
2013 T2	187392	199152	0.941
2013 T3	181556	185160	0.981
2013 T4	182731	186411	0.980

Source: Banco Central do Brasil. Self-Elaboration.