Flow-of-Funds Analysis in Brazilian Economy

Abstract

The purpose of this paper is to investigate financial system in Brailian economy and its effect on objective economy. The Flow-of-Funds (FOF) framework proposed by Tsujimura and Mizoshita (2003a) is applied to Brazilian economy. We present the compilation process of asset-liability-matrix (ALM) and the ALM developed to Brazilian economy with 6 institutional sectors (household, non financial firms, government, rest of world, financial firm and Central Bank of Brazil) in the liability side and in the asset side, to the years from 2004 to 2009 and from 2009 to 2014. The two periods are defined because of availability of different data-source. From Brazilian ALM, FOF indexes are calculated (power of dispersion, sensibility of dispersion and discrepancy of dispersion). Structural decomposition of change in the discrepancy index is made for selected years (2008, 2009 and 2010) and an additional expansion presents an ALM with 4 additional financial firms, three government-sponsored banks: Banco do Brasil (BB), Caixa Econômica Federal (CEF), Banco Nacional de Desenvolvimento Econômico e Social (BNDES); one private bank (Itau - the largest private bank in Brazil). From flow-of-funds indexes we could illustrate the role of each institutional sector in the Brazilian financial system, we could highlight that the discrepancy of dispersion can be a good indicator to economic problems and the cause of recession origins both in the structure of financial system as well in the behavior of agents in objective economy.

Key-word: flow-of-funds, financial crisis, Brazilian economy, asset-liability-matrix, input-output.

1. Introduction

Recent financial crises have shown that shocks in financial markets trigger significant effects on the real side of the economy. Brazilian economy suffered at least 2 periods of recession in last decade reflected with a decrease in the total Gross Domestic Product (GDP) in the years 2009 and 2014 (IBGE, 2017). It is not a coincidence that the previous year of each one, had show high dispersion between asset and liability discrepancy.

According to Tsujimura and Tsujimura (2010), the Flow-of-Funds (FOF) analyses captures the relationships between the financial side and the objective economy, thus can give us a clue to the generation mechanism of financial bubbles.

With this kind of account we can have a notion about the relation between financial and objective economy. This is the peculiar feature of Flow of Funds Analysis. Since excess assets in the financial account represent excess saving in the current account and excess liabilities in the financial account represent excess investments in the current account. Thereafter, the sequence of the accounts is not one-way relation but it consists of a loop. This loop explains the feedback process between real and financial markets.

The FOF framework is originated from Copland (1952) money flow. From Four Entry System we can extract Asset-Table and Liability-Table to derive Asset-liability-matrix (ALM). ALM is a sector by sector square matrix, so we can apply input-output (IO) methodology to extract information about financial market. However, one of the leading peculiarities of the FOF analysis is that two distinct sector by sector ALM can be derived from a set of balance sheets. The first one describe the propagation process of fund raising (liability side) while the other one, according to describe the fund employment (asset side). According to Tsujimura and Mizoshita (2004), when there are discrepancies in the valuation of assets and liabilities, the magnitude of the dispersion could be different in one system from another. This magnitude will give us a clue to the generation mechanism of financial bubbles.

We will present the details of compilation process of asset-liability-matrix (ALM) to Brazilian economy from 2004 to 2014. We developed ALM to Brazilian economy with 6 institutional sectors (household, non financial firms, government, Rest

of World, financial firm and Central Bank of Brazil) in the liability side and in the asset side, to the years from 2004 to 2009 and from 2009 to 2014. The two periods are defined because of availability of different data-source. To the period of 2004 to 2009, data came from IBGE and BCB; to the period of 2009 to 2014, data came from OECD and BCB.

We calculate the Leontief inverse from ALM in the both sides, and extract 4 Flow-of-Funds indexes, analogous to forward and backward linkages in IO. From these indexes we could observe the role of each institutional sector and its fluctuation in the financial market.

We calculate the discrepancy of dispersion and we could observe that the year of a high decline in the GDP in the objective economy (2009, 2014) were preceded for a year with a high increase in the difference of ALM total sum between the asset and liability side (2008 and 2013) and that this great increase in discrepancy is concomitant of an increase in the interest rate controlled by monetary authority. Figure 1 plots the observed SELIC (interest rate), Discrepancy of dispersion and GDP fluctuation between 2004 and 2009.

Figure 1: Fluctuation of SELIC, Discrepancy and GDP, Brazil, 2004 to 2009.
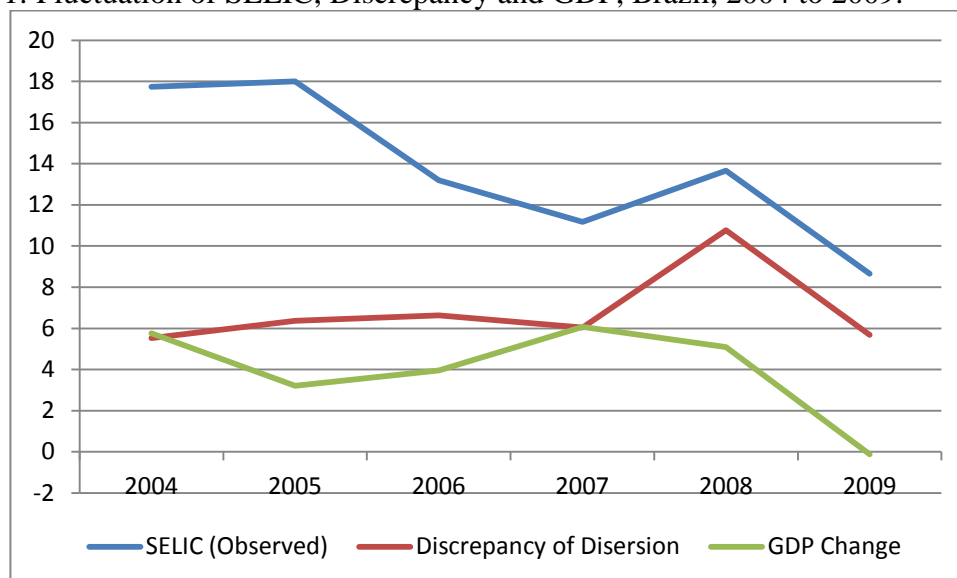
Source: BCB (2017), IBGE (2017) and authors data.

We decompose the total sum of FOF in the years which presented highest difference between ALM total sum in the asset and liability side (2007 to 2008, 2008 to 2009; 2009 to 2010) to access the contribution from financial structure and contribution

from objective economy to total change in discrepancy. Moreover we developed an expanded ALM to include some important financial institutions to have a wide view of Brazilian financial system in 2009.

The novelty of the research is to apply FOF framework to Brazilian economy and corroborate de idea that FOF can be a useful tool of preview economic recession.

Beyond this introduction, the paper presents the flow-of-funds analysis, including the methodology to develop ALM, to calculate the indexes and the structural decomposition analysis. Then we present the methodology of empirical analysis, Brazilian data and the results.

2. Flow-of-Funds

The Flow-of-Funds analysis was stimulated by the four entries system proposed by Copeland (1952). Called "System of Money Flow", the four entry system intended to presents financial transactions using a table that records financial assets and liabilities, organized with financial instruments in the row, held by each institutional sector located in the column (to each agent there are 2 columns: one to assets and other to liabilities). It is possible to visualize the total of assets, the total of liabilities, and the excess of assets and liabilities of institutional sectors and of wide economy.

Since all financial transactions occur between, at least, two agents and from management accountability all asset (liability) mutation needs a liability (asset) mutation in the same amount, so financial transactions are registered in four accounts. Figure 2 represents the Copland´s Quadruply-Entry-System using financial assets and liabilities of Brazilian institutional sectors in the year 2004.

The Copeland´s four entry system evidences solely the **financial** assets and liability. Since the Balance Sheet from business accounting method of any entity represent all of his assets (financial and fixed) and liabilities (required and equity) with a double entry, the excess of financial assets and excess of liabilities in the flow-of-funds accounts, represent respectively excess of savings and excess of investments in the current account. In this way, the FOF analysis can evidence linkages between objective economy (production, income, gross fixed capital formation and saving) with financial economy (allocation of excess savings in financial asset and liability portfolio to finance excess investment).

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The Flow-of-funds analysis evolves the application of the Input-Output (IO) Methodology to square matrixes sector-by-sector (institutional sectors), which represent the financial assets and liabilities transacted between institutional sectors, the Asset-Liability-Matrix (ALM). The ALM behaves as an IO matrix, however, intermediate consumption refers to funds (financial assets and liabilities) rather than goods and services. The IO matrix shows the demand (input) and the supply (output) of goods, services and factors of production (intermediate production flow), while the ALM shows the supply and demand of financial assets and liabilities (we should call "intermediate financial flow").

Although there are "two sides of the coin": assets and liabilities represent counterparts of the same accounting entry, however the changes of assets and liabilities have distinct origins and effects. This is one of the most important properties of Flow-of-funds analysis (TSUJIMURA and MIZOSHITA, 2003b).

Table 1: Representation of Quadruply-Entry-System to Brazilian Economy, 2004 (R$ 1.000.000).

Institutional Sectors	Financial Firms		Central Bank		Enterprises		Governement		Household		ROW		Total (Instruments)	
Instruments	ASSET	LIABILITY	ASSET	LIABILITY	ASSET	LIABILITY	ASSET	LIABILITY	ASSET	LIABILITY	ASSET	LIABILITY	ASSET	LIABILITY
Cash and Depósits	227228	864157	76836	179795	206243	0	381815	0	228661	0	7824	84655	1128607	1128607
Bonds	942146	340188	384828	13644	100487	112963	40952	1228089	46959	0	281205	101693	1796578	1796578
Loans	819069	264712	22869	228167	110422	461218	461639	518530	9514	193655	244521	1752	1668034	1668034
Shares	814491	1336120	0	0	1220302	1765791	219413	0	411859	0	588038	152192	3254102	3254102
Tecnichal Insurance	1481	316383	0	3831	4932	0	142	0	312953	0	706	0	320214	320214
Other Deb./Credit	293387	347769	110	677	735382	1196085	724958	233824	357063	346889	62465	48122	2173366	2173366
Difference	371528	0	0	58529	1158289	0	151522	0	0	826466	0	796345	1681339	1681339
Total (Sector)	3469329	3469329	484643	484643	3536057	3536057	1980442	1980442	1367009	1367009	1184760	1184760	12022240	12022240

Source: Elaborated by authors from Financial Balance Sheet of Brazil (2011) and Balance Sheet of Central Bank of Brazil (2004).

In Table 2, we can see the inter-relation between the flow of financial assets and liabilities in the economy. It represents the quadruple entry system proposed by Copeland (1949). We can see the financial transactions within each agent and the transactions occurred between all of them. We can see the vertical double entry that ensures the internal consistency within an institutional unit, look that in the last row in table 1 we can observe that there are consistence for each one individually (Total asset + excess liability = Total liability + excess assets to each institutional sector).

Since each financial transaction evolves at least two different agents, creditor and debtor, we can also see the horizontal double entry that assures the inter-consistency between institutional units. In the two last column in table 1, we can see that the consistence is maintained throughout the financial market (total asset = total liability and total excess = total assets to the total of the economy).

2.1 E & R-Table

To develop the ALM and analyze the structure of financial flows is necessary first obtaining the Asset-Table and the Liability-Table.

The Asset-Table is composed by one matrix (E-Matrix) with various assets negotiated by various sectors and by additional vectors, which represent the excess of liabilities in relation to the assets and the total by instrument and total by sector.

Where n is the number of financial instruments and m is the number of institutional sectors, the equation 1 expresses the elements contained in the Table of Assets (TSUJIMURA & MISOSHITA, 2003a):

$$E = \begin{bmatrix} e_{11} & e_{12} & \cdots & e_{1m} \\ e_{21} & e_{22} & \cdots & e_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ e_{n1} & e_{n2} & \cdots & e_{nm} \end{bmatrix} \quad \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_m \end{bmatrix} \quad S^E = \begin{bmatrix} s_1^E \\ s_2^E \\ \vdots \\ s_n^E \end{bmatrix} \quad z = \begin{bmatrix} z_1 \\ z_2 \\ \vdots \\ z_m \end{bmatrix} \tag{E.1}$$

Where:

e_{ij} = amount of funds allocated to i-th financial instrument by the j-th institutional sector.

ε_j = excess of liabilities in the j-th sector = total Liability minus total Asset to each sector, if the difference is positive; and zero, if the difference is negative. If the total of assets is bigger than of liability, there is not excess of liabilities;

s_i^E = total of financial instruments i in terms of assets;

z_j = total sum of assets or liabilities of sector j, which is bigger. Sum the total of assets and the excess of liabilities to each agent;

Similarly, the Liability-Table consists of a matrix (R-Matrix) which presents the quantity of funds obtained from financial liabilities by the institutional sectors and additional vectors: excess of assets in relation to the liabilities and the totals by instrument and by sector. The elements of the Liability-Table are expressed in the equation 2:

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1m} \\ r_{21} & r_{22} & \cdots & r_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ r_{n1} & r_{n2} & \cdots & r_{nm} \end{bmatrix} \quad \rho = \begin{bmatrix} \rho_1 \\ \rho_2 \\ \vdots \\ \rho_m \end{bmatrix} \quad S^R = \begin{bmatrix} s_1^R \\ s_2^R \\ \vdots \\ s_n^R \end{bmatrix} \quad z = \begin{bmatrix} z_1 \\ z_2 \\ \vdots \\ z_m \end{bmatrix} \tag{E.2}$$

Where:

r_{ij} = quantity of collected funds by the j-th institutional sector via i-th financial instrument;

ρ_j = excess of assets in the sector j;

s_i^R = total quantity of each financial instrument in terms of liabilities;

z_j = sum of assets or liabilities of sector j, which is bigger;

2.2 ALM in the liability-oriented & asset-oriented system

From Flow-of-Funds analysis to develop the Asset-Liability-Matrix (ALM), these two presented Tables: Table of Assets (E) and Table of Liabilities (R) are combined to make two ALM. One is the ALM in the liability-oriented system or fund raising (Y), and the other is the ALM in the asset-oriented system or fund employment (ALM* = Y*).

The Make and Use of the E and R tables (specified in the equations 1 and 2, respectively) are expressed in percentage (column share), to generate two matrixes of technical coefficients.

In the liability-oriented system, we define the matrixes B and D. The matrix B is the matrix of technical coefficients of "Use" (use of liabilities) can be expressed by the equation 3 and the Matrix D is the matrix of technical coefficients of "Make" (resources of liabilities = assets), can be expressed by the equation 4:

$$b_{ij} = r_{ij}/z_j \qquad\qquad (E.3)$$

$$d_{ji} = \frac{e'_{ij}}{s_i^E} \qquad\qquad (E.4)$$

Using the "portfolio assumption of the institutional sector" we define the matrix C, where C = DB. C is a square matrix formed by technical coefficients, which indicate in proportional terms, the quantity of funds that the sector j (sector located in the column) obtains from the sector i (sector located in the line).

The "portfolio assumption of the institutional sector" corresponds to the "technology based in the industry" in the IO methodology, while the "portfolio assumption of financial sector" corresponds to the "technology based on product".

The "technology based in the industry" reflects an industry always producing with the same structure of production whatever is the type of product. In the FOF analysis, it means that sectors allocate (or raises) funds according to a portfolio of assets (or liabilities) of the same sector.

The "technology based on product" in the IO methodology, indicates that a product has the same structures of inputs in whatever industry it is produced. To the financial flows it would indicate that each financial instrument would have its own portfolio, no matter the institutional sector that was allocating (or raising) funds.

To obtain the matrix of monetary values (effectively the Flow-of-funds matrix), pre-multiplies the matrix C by the vector that represents the total of financial resources moved by the sectors j (z_j), coming up with the matrix Y, Flow-of-funds matrix or asset-liability-matrix in the liability-oriented system, as can be expressed in equation 5:

$$Y = \begin{bmatrix} y_{11} & \cdots & y_{1m} \\ \vdots & \ddots & \vdots \\ y_{n1} & \cdots & y_{nm} \end{bmatrix} \tag{E.5}$$

Where:

$y_{ij} = c_{ij}z_j$, how many funds the sector i obtains from sector j (in monetary values).

The procedure to obtain the Asset-Liability-Matrix in the asset-oriented system (ALM*), defined as Y*, is similar to described above in the liability-oriented system.

We define, D* and B*, according to what is expressed in equations 6 and 7:

$$d_{ji}{}^* = r'_{ij}/s_i^R \tag{E.6}$$

$$b_{ij}{}^* = e_{ij}/z_j \tag{E.7}$$

Based on the "portfolio assumption of the institutional sector", we define C*=D*B*, to obtain ALM* (Y*), as expressed in equation 8:

$$Y^* = \begin{bmatrix} y_{11}{}^* & \cdots & y_{1m}{}^* \\ \vdots & \ddots & \vdots \\ y_{n1}{}^* & \cdots & y_{nm}{}^* \end{bmatrix} \tag{E.8}$$

Where:

$y_{ij}{}^* = c_{ij}{}^*z_j$, how many funds sector j employs in sector i (in monetary values).

2.3 *Power of dispersion and Sensitivity of dispersion Indexes*

From asset-liability-matrices (Y and Y *), presented in the previous section, we can examine the direct and indirect effect of changes in flow of funds.

When one agent raises new liabilities, for example, when a company obtains new bank loans, there is an increase in financial liabilities of the company and, on the other hand, an increase (of equal value) in financial assets of the other agent, in this case

the bank. This would be the direct effect. To increase their financial investments (increase in banks assets), banks seek new sources of funding (increase in banks liabilities), for example, sell securities to other financial firm, rediscount with the Central Bank. By the way, this operation needs a counterpart, which is registered as an increase on the other agent amount of assets. Therefore, the direct effect of raising liabilities is the increase on bank assets, which will generate another effect on the financial structure of other agents. This is the indirect effect.

To analyze the direct and indirect effect of the financial transactions of a particular institutional sector we calculate Dispersion indexes from the Leontief inverse of the two ALM (Y e Y*). The four indexes are:

    i)   Power-o- Dispersion Index Fund-Raising;

    ii)   Sensibility-of-Dispersion Index Fund-Raising;

    iii)   Dispersion-Power Index Fund-Employ;

    iv)   Sensibility-of-Dispersion Index Fund-Employ;

To calculate the indexes, we will derive the Leontief inverse of Y and Y*. First, begin from the ALM in the liability-oriented system. The equation 9 establish the relation behind the ALM in matrix notation:

$$C.z + \varepsilon^Y = z \qquad\qquad (E.9)$$

Where:

C = matrix of technical coefficient fund-raising;

Z^Y = vector with sum of assets and liabilities, whichever is greater;

ε^Y = vector of excess of liabilities.

Solving the equation 9 by Z^Y (analog to IO methodology), we find the equation 10:

$$z = (I - C)^{-1}\varepsilon^Y \qquad\qquad (E.\ 10)$$

We can highlight the Leontief inverse for the ALM in the liability-oriented system, expressed by equation 11:

$$\Gamma = (I - C)^{-1} = \begin{bmatrix} \gamma_{11} & \cdots & \gamma_{1m} \\ \vdots & \ddots & \vdots \\ \gamma_{m1} & \cdots & \gamma_{mm} \end{bmatrix} \qquad (E.11)$$

From the Leontief inverse of the ALM in the liability system, we can derive Power-of-dispersion index fund-raising (expressed in the equation 12) and the Sensibility-of-dispersion index fund-raising (expressed in the equation 13):

$$\omega_j^Y = \frac{\sum_{i=1}^{m} \gamma ij}{\frac{1}{m}\sum_{j=1}^{m}\sum_{i=1}^{m} \gamma ij} \qquad (E.12)$$

$$\varphi_j^Y = \frac{\sum_{j=1}^{m} \gamma ji}{\frac{1}{m}\sum_{i=1}^{m}\sum_{j=1}^{m} \gamma ij} \qquad (E.13)$$

Where:

m = is the number of Institutional Sectors;

γ_{ij} = are elements of Leontief Inverse ALM (Y);

According to Mizoshita and Tsujimura (2003a), the power-of-dispersion index fund-raising (DPI-FR) indicates the total demand for funds, direct and indirect, induced by an increase in demand for funds of a given sector j (excess of investments in terms of the real economy).

The Sensibility-of-dispersion index fund-raising indicates the direct and indirect demand for funds in a given sector j induced by increases in demand for funds from wide economy.

Those indicators show "how far" the influence spreads when a certain economic agent raises new money in the financial market (2015).

The liability system shows the spreading effect of funds when there are variations in the demand for funds. On the other hand, the asset system shows the effect of scattering funds when there are variations in supply of funds.

The develop the indexes in the asset system, the same algebraic procedure is applied, however it will start with the ALM* in the asset system (Y*). We presented the Leontief inverse of Y* (Γ^*) in the equation 14, the power-of-dispersion index fund-employ (ω^*) in the equation 15 and, the sensitivity-of-dispersion index fund-employ (φ^*) in the equation 16, respectively:

$$\Gamma^* = (I - C^*)^{-1} = \begin{bmatrix} \gamma_{11}^* & \cdots & \gamma_{m1}^* \\ \vdots & \ddots & \vdots \\ \gamma_{1m}^* & \cdots & \gamma_{mm}^* \end{bmatrix} \qquad (E.14)$$

$$\omega_j^{Y^*} = \frac{\sum_{i=1}^m \gamma^* ij}{\frac{1}{m}\sum_{j=1}^m \sum_{i=1}^m \gamma^* ij} \qquad (E.15)$$

$$\varphi_j^{Y^*} = \frac{\sum_{i=1}^m \gamma^* ji}{\frac{1}{m}\sum_{i=1}^m \sum_{j=1}^m \gamma^* ij} \qquad (E.16)$$

Where:

y_{ij}^* = elements of the Leontief inverse of the ALM in the asset system.

Mizoshita and Tsujimura (2003a) point that the power-of-dispersion index fund-employ (DPI-FE) indicates the supply of funds of total economy, direct and indirectly, induced by increases in fund supply of a given sector j (excess savings in relation to current account).

The sensitivity-of-dispersion index fund employ shows the direct and indirect effect on funds of a given sector i, induced by increases in the supply of funds from wide economy.

In the liability system, the indexes represent the reaction caused by demand for funds (excesses of investment in terms of the real economy) and in the asset system, the indices represent the reaction originated by the supply of funds (excess savings in terms of the real economy).

2.4 Discrepancy index

The dispersion indices previously presented are obtained by normalizing either the column sum (in case of power-of-dispersion index) or the row sum (sensitivity-of-dispersion index) of the FOF Leontief inverse matrix (Γ and Γ^*). The discrepancy of the total sum of assets and liabilities is also a useful indicator.

Denote the sum of elements of Γ as w^Y and the sum of elements of Γ^* as w^{Y^*}.

$$w^Y = \sum_{i=1}^m \sum_{j=1}^m \gamma_{ij} \qquad (E17)$$

$$w^{Y^*} = \sum_{i=1}^m \sum_{j=1}^m \gamma_{ij}^* \qquad (E18)$$

We will call them liability dispersion index (w^Y) and asset dispersion index (w^{Y^*}) respectively.

The subtraction of the liability dispersion index from the asset dispersion index gives the Discrepancy index.

$$w^{Y^*-Y} = w^{Y^*} - w^Y \quad \text{(E19)}$$

2.5 Structural decomposition

The causes for the alteration in the Leontief inverse can be decomposed into two categories: i) the total sum of each element of the coefficient matrix, and ii) the other is the apportionment of coefficients among them. While the latter is a purely monetary phenomenon, the former is the reflection of the objective economy because the excess assets and liabilities are corresponding respectively to excess savings and investments.

This kind of decomposition is useful to determine either the cause of financial bubbles lies in the structure of financial market itself or it is merely a mirror image of the objective economy, lack of investments in plants and equipments and so on.

In section 2.2, we defined the flow-of-funds technical coefficient matrices C, and C*. From Equation 5 we can define:

$$c_{ij} = \frac{\gamma_{ij}}{z_{ij}} \quad \text{(E20)}$$

The total financial flow Z_{ij} can be written as expressed in the Equation 21:

$$Z_j = \sum_{i=1}^m \gamma_{ij} + \rho_j \quad \text{(E21)}$$

Iif we omit ρ_j, we can redefine coefficient matrix C as C#, in which each element could be defined according to Equation 22.

$$c_{ij}^\# = \frac{\gamma_{ij}}{\sum_{i=1}^m \gamma_{ij}} \quad \text{(E22)}$$

The ratio of $\rho_j \; to \; Z_j$ is expressed in the Equation 23.

$$c_{\rho j} = \frac{\rho_j}{Z_j} = 1 - \sum_{i=1}^m c_{ij} \quad \text{(E23)}$$

Therefore the relations between c_{ij} and $c_{ij}^\#$ is expressed in the Equation 24.

$$c_{ij} = c_{ij}^\# \times (1 - c_{\rho j}) \quad \text{(E24)}$$

To decompose the differences in c_{ij}, we will introduce two subscript of time t. The first one refers to the time concerning to $c_{ij}^\#$ and the second one refers to the time concerning to $c_{\rho j}$. Equation 25 express the decomposition of c_{ij}.

(E.25)

$$\Delta c_{ij,t,t} = c_{ij,t,t} - c_{ij,t-1,t-1} = c_{ij,t}^{\#} \times \left(1 - c_{\rho j,t}\right) - c_{ij,t-1}^{\#} \times \left(1 - c_{\rho j,t-1}\right)$$

$$= \frac{2 \times c_{ij,t}^{\#} \times \left(1 - c_{\rho j,t}\right) - 2 \times c_{ij,t-1}^{\#} \times \left(1 - c_{\rho j,t-1}\right)}{2}$$

$$= \frac{c_{ij,t}^{\#} \times \left(1 - c_{\rho j,t-1}\right) - c_{ij,t}^{\#} \times \left(1 - c_{\rho j,t-1}\right)}{2}$$

$$+ \frac{c_{ij,t-1}^{\#} \times \left(1 - c_{\rho j,t}\right) - c_{ij,t-1}^{\#} \times \left(1 - c_{\rho j,t}\right)}{2}$$

In the last equality of the equation 25, the first term represents the differences in c_{ij} caused by the transition of $c_{\rho j}$ from t-1 to t, equally arithmetically weighted by $c_{ij}^{\#}$ at t-1 and t. Likewise, the second term represents the differences in c_{ij} caused by the transition of $c_{ij}^{\#}$ from t-1 to t, equally arithmetically weighted by $c_{\rho j}$ at t-1 and t.

In matrix notation we could re-writte the Equation 25 as follows.

(E26)

$$\Delta c_{t,t} = c_{t,t} - c_{t-1,t-1}$$

$$= \{\frac{\left(c_{t,t} - c_{t,t-1}\right) + \left(c_{t-1,t} - c_{t-1,t-1}\right)}{2}$$

$$+ \frac{\left(c_{t,t} - c_{t-1,t}\right) - \left(c_{t,t-1} - c_{t-1,t-1}\right)}{2}\}$$

If the equation above is retained the relation of dispersion indexes are also proved[1] and the difference in liability dispersion index could be decomposed as follows.

(E27)

$$\Delta w^{Y}_{t,t} = w^{Y}_{t,t} - w^{Y}_{t-1,t-1}$$

$$= \{\frac{\left(w^{Y}_{t,t} - w^{Y}_{t,t-1}\right) + \left(w^{Y}_{t-1,t} - w^{Y}_{t-1,t-1}\right)}{2}$$

$$+ \frac{\left(w^{Y}_{t,t} - w^{Y}_{t-1,t}\right) - \left(w^{Y}_{t,t-1} - w^{Y}_{t-1,t-1}\right)}{2}\}$$

Analogous the liability procedure, the decomposition of dispersion index in the asset side can be expressed by the Equation 28.

(E28)

$$\Delta w^{Y^*}_{t,t} = w^{Y^*}_{t,t} - w^{Y^*}_{t-1,t-1}$$

$$= \{\frac{\left(w^{Y^*}_{t,t} - w^{Y^*}_{t,t-1}\right) + \left(w^{Y^*}_{t-1,t} - w^{Y^*}_{t-1,t-1}\right)}{2}$$

$$+ \frac{\left(w^{Y^*}_{t,t} - w^{Y^*}_{t-1,t}\right) - \left(w^{Y^*}_{t,t-1} - w^{Y^*}_{t-1,t-1}\right)}{2}\}$$

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[1] Mizoshita and Tsujimura (2004) present the detail of this relations in the appendix 4.

The dispersion discrepancy index was defined in the Equation X and using 27 and 28, we define the decomposition of dispersion discrepancy index.

(E29)

$$\Delta w^{Y^*-Y}_{t,t} = \left\{ \frac{\left(w^{Y^*}_{t,t} - w^{Y^*}_{t,t-1}\right) + \left(w^{Y^*}_{t-1,t} - w^{Y^*}_{t-1,t-1}\right)}{2} \right.$$
$$\left. - \frac{\left(w^{Y}_{t,t} - w^{Y}_{t,t-1}\right) + \left(w^{Y}_{t-1,t} - w^{Y}_{t-1,t-1}\right)}{2} \right\}$$
$$+ \left\{ \frac{\left(w^{Y^*}_{t,t} - w^{Y^*}_{t-1,t}\right) - \left(w^{Y^*}_{t,t-1} - w^{Y^*}_{t-1,t-1}\right)}{2} \right.$$
$$\left. - \frac{\left(w^{Y}_{t,t} - w^{Y}_{t-1,t}\right) - \left(w^{Y}_{t,t-1} - w^{Y}_{t-1,t-1}\right)}{2} \right\}$$

According to Mizoshita and Tsujimura (2004), the first term of the expanded right side of the Equation 27 is the portion attributed to the changes in the objective economy (decline or increment in savings and in investments) while the second term is the segment referring to the changes in the structures of the financial market (alterations in asset- liability portfolio allocation)

3. Empirical Analysis

Brazil is a large Country with population of 208.502.021 habitant (IBGE, January, 2018). The economic activities are diversified, the Trade sector and Public Administration are important in the production and generation of added value. The Food and Beverage manufacture has great capacity for dispersal of funds in the economy. Despite income generation, there is a strong dependence on transfers of income distribution among domestic economic agents. Given support to economic activities, the financial system has a great role in Brazilian economy. Instead of high volatility, the flow of financial investment is more than four times the amount of fixed investments (Burkowski, et al, 2016).

Financial Intermediation is the fourth largest sector in terms of gross value of production, the growth of this sector in last decade was upper than the average of the economy, with a significant participation in the generation of value added. About the structure, here was a decrease in the amount of banks in the last decade, however an

increase in the amount of agencies. In 2016, there were 174 banks and 22.547 banking agencies (FEBRABAN, 2016).

The distribution within type of banks stock control showed that 45% of banks operating on Brazilian economy are public, 40% are private domestic and 15% are foreign private. Although the large quantity and diversification of banks, we can observe a hardly concentration: 83% of total assets are concentrated in the five major banks and two of them are public banks. The table X presents the 10 largest banks in 2016, total assets, total deposits, net-woth, net profit, number of agencies and type of stock control.

Table 2: The 10 largest banks in Brazil, 2016 (R$ 1.000.000)

Bank	Total Asset	Total Deposits	Net Worth	Net Profit	Number of Agencies	Type of Stock Control
BB	1436765	447949	77040	6650	5460	Public
ITAU	1331841	369390	129935	19486	3494	Private
CEF	1256172	513098	27180	3421	3412	Public
BRADESCO	1081375	235821	101221	13663	5335	Private
SANTANDER	705061	146963	60009	6205	2763	Foreign
SAFRA	148391	12589	9508	1736	114	Private
BGT PACTUAL	131933	10894	17678	2794	13	Private
VOTORANTIM	103005	4578	8426	463	95	Private
CITIBANK	72024	19374	8411	1193	134	Foreign
BANRISUL	68235	42783	6441	540	539	Public
Total 10 largest	6334863	1803439	445849	46151	172	
National Banking System	7009784	1995174	521904	62301	22899	

Source: FEBRABAN (2016).

In the 1990s, Brazil began a process of commercial and financial market opening to foreign transactions. Foreign banks increased their participation in the Brazilian market, mergers and acquisitions intensified. However, foreign banks maintained a conservative strategy that contributed little to the expansion of credit concession, spread reduction, quality and diversification of financial products and services.

Even with the entry of international banks, the cost of capital, which is determined, among other factors, by the interest rate, the SELIC rate, and by the spread fixed by the banks, has remained excessively high.

In this way, the financial system is characterized as dysfunctional or of low macroeconomic efficiency, due mainly to the existing incentives: on the asset side, investments in government bonds and on the liabilities side, raising funds from middle and high.

Private banks display higher concentration on short-term operations, investments in securities and investments in securitization. Public banks dedicate a greater proportion of resources to credit operations.

Camargo (2009) highlight some characteristics of the banking sector in last decade:

i) The performance of banks as financial intermediaries, with bond markets playing an almost irrelevant role in financing private activity;

ii) High degree of concentration in the banking sector;

iii) The structure of the banking sector, which encourages the emergence of a form of oligopolistic competition, in which leading banks set the basic prices of financial services and compete with each other through service differentiation rather than price.

iv) The performance of non-leading banks in niches not attractive to the leading banks, due to the few conditions for the former to exert more effective competitive pressures on the latter in the more attractive markets.

v) The permanent situation of economic instability and fiscal deficits, which led successive governments to offer large amounts of government bonds, under extremely favorable conditions of return and liquidity.

The financial institutions are ruled by National Monetary Council (CMN) and supervised by Central Bank of Brazil (BCB). Figure 3 presents the actual composition of Brazilian financial system.

Figure 3: Composition of Brazilian Financial System:

Regulating entities	National Monetary Council (CMN)		National Council for Private Insurance (CNSP)	National Council for Complementary Pension (CNPC)
Supervision entities	Central Bank of Brazil (BCB)	Securities and Exchange Commission (CVM)	Private Insurance Superintendence (SUSEP)	National Complementary Pension Superintendency (PREVIC)
Operators*	Financial institutions taking demand deposits	Commodities and futures exchanges	Reinsurance Companies	
	Other financial institutions / Foreign exchange banks	Stock exchanges	Insurance companies	Entities operating private closed pension funds
	Other financial intermediaries and entities administering financial assets of third parties		Capitalization companies	
			Entities operating private open pension funds	

The actual economic system in Brazil, called "Real Plan", begins in 1994. Before this date, Brazil experienced high inflation rate. The "Real Plan" met 3 steps to access price stability: i) the fiscal adjustment (May, 1993 to Febuary, 1994); ii) the monetary reform (March to July, 1994) iii) the adoption of an anchor exchange rate (July, 1994 to January, 1999).

Since 1999, the Inflation Target Regime (RMI) is adopted. Monetary Policy Committee (COPOM) was created on June 20th 1996, and was assigned the responsibility of setting the stance of monetary policy and the short-term interest rate (SELIC). The Central Bank of Brazil's (BCB) provides that the target of the SELIC rate works, through Open Market operations. The SELIC rate is the main instrument to control the inflation rate.

The COPOM publish a report each 3 months, since 1998. In this report they describe the economic condition (inflation behavior), risks around inflation, discussion around monetary policy conduction.

In the last decade, we can observe that the inflation target is being achieved, between 2004 and 2014 the observed inflation, expressed in the General Consumer Prices Index (IPCA) stayed behind the upper goal limit. Except in 2015, when observed inflation was upper then the target. In 2014 and 2015 the SELIC rate showed an increase. However in December 2017, the observed inflation rate is considered smaller than expected, the SELIC rate was fixed in 7% (BCB, 2017), decreasing from 14,15% since December of 2015, when it showed the highest interest rate of the decade.

Despite the success in controlling inflation since its implementation in Brazil, the economy's performance was below expectations. Total Gross Domestic Product (GDP) revels recession in Brazilian economy. The GDP increase on average 4,8% between 2004 and 2008; decrease 0,1% in 2009, increase on average 4% between 2010 and 2013, increase just 0,5% in 2014 and decreased on average 3,8% in subsequent years. The evaluation of fixed investment in last decade, show a movement synchronized to GDP: high decrease in 2009, 2014 and subsequent years (IBGE, 2017).

3.1 Methodology

We will use FOF analyses to evidence the financial structure of Brazilian economy and investigate relationship between objective and financial economy. We will develop two set of ALM and AML*, one from 2004 to 2009 and other from 2009 to 2014.

We calculated dispersion indexes. They are combined: i) the PDI-FR and PDI-FE, give a position of institutional sectors in financial market, financial intermediary usually shows both DPI close to 1 and highest indexes indicates better ability in borrowing and lending funds (intermediating funds); ii) the SDI-FR and SDI-FE, could be used to measure the importance of each sector as intermediaries in the financial market (how they react to changes in total demand of funds).

We also observe the evolution of power of dispersion and sensibility of dispersion indexes to investigate if there were any change in the behavior of institutional sectors in the financial market.

Furthermore, we calculate the discrepancy index to the years 2004 to 2014. To the years 2008 and 2009 we made the decomposition of the discrepancy and presents an expanded ALM, which financial institutions are disaggregated.

3.2 Brazilian Data

The data used to apply the FOF analysis in Brazilian economy are Financial Balance Sheet and Balance Sheet of Central Bank of Brazil (BCB). The Balance Sheet of BCB are available in the BCB web site.

To the period from 2004 to 2009, the Financial Balance Sheet of Brazil is available in Brazilian Institute of Geography and Statistics (IBGE)[2]. To the period of 2009 to 2014 it is available in the Organization for Economic Co-operation Development (OECD).

The Financial Balance Sheet is an Accounting Statement that presents the stock of financial assets and liabilities detained by economic agents in a beginning date, the variations occurred in these assets and liabilities during the period of one year and the assets and liabilities detained in the final date of ascertainment of the balance sheet. This Financial Balance Sheet was published for the years of 2004 to 2009, as a part of

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[2] IBGE is official organization responsible to collect, organize and publish information and data to Brazilian economy. Brazilian Input-Output Matrix are published from IBGE.

the Integrated Economic Accounts (CEI) by Central Bank of Brazil (BCB) together with Brazilian Institute of Geography and Statistics (IBGE)3.

After 2009 there was a discontinuity of the publication, and then, they were available in the Organization for Economic Co-operation Development (OECD) to the period from 2009 to 2014. We used non-consolidated SNA 2008.

The financial assets and liabilities are detailed in seven (7) main financial instruments detained by five (5) institutional sectors: Non-Financial Firms, Financial Firms, Households, Government and Rest of the World[4]. Bellow the main financial instruments are listed:

F1.Gold and DES*
F2.Cash e Deposits
F3.Bonds
F4.Loans
F5.Shares
F6.Technical insurance
F7.Others

*Gold and DES are not included in FOF BR because they refer to monetary funds.

We disaggregate the "Financial Enterprises" in to two "subgroups": the "Central Bank" and "Other Financial Enterprises", subtracting the flows of assets and liabilities of the Central Bank of Brazil (obtained on its Balance Sheet) from the flows of financial assets and liabilities of the "Financial Enterprises" in the Financial Balance Sheet.

The Balance Sheet of the Central Bank of Brazil (BCB) is published monthly together with other financial statements and explanatory notes. We used the annual data related to the exercises closed in December 31th of each year between 2004 and 2014. The Balance Sheet is a Statement Accounting that represents stock accounts, indicating the stock of assets (physical and financial assets) and liabilities (obligations and equity) held by the entity in a certain date. The elaboration of Balance Sheet of Central Bank of Brazil follow the Central Bank General Accounting Plan (Plano Geral de Contas do Banco Central - PGC). The balance Sheet of BCB is available monthly, since 1965 until 2017. Figure 4 presents the BCB balance sheet structure.

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[3] IBGE is official organization responsible to collect, organize and publish information and data to Brazilian economy. Brazilian Input-Output Matrix are published from IBGE.
[4] The definition of each institutional sectors are detailed in the Methodological Notes, IBGE (2008).

Figure 4: Accounting Structure of the Balance Sheet of Central Bank of Brazil:

1.ASSET	2.LIABILITY
1.1.FOREIGN CURRENCY ASSETS	2.1.FOREIGN CURRENCY LIABILITIES
1.1.1.Available	2.1.1.Contracted operations to be settled
1.1.2.Time deposits in financial institutions	2.1.2.Deposits in financial institution
1.1.3.Resale agreement	2.1.3.Repurchase agreement
1.1.4.Derivative	2.1.4.Derivatives
1.1.5.Securities	2.1.5.Credits to pay
	2.1.6.Deposits in International Financial Organization
1.1.6.Credits Receivable	
1.1.7.Gold	2.1.7.Other
1.1.8.Participation in International Financial Organization	
1.1.9.Other	2.2.LOCAL CURRENCY LIABILITIES
	2.2.1.Contracted operations to be settled
1.2.LOCAL CURRENCY ASSETS	2.2.2.Deposits from financial institution
1.2.1.Available	2.2.3.Repurchase agreement
1.2.2.Deposits	2.2.4.Derivatives
1.2.3.Resale agreement	2.2.5.Liabilities with federal government
1.2.4.Derivative	2.2.6.Credit to pay
	2.2.7.Deposits in International Financial Organization
1.2.5.Federal public securities	
1.2.6.Credit with federal government	2.2.8.Provisions (Allowance)
1.2.7.Receivable credit	2.2.9.Other
1.2.8.Bens Móveis e Imóveis	
1.2.9.Other	2.3.CIRCULATING
	2.4.NET WORTH
	2.4.1.Result Reservation
	2.4.2.Revaluation Reserve
	2.4.3.Unrecognized gains / losses in income
	2.4.4.Effects of Changes in Accounting Practices
	2.4.5.Accumulated result
Total	Total

Source: Financial Statements, (BCB, 2017)

To the year 2008 and 2009, we made an additional disaggregation of financial firms. We disaggregate the "Other Financial Enterprises" in four (4) financial institutions. Tree (3) of them are government-sponsored financial institutions: Banco do Brasil (BB), Caixa Econômica Federal (CEF), Banco Nacional de Desenvolvimento Econômico e Social (BNDES); and one (1) is the largest private bank, in terms of total assets in Brazil, the Itaú Bank. All of these financial institutions play important roles in the Brazilian economy.

The assets and the liabilities of these Institutions, presented in their Balance Sheets, were subtracted from the flows of "Other Financial Enterprises". The financial

statements of financial institutions operating in Brazil are monthly published by BCB. Their structure follows the Financial Institutions Accounting Plan (COSIF), wich is in according to PGP. We also used the annual data related to the exercises closed in December 31th of each year from 2004 to 2009.

A "Plan of Codification" was made to link the asset and liability accounts of the Central Bank, Financial Institutions Balance Sheet, and the financial instruments of the Financial Balance Sheet, from the PGC, COSIF and the Methodological Notes of Financial Balance Sheet (IBGE, 2011). The "Plan of Codification" proposed is presented in Table 3.

Table 3: Plan of Codification between Financial Instruments in the Financial Equity Account, Balance Sheet of the Central Bank and the Balance Sheet of Financial Institutions.

FINANCIAL EQUITY ACCOUNT	BALANCE SHEET ACCOUNT OF THE CENTRAL BANK OF BRAZIL	BALANCE SHEET ACCOUNT OF FINANCIAL INSTITUTIONS
ASSETS		
F1 - Cash and Deposits	Availability Deposits Deposits in terms in financial Institutions Resale Commitment	Availability
F2 – Bonds	Derivative Bonds Federal Government Bonds	Liquity Interbank Investments Bonds and Underlying Securities and Derivatives
F3 - Loans	Receivable Credits Credits to the Federal Government	Interbank Operations Credit Operations
F4 - Shares		Investments
F5 - Technical Insurance		
F6 - Other Deb./Credit	Other credit	Other credit
LIABILITY		
F1 - Cash and Deposits	Contracted Operation to be settled Deposits in Financial Institutions Repurchase Commitment	Deposits Repurchase Agreements obligations
F2 – Bonds	Derivatives	Derivative Financial Instruments Funds, Accetable Exchange, Mortgage Notes, Debentures and Similiar
F3 - Loans	Credits to pay Obligations to the Federal Government	Interdependence Relations Onlending Obligations
F4 - Shares		Net Worth
F5 - Technical Insurance	Provisions	
F6 - Other Deb./Credit	Others	Other Obligations

Source: Elaborated by authors.

4.   Brazilian Flow-of-Funds

Table 4 and 5 presents Asset Table (E-Table) and Liability Table (R-Table), respectively. In Table 4, we can see the Asset Table (E-Table), from Flow of Funds Account 2005. The main bloc of accounts represent how much funds the Institutional Sector employed to each Financial Instrument, all of assets investments – the portfolio investment of each sector. These elements were defined the equation 1: e_{ij}. The row named "Diff. (Excess Liability)" express the excess of liabilities. Looking at each sector it is the difference observed in its Balance Sheet, which revels that this sector has saving excess or net financing capability (net lending), in the real economy. In the equation 1, it was referred to vector ε_j. In this same equation, we can identify the total of instruments in terms of assets (vector s_i^E), it is the last column in table 4, and the total of resources of each sector (vector z_j - the last row in table 4)

In Table 5, we can see the Liability Table (R-Table), from Flow of Funds Account 2005. The main bloc of accounts in the R Table, are elements that represents how much funds the Sector raised from each Financial Instrument, all of financial liabilities used by this sector (the liability portfolio or capital structure of the institutional sector). The elements of R-Table described in the equation 2 can be highlight in the table 5. The row named "Diff. (Excess Assets)" represent the vector ρ_j, which express the excess of assets related to those sources of funds and in the real economy it indicates that these Institutional Sector has investment excess or net financing necessity (net borrowing). The last column in table 5, represents the vector s_i^R, which is the sum of liabilities and the last row in table 5, represents the vector z_j, which refers to the total of financial funds of each sector.

Table 6 and 7 presents Assets-Liabilities-Matrix (ALM) in the Liability-Oriented System and in Asset System, respectively defined as Y and Y*. The sectors are in rows and columns, and intersections represent the flow of funds occurred between Institutional Sectors. Table 6 presents how many funds the sector in the column raises from sector in the row. Table 7 presents how many funds the row sector apply in the column sector (current value).

Table 4: Asset Table (E) – Brazil, 2005

E - Table	Government	Enterprises	Household	ROW	Central Bank	Financial Firms (without BCB)	Total Financial Instrument
Cash & Deposits	847.761	419.489	459.699	9.060	32.952	740.449	2.509.410
Bonds	72.176	225.844	192.536	298.572	1.026.191	1.911.169	3.726.486
Loans	652.978	52.543	12.942	175.061	83.849	2.568.596	3.545.970
Shares	393.492	2.646.984	777.222	1.244.980	0	1.924.842	6.987.520
Technical Insurance	292	10.150	623.211	738	0	2.958	637.350
Others Deb./Credit	677.911	1.194.021	245.027	151.765	3.455	454.486	2.726.665
Differences	567.910	1.360.543	0	0	0	448.908	0
Total (w/ differences)	2.644.611	4.549.030	2.310.638	1.880.175	1.146.447	7.602.499	20.133.400
New Total	3.212.520	5.909.573	2.310.638	1.880.175	1.146.447	8.051.406	22.510.760

Source: Elaborated by authors from the Flow of Funds Account.

Table 5: Liability Table (R) – Brazil, 2005

R - Table	Government	Enterprises	Household	ROW	Central Bank	Financial Firms (without BCB)	Total Financial Instrument
Cash & Deposits	0	0	0	55.170	558.475	1.895.765	2.509.410
Bonds	2.083.490	158.420	0	397.314	63	1.087.199	3.726.486
Loans	561.422	926.026	596.345	28.714	423.141	1.010.322	3.545.970
Shares	0	3.682.728	0	247.858	0	3.056.933	6.987.520
Technical Insurance	0	0	0	0	17.206	620.143	637.350
Others Deb./Credit	567.609	1.142.399	551.831	83.758	24	381.044	2.726.665
Differences	0	0	1.162.463	1.067.360	147.537	0	0
Total (w/ differences)	3.212.520	5.909.573	1.148.176	812.815	998.910	8.051.406	20.133.400
New Total	3.212.520	5.909.573	2.310.638	1.880.175	1.146.447	8.051.406	20.133.400

Source: Elaborated by authors from the Flow of Funds Account.

Table 6: Asset-Liability-Matrix in the Liability System (ALM), Brazil 2009.

Sector	Government	Enterprises	Household	ROW	Central Bank	Financial Firms	Total
Government	6.878.877	6.495.426	1.467.414	891.357	1.314.281	8.986.602	26.033.958
Enterprises	5.790.401	17.660.747	2.273.263	1.506.109	1.804.644	14.706.529	43.741.692
Household	3.116.944	5.647.588	3.441.557	785.281	1.041.691	8.239.550	22.272.612
ROW	2.444.552	4.826.780	895.471	2.513.054	726.561	6.040.189	17.446.608
Central Bank	1.994.384	2.550.253	550.682	454.312	1.631.186	3.708.043	10.888.861
Financial Firms	10.989.200	18.525.175	4.000.611	2.632.583	3.454.753	33.068.494	72.670.817
Total	31.214.360	55.705.970	12.628.999	8.782.696	9.973.116	74.749.407	

Source: Elaborated by authors.

Table 7: Asset-Liability-Matrix Asset System (ALM*), Brazil 2009.

Sector	Government	Enterprises	Household	ROW	Central Bank	Financial Firms	Total
Government	6.878.877	5.790.401	3.116.944	2.444.552	1.994.384	10.989.200	31.214.360
Enterprises	6.495.426	17.660.747	5.647.588	4.826.780	2.550.253	18.525.175	55.705.970
Household	1.467.414	2.273.263	3.441.557	895.471	550.682	4.000.611	12.628.999
ROW	891.357	1.506.109	785.281	2.513.054	454.312	2.632.583	8.782.696
Central Bank	1.314.281	1.804.644	1.041.691	726.561	1.631.186	3.454.753	9.973.116
Financial Firms	8.986.602	14.706.529	8.239.550	6.040.189	3.708.043	33.068.494	74.749.407
Total	26.033.958	43.741.692	22.272.612	17.446.608	10.888.861	72.670.817	

Source: Elaborated by authors.

Over all, those tables show that households employ funds mainly in the form of Shares, Other Credit and Insurance Technical Reserve; the ratio of Cash & Deposits is relatively low. Shares includes listed stocks and shares in investments funds (the biggest part), Insurance Technical Reserve includes life insurance and pension funds. Most part of these financial instruments are available from financial institutions.

Moreover, Other Credit includes trade credit and advances, the high ratio of Other Credit together with the low ratio of Cash & Deposits must mean there is a huge informal financial activity.

Non financial firms are raising funds mainly through Shares (between 50% and 60% of capital structure). Treasury bonds (i.e., bonds issued by the government) is the main fund raising instrument of the government. (e.g., 62.0% in 2004 and 64.9% in 2009). The ALM revels that these funds came from foreign funds, from BCB, and from financial institutions, which increased their employment of funds in governments bonds.

To begin the analyses, we obtain FOF Leontief inverse, from which we could extract FOF indexes. The discrepancy index reveled two important charges: i) two dates when there was a "collapse" in financial system (2008, 2013) ; ii) one date when there are a change in the signal of discrepancy (2010).

The table 8 presents asset dispersion, liability dispersion and discrepancy of dispersion to Brazilian FOF from 2004 to 2014 (obtained according to equation 17-19).

We can see in table 8, that two years (2008 and 2013) presented higher discrepancy of dispersion. These high discrepancy occur in different context, as we can see, in 2010 there was a modification in the sign of discrepancy index, the total sum of Leontief inverse in the asset system became smaller than in the liability system. This context extended to following years. Looking together to asset-table and liability-table (E, R), we can observe that in wide economy there was excess assets the (to wide economy, the amount of savings was greater than the amount of fixed investments in

objective economy), until 2010. After 2010, happens to have excess liability in financial system which means savings smaller than investments in objective economy.

Table 8: Asset dispersion, liability dispersion and discrepancy of dispersion, Brazil, 2004 to 2014

Year/ Index	Asset Dispersion	Liability Dispersion	Discrepancy
2004	40,16	34,64	5,52
2005	45,02	38,65	6,37
2006	47,01	40,38	6,63
2007	47,54	41,50	6,04
2008	61,83	51,05	10,77
2009	52,95	47,26	5,69
2009*	39,36	35,41	3,95
2010	24,59	29,51	-4,92
2011	28,46	33,11	-4,64
2012	28,46	34,90	-6,43
2013	26,24	44,80	-18,56
2014	28,46	38,79	-10,32

Source: Elaborated by authors.

Near 2007, there was a rumor of international financial crises. Institutional sectors, i.e. entrepreneurs for fear of making physical investments summed up with an increase in interest rate, the excess saving stayed accumulated in financial system.

The year 2008, was the crucial point were the growth in excess asset was so great that causes a high discrepancy index (concomitant to Lehman Brothers bank breakdown). In the next year 2009, Brazilian gross domestic product (GDP) effectively fall down.

In 2009 and in subsequent years CMN adopted set of anti-cyclical measures, fiscal, monetary and credit policies. The effect was a change in the financial behavioral in the economy, since from 2010 there is a change in the signal of discrepancy of dispersion. Meanwhile, the remedy was excessively, and in 2013 there is another collapse in financial system, however, with excess liabilities (In the same time we can observe increase in interest rate). As a consequence, the GDP of 2014 shows decrease in growth rate and in the subsequent (2015 and 2016) the GPD effectively decrease. Figure 5 presents the evolution of SELIC rate, Discrepancy dispersion and GDP Change from 2009 to 2014.

Figure 5: of SELIC rate, Discrepancy dispersion and GDP Change, Brazil, 2009 to 2014.
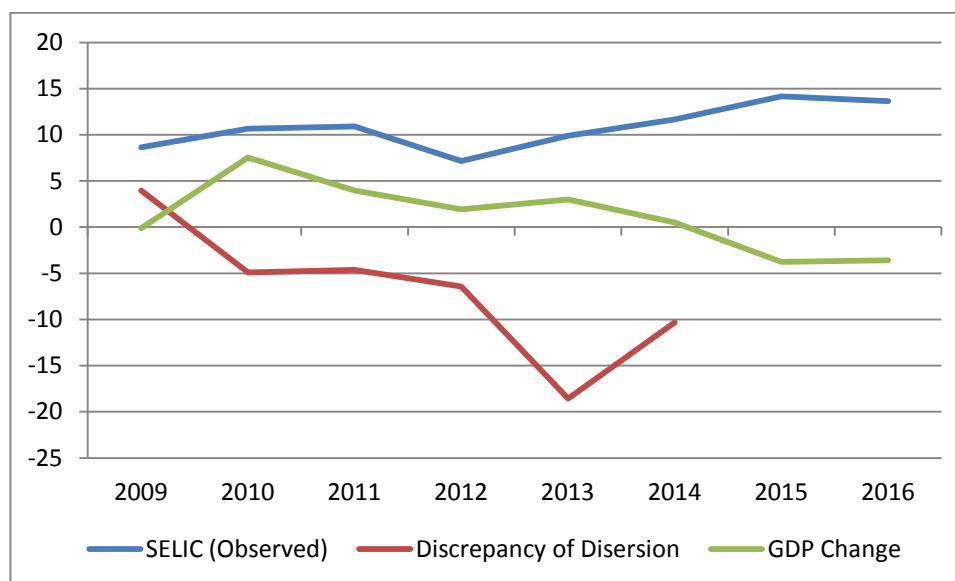
The structure of Brazilian financial market evidenced with the power-of-dispersion-index fund-raising and fund-employment show that household and Rest-of-world (ROW) are mainly "Saving Sectors" (DPI-FE higher than DPI-FR). They are saving and accumulating financial assets, while enterprises and government are mainly "Investor Sectors" (DPI-FE lower than DPI-FR), they usually raise funds to finance excess investments in objective economy. Brazilian Central Bank are in the middle of financial market while financial firms are a little below, which means that they have difficulty to employ funds.

In the first part of the period, 2004 to 2009, these indexes are interesting as pointing out that the Government and the Central Bank take on more important roles, with greater influence in the financial market, over Financial Firms (financial sector without the Central Bank). Since Government borrow new sources of financing by issuing Treasure bonds and/ or borrowing new loans and BCB provides funds to finance ultimately the needs of all other financial institutions as well as the government's deficits. It highlights the greatest power of the Government and the Central Bank in Brazilian economy and raises the question in relation to the financial intermediation performance.

The BCB has low SDI-FE, indicating that it does not immediately react to savings increases. However, the Financial Firms, government and enterprises are strongly influenced by increases in total savings.

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In this sense, we highlight that enterprises as well as government seems to work as financial intermediaries, because they generate great influence when borowing and are strongly affected when there are investment excess in the wide economy.

The evolution of power of dispersion indexes, from 2010 to 2014, shows that households and enterprises sectors are moving toward the middle (1, 1), indicating households are increasing investment and firms' net investment is decreasing. The ROW stays in the second quadrant, near households, and is playing important role as funds supplier.

The government stays in the fourth quadrant, probing that its role in the financial market is not much different from that of enterprises; the government is actively investing. Financial firms are still situated in the fourth quadrant indicating that they are good at borrowing rather than lending.

Figure 6 plots the graphics with the power-of-dispersion-indexes from the year 2004 to 2014. The DPI-FR assumes values in the abscissa (horizontal axis) and the DPI-FE in the ordinate (vertical axis). The center of the graphic assumes the value of 1.

Figure 6: The position shifts of institutional sectors in the PDI diagram
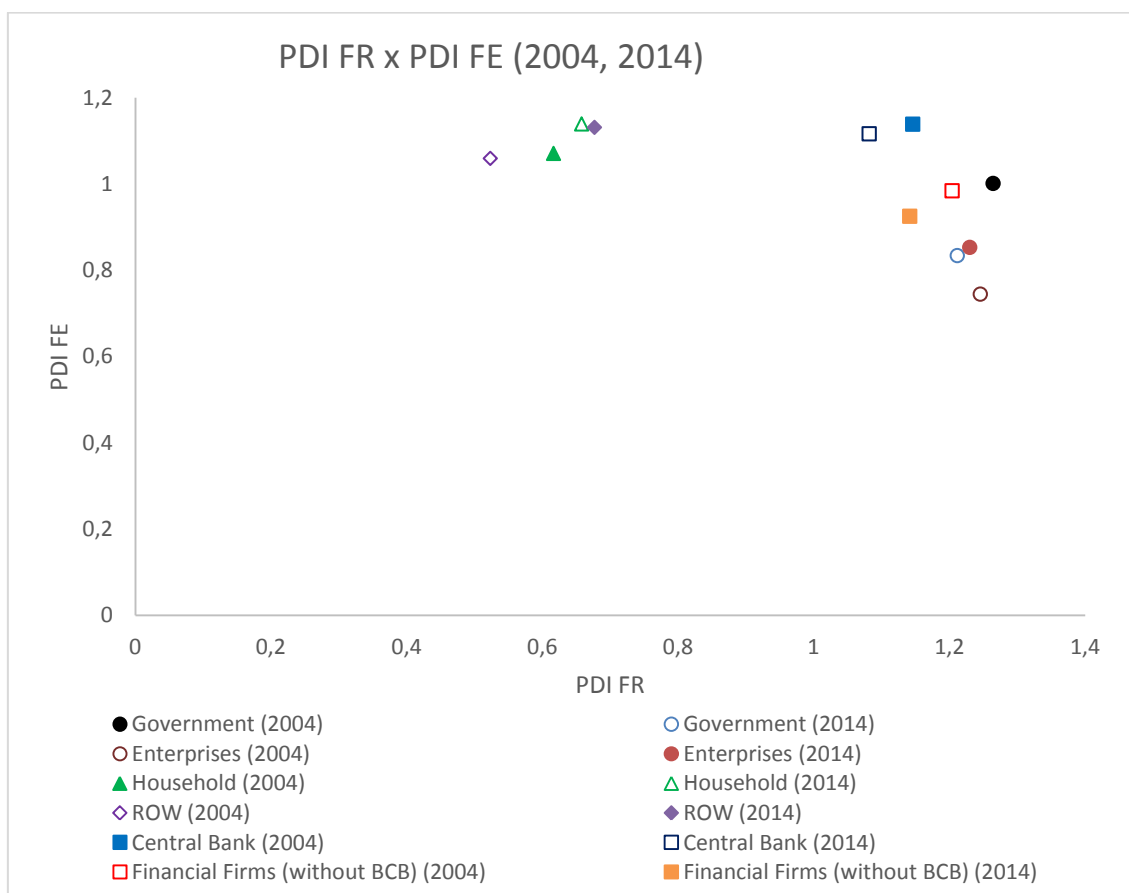
We can see that households moved a little to north-east in the diagram suggesting the sector has become a dominant player as a funds supplier though they still are not very active as a fund raiser. Similar movement is observed to rest of implying that Brazilians are finding their investment opportunity in abroad.

Enterprises moved northward implying that their presence as a fund supplier has risen during the observation period.

The government moved to south-west suggesting that the private sector has taken over the economic dominance.

The figure 7 plots the graphics with the power-of-dispersion-indexes from the year 2004 to 2014. The SDI-FR assumes values in the abscissa (horizontal axis) and the SDI-FE in the ordinate (vertical axis). The center of the graphic assumes the value of 1.

Figure 7: The position shifts of institutional sectors in the SDI diagram, Brazil, 2004 and 2014.

SDI FR x SDI FE (2004, 2014)

Legend:
● Government (2004)   ○ Government (2014)
○ Enterprises (2004)   ● Enterprises (2014)
▲ Household (2004)   △ Household (2014)
◇ ROW (2004)   ◆ ROW (2014)
■ Central Bank (2004)   □ Central Bank (2014)
□ Financial Firms (without BCB) (2004)   ■ Financial Firms (without BCB) (2014)
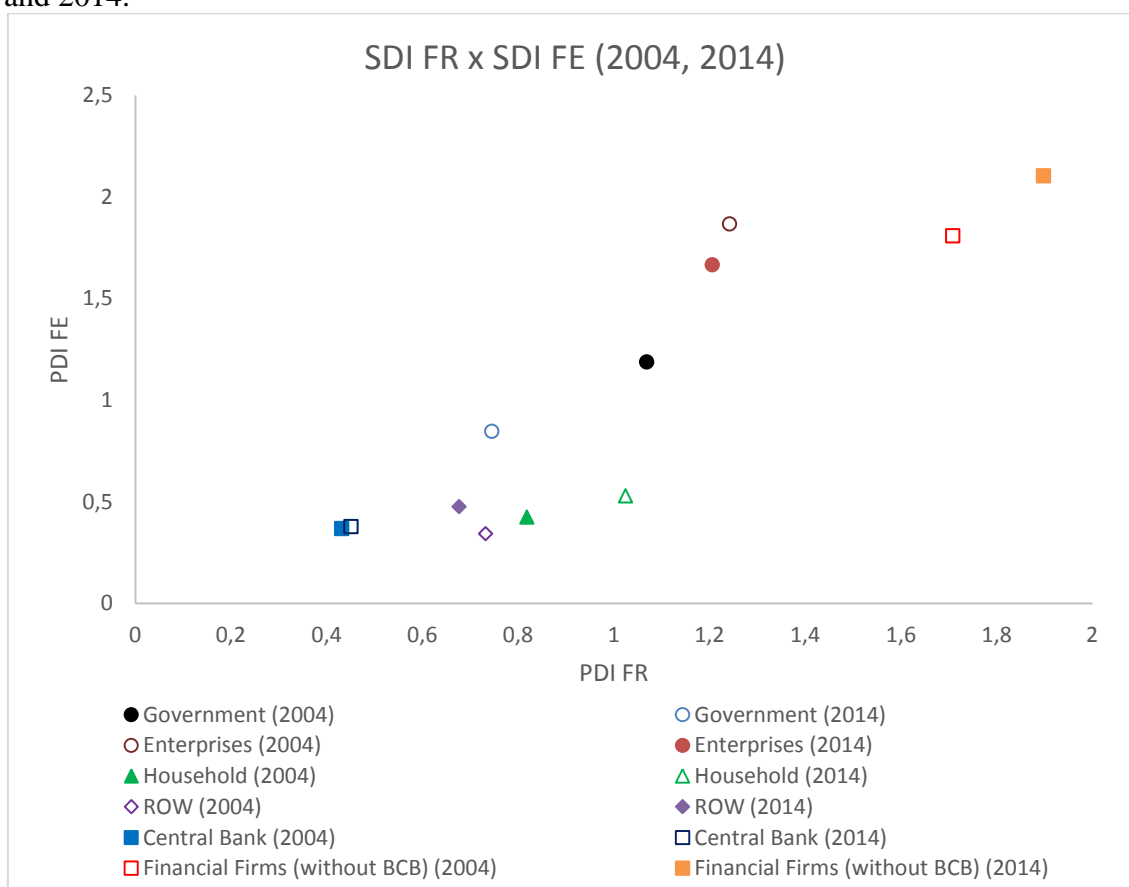
Looking to sensibility of dispersion indexes, we can see that financial firms stay in the first quadrant and the position is moving toward right, suggesting that there is a considerable improvement in their performance as intermediaries.

As a consequence, the financial firms can absorb the household savings more effectively; households moved eastwards in the diagram from the third quadrant to the fourth quadrant.

Enterprises and the government moved to south-west implying that they are no longer active as financial intermediaries.

On the other hand, central bank and the government are moving toward left, showing that the presence of them as intermediaries is decreasing. Notwithstanding, enterprises are situated in the first quadrant, suggesting trade credit is an essential tool of finance in Brazil.

According to the order of the SDI-FR, we can see that individuals tend to borrow first with Financial Firms ("Financial System without the Central Bank"), then with Enterprises and then from Government.

Figure 8 and 9 presents the fluctuations in FR-PDI from 2004 to 2009 and from 2009 to 2014 respectively.

Figure 8: Fluctuation of institutional sectors in DPI FR, Brazil, 2004-2009.
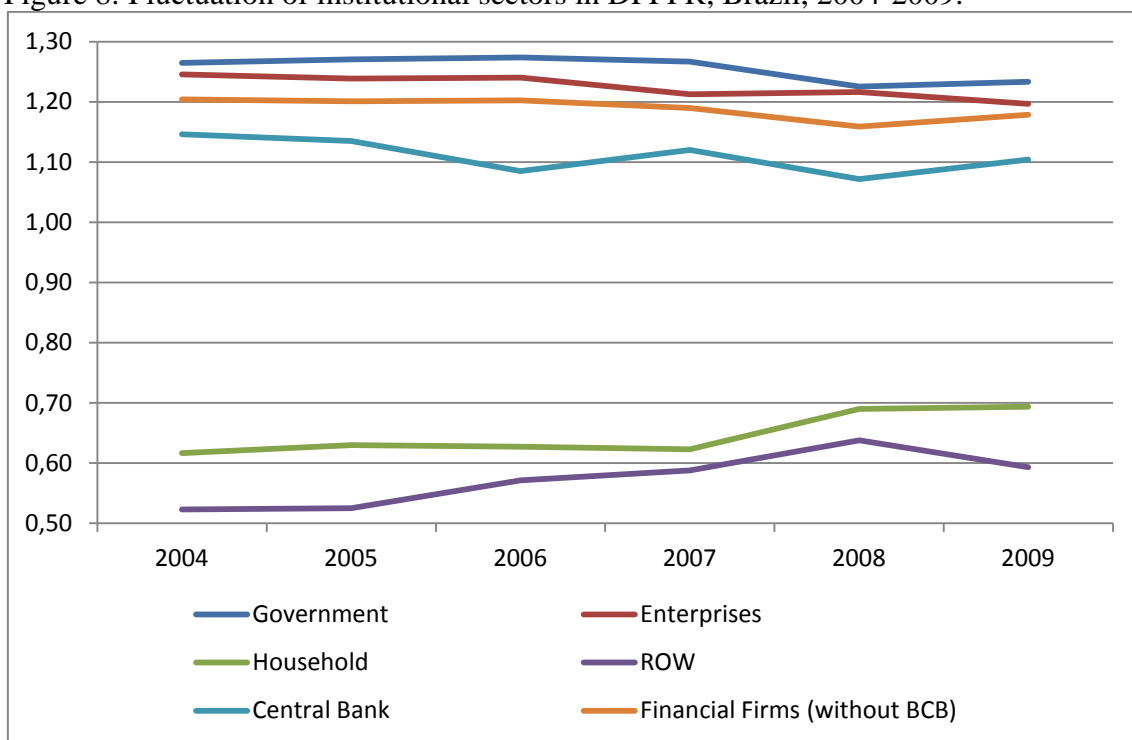
Source: Elaborated by authors.

Figure 9: Fluctuation of institutional sectors in DPI FR, Brazil, 2009-2014.
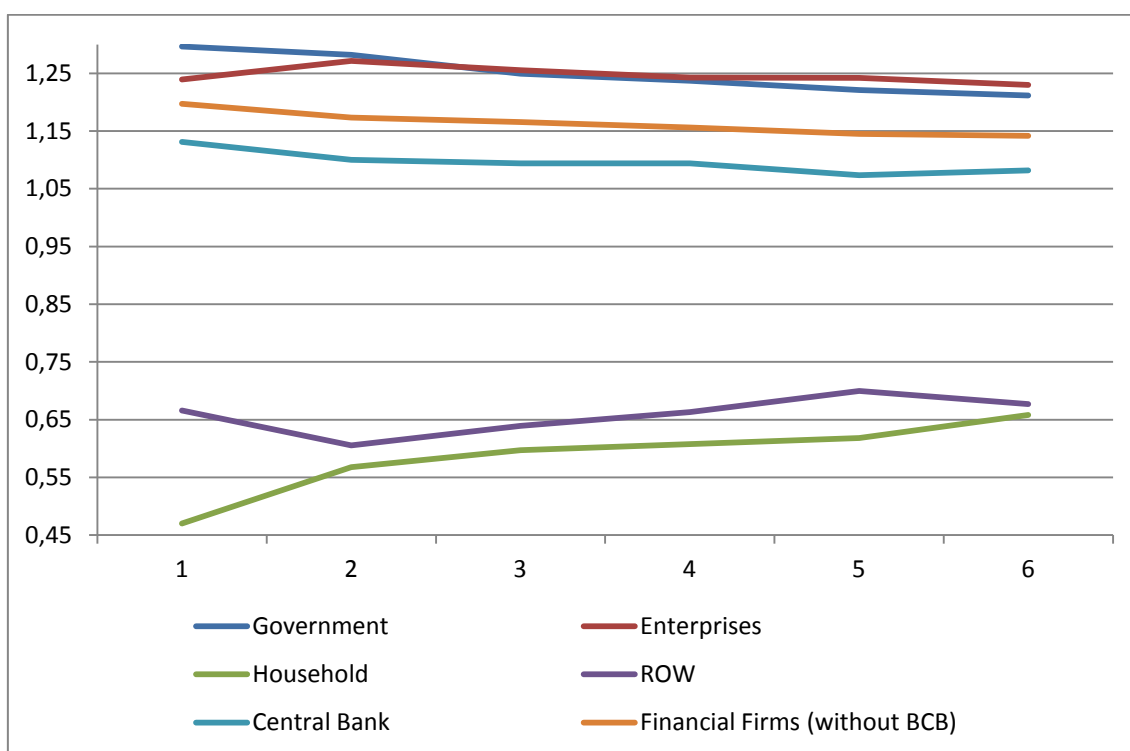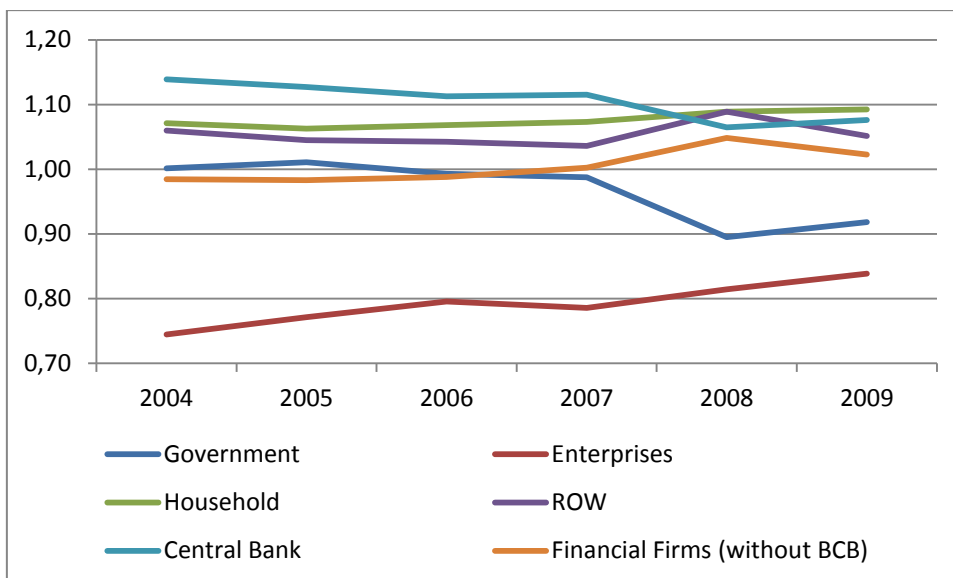

Source: Elaborated by authors.

Households' FR-PDI showed significantly risen in 2008 and moderate rise subsequent years. From this year, the mortgage and consumer-finance market was heated in Brazil this year because of anti-cycle polices as a consequence of the credit crunch

As well as Households', Rows' FR-PDI showed significantly risen in 2008, however the index dropped in 2009 and 2010.

Enterprise, Government, Financial Firms, BCBs' FR-PDI shows a downward trend, although enterprise sector showed a small growth in 2010.

Figure 10 and 11 presents the fluctuations in FE-PDI from 2004 to 2009 and from 2009 to 2014 respectively.

Figure 10: Fluctuation of institutional sectors in DPI FR, Brazil, 2004-2009.

The government's and Central Bank's FE-PDI declined significantly in 2008 while Row and Financial firms indexes have grown. In the previous year there was excess an inflow of financial funds came from abroad, as we could observe in discrepancy indexes, there were excess assets in the economy. However, funds were almost concentrated in financial firms, almost of them were not allocated to productive sectors.

Figure 11: Fluctuation of institutional sectors in DPI FR, Brazil, 2004-2009.
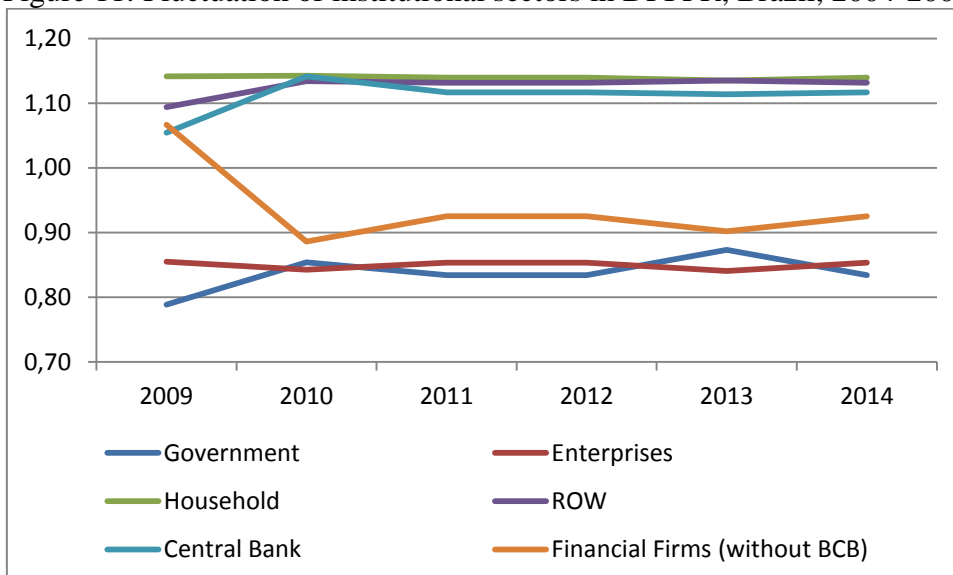
Financial firms' FE-PDI dropped sharply in 2010, while government and Central Banks' FE-PDI raised, suggesting that the credit crunch was triggered by the

reluctance of banks etc. to extend new loans, instead, government and Central Bank take on anti-cycle politics to help the economy out of the crisis.
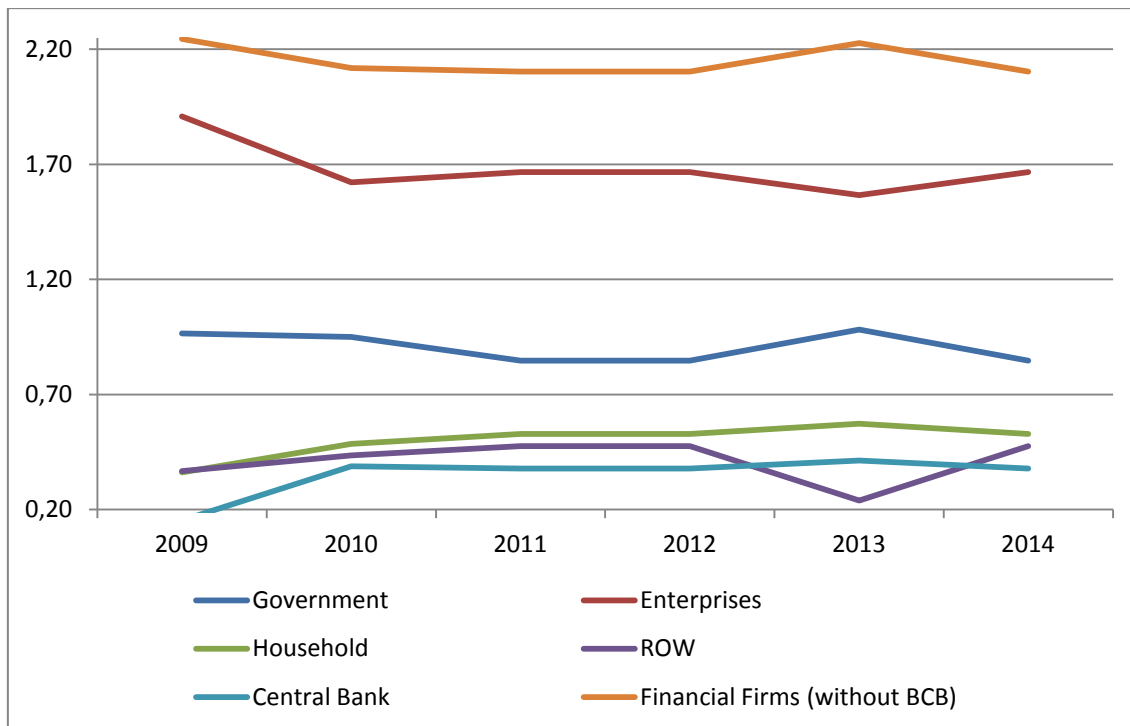
Figure 12 presents the fluctuations in FR-SDI from 2009 to 2014 and Figure 13 presents the fluctuations in FE-SDI from 2009 to 2014.

Figure 12: The fluctuations in FR-SDI, Brazil, 2009-2014
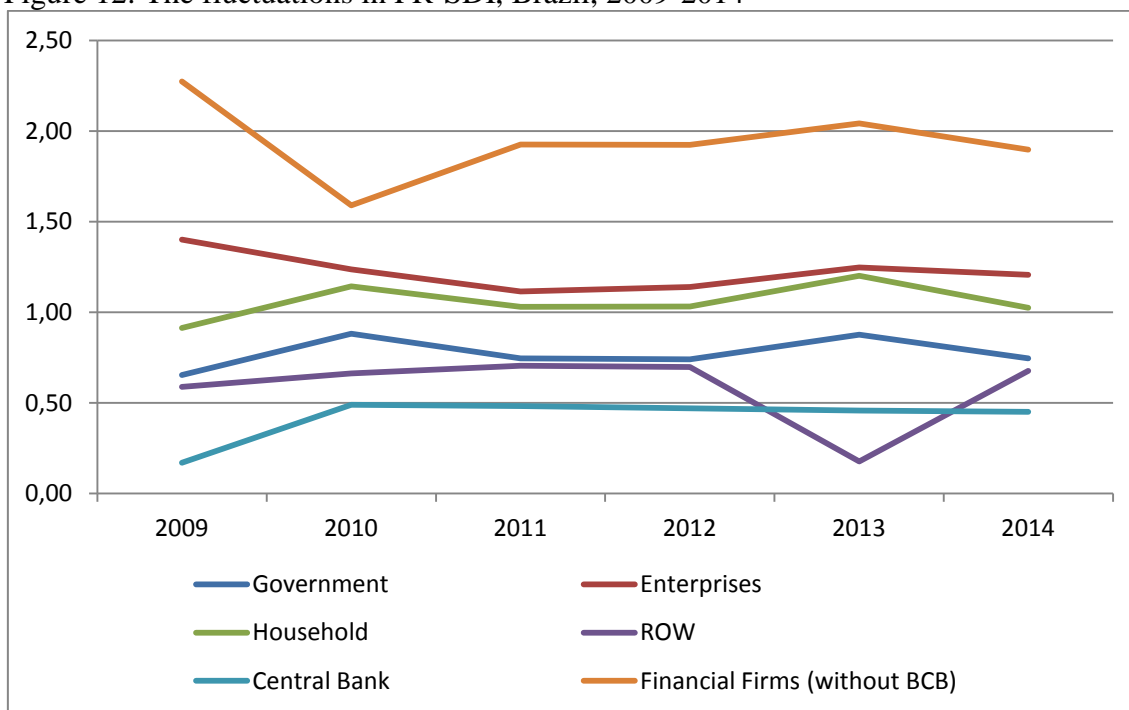
Source: Elaborated by authors.

Figure 13: The fluctuations in FE-SDI, Brazil, 2009-2014

Figure 12 revels that financial firms absorbed most part of fluctuations of the demand for funds in the Brazilian economy.

However, financial firms' FR-SDI dropped sharply in 2010 showing that the credit crunch was going on. Moreover, it should be noted that FR-SDI of the government and central bank dropped one year earlier; the credit crunch must have been the results of economic-tightening policies.

The rise in households' FR-SDI suggests that the fund raisers found last resort in the sector.

Another problem is that ROW's FR-SDI declined sharply in 2013; The exchange rate has been in a trend of growing since 2011. In 2012, 2013 and 2014, the growth rate was 13% each year. It could have generated distortions in imports and exports.

From figure 13 we can see that the FE-SDI of enterprises rose while that of the central bank dropped in 2009 suggesting that enterprises mutually gave credit among them to continue their day-to-day business under an economic tightening.

We could observe in dispersion indexes in the years 2008, 2009 and 2010 a lot of changes occur in the behavioral of institutional sectors in financial market. Remember that, according to discrepancy index, the year 2008, was a crucial year which higher discrepancy. Follow, we present the photography of Brazilian financial system with the additional disaggregation in the financial firms.

Figure 14 shows FR PDI and FE PDI in the year 2009 to Brazilian Central Bank (BCB), government-sponsored financial institutions: Banco do Brasil (BB), Caixa Econômica Federal (CEF), Banco Nacional de Desenvolvimento Econômico e Social (BNDES); Itaú Bank (largest private bank) and"Other Financial Firms". Figure 15 shows FR SDI and FE SDI to this additional disaggregation.

Figure 14: The position of financial firms in the PDI diagram, Brazil, 2009
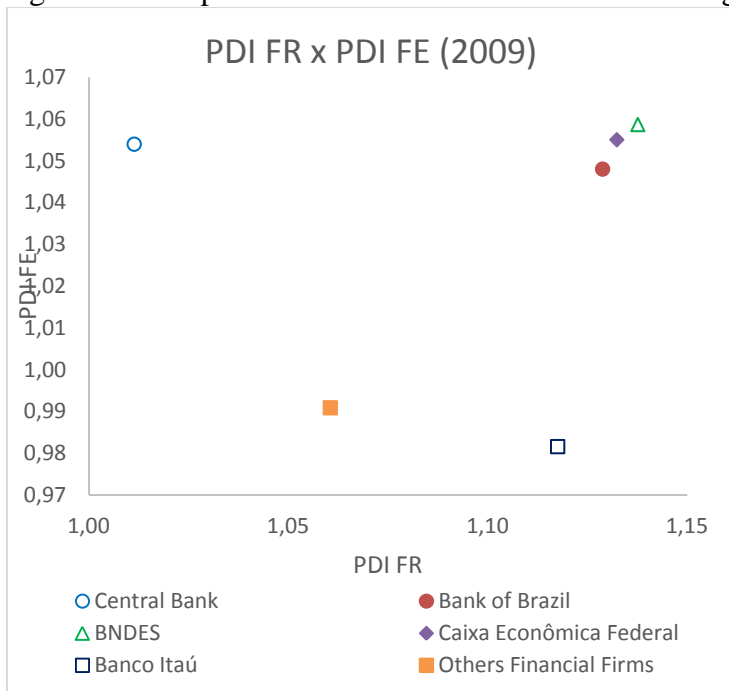
Source: Elaborated by authors.

Figure 15: The position of financial firms in the SDI diagram, Brazil, 2009

SDI FR x SDI FE (2009)
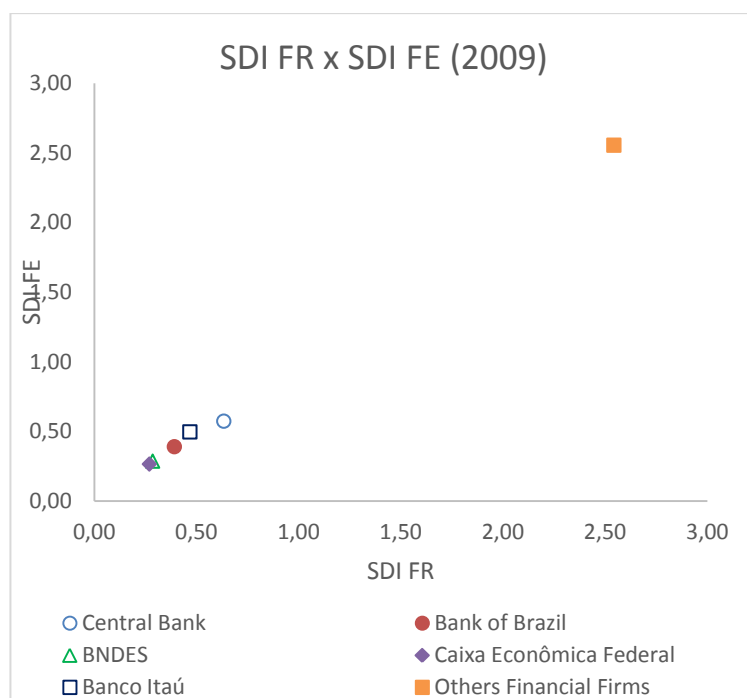
Source: Elaborated by authors.

The wide view presented in figure 14 shows that BB, CEF and BNDES is upper than other financial firms and the private bank indicating that that government-sponsored banks showed greatest ability to spreads funds. However they did not showed ability to absorb changes in demand. Figure 15 revels that other financial firms shows ability to absorb demand (they are upper and right side of graph) than government-sponsored banks but does not to spreads funds, as we could see in figure 14, they are bellow government-sponsored banks.

Therefore, one part of demand for funds is supplied by other financial firms, who do not effectively pass on these funds, and another part of demand is supplied by informal market.

In the sequence, we present the decomposition of change in the discrepancy of dispersion, within contributions of objective economy and contributions of financial system.

The table 9 presents the decompositions of the change in the discrepancy index to the years 2008, 2009 and 2010.

	2007 - 2008			2008 - 2009			2009 - 2010		
	Tot Cg	OE %	FM %	Tot Cg	OE %	FM %	Tot Cg	OE %	FM %
Government	1,52	82,69	17,31	-1,04	-85,65	14,35	-2,91	-87,66	12,34
Enterprises	0,22	58,49	-41,51	-1,06	81,85	18,15	-3,68	-83,48	16,52
Household	0,81	13,64	86,36	-0,74	47,65	52,35	-0,61	-93,00	7,00
ROW	0,20	23,99	-76,01	-0,35	50,39	49,61	-0,41	-61,81	38,19

Central Bank	0,39	4,67	95,33	-0,33	49,45	50,55	-0,81	76,37	23,63
Financial Firms	1,60	45,73	54,27	-1,57	-76,74	23,26	-0,44	-51,35	48,65
Wide Economy	4,74	38,20255	61,79745	-5,09	65,29	34,71	-8,87	75,61	24,39

The year 2008, highlighted by the increase in the discrepancy, we can verify that 61% of the change in discrepancy was caused by changes in financial market structure. If we take a closer look, we can see that enterprises' and governments' decomposition shows higher contribution of objective economy, while changes in households and other institutional sectors contributions of financial market structure to the change in discrepancy was higher. We could conclude that households savings was not allocated to productive sectors, financial firms maintains their excess funds in treasury bonds, which are more profitable and with small risk. This financial behavior is the most important cause of change in 2008.

The decomposition of change in discrepancy index to the year 2009 and 2010, were almost caused changes in objective market (65% and 76% respectively). Remember that in both of this year the change was a decrease in the discrepancy. The year 2009 was highlighted by the decrease in GDP, in this year we could observe that the decrease in discrepancy was almost caused by economic result of objective economy. In the same way, in the year 2010, highlighted by a change in wide behavior, the financial behavior was caused by economic result of objective economy.

So we could conclude that in Brazil the economic recession had a financial origin in previously year (2008), were excess assets are not allocated to productive sectors. The ridge of crisis was reflected with decrease in GDP in the year 2009. In this year the movement in financial market was almost a mirror of changes in objective economy. Keeping the mirror, the wide change in financial behavior was also a reflection of objective economy.

4.1 Concluding Remarks

In this paper we applied Flow-of-Funds analysis to investigate Brazilian economy between 2004 and 2014. We developed two set of Asset-Liability Matrix and derived flow of funds indexes (Dispersion-Power Index, Sensibility-of-Dispersion Index

and Discrepancy of dispersion index) in the Asset-Oriented system and in the Liability-Oriented system.

We observe that household and Row are saving sector, their funds are allocated to enterprises, government and to financial firms by shares (investment funds and direct foreign investments), but it is also going to investor sectors through an in to informal market by other debts and credits.

We also observe that the Government and the Central Bank played important role in the Financial Market, both of them have high power of dispersion indices. Another remark is that Government, Central Bank and the Enterprises work as financial intermediaries in Brazilian economy, but along the years their involvement decreased. We could see that there was a relevant change in financial market in the period, with a high monetization of assets and in the same way, other financial firms show an increase in the ability of colleting funds.

There is a difference between the behavioral of government-sponsored banks and other financial firms. The former has ability to spread funds and the last has ability to absorb demand. In this sence, it is clear that there is a strong possibility that households savings are not being allocate in productive sectors.

We highlight that discrepancy index is a good indicator of economic behavior, because one year before a fall in GDP, there was a high increase in the discrepancy. We also highlight from discrepancy of dispersion, that until the year 2009 there was excess assets and from year 2010 there was excess liability in wide economy.

Decomposition of change in the years 2008, 2009 and 2010, showed that financial crisis in Brazilian economy had origins both in the structure of financial market and in objective economy decisions. The structure of financial system showed that excess assets stayed accumulated in financial system instead of going to productive sectors, generation the collapse in the financial system in 2008, followed by a decrease in GDP in 2009, and a change in structural behavior in 2010.

Without regard to government financial deficit (this is an important and much more complex issue), our adviser is that police makers should pay attention in this results. Improve financial intermediation in Brazilian financial system has to be a target to get a sustainable growth. One of the primarily concern is to look for financial instruments that could facilitate the mobilization of household savings and allocation to enterprises.

The limitations of the paper relates to the Input-Output Methodology assumption of fixed coefficient, which is especially important when we work with financial flow, because the amount of funds usually show higher volatility than consumption of goods and services.

To future work, we intend to expand the Institutional Sectors, the Balance Sheet of a set of Financial Institution, in other "groups" of Financial Institution, for example Commercial Banks, Investment Banks and Financial Cooperatives, analyses asset portfolio and liability portfolio of institutional sectors in many different periods and try to propose effective monetary and credit policies.

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ANEXX 1: The accounts of the Balance Sheet of the Central Bank of Brazil

Assets in foreign currency:
1.1.1. Available:
Available (foreign currency): refers to a share of foreign exchange reserves maintained by Central Bank with short and very short term.

1.1.2. Time deposits in financial institutions:
Time deposits in financial institutions (foreign currency): refers to a share of foreign exchange reserves maintained by Central Bank with medium term.

1.1.3. Resale agreement
Resale agreement (foreign currency): operations in which a spot purchase occurs concurrent with the assumption of the resale commitment (repo) or a spot sale assumption of the repurchase commitment at a future date (reverse repo).

1.1.4. Derivatives
Derivatives (foreign currency): refers to operations with the objective to administration of international reserves and exposure to risk. Works as a hedge of short term external liability. The financial instrument derivatives are: Forwards of currency, Forward of interests and securities.

1.1.5. Securities
Securities (foreign currency): refers to free bonds and bonds linked to repurchase agreements, issued from foreign national treasures.

1.1.6. Credits Receivable
Credits Receivable (foreign currency): refers to loans transactions in foreign currency made by BCB to provide liquidity do national financial system. Mainly instruments are Global Bonds, ACC e ACE, credit agreement.

1.1.7. Gold
Gold: refer to a share of the international reserve. Monetary financial asset.
This accounts do not enter in the FOF.*

1.1.8.Participation in International Financial Organization

Participation in International Financial Organization: refer a share of participation inte the International Monetary Fund (FMI) and in the Bank for International Settlements (BIS).

This accounts do not enter in the FOF.*

1.1.9.Other

Assets in local currency:

1.2.1.Available

Available (local currency): refers to amounts receivable arising from operations to be settled under the Local Currency Payment System - SML.

1.2.2.Deposits

Deposits (local currency): The deposits are constituted by legal determination, linked to lawsuits for which there is recognition of a provision (note 23.1) or a court order to pay (note 19.2). They are remunerated by the Referential Rate - TR and, due to this linkage, are unavailable until the judicial decision.

1.2.3.Resale agreement

Resale Agreement (local currency): operations in which a purchase occurs concurrent with the assumption of the resale obligation (Resale Commitment) or a sale assumption together with the repurchase obligation at a future date (Repurchase Commitment). In these operations, in view of their characteristics, the assets traded are accounted for as collateral, except in the case of foreign currency purchase and sale operations, since only against payment on the agreed date, ie the actual receipt of the negotiated currency settled operation. In the foreign market, the Central Bank of Brazil usually contracts with the same counterparty a repurchase agreement (repo) at the same time as a reverse repo, with independent financial settlement.

1.2.4.Derivative

Derivative: refer to Swap: used to execute the monetary and exchange policy, hedge to financial institutions; Currency equalization: daily balance operation between BCB and National Treasure. Purchased position.

1.2.5.Federal public securities

Federal public securities: refer to federal public bonds. They are Letras do Tesouro Nacional (LTN), Letra Financeira do Tesouro (LFT), Notas do Tesouro Nacional (NTN).

1.2.6.Credit with federal government

Credit with Federal Government: currency equalization and "Single Account of National Treasure". It is the account that registry all transaction between the BCB and Federal Government.

1.2.7.Receivable credit

Receivable credit (local currency): refers to credits of BCB with institutions in liquidation originated from financial assistance transactions (Proer) and balance from balance due on overdrafts in the Reserves Accounts.

1.2.8. Movable and immovable property
*This account does not enter in the FOF.

1.2.9.Other: Other credits

Liabilities in foreign currency:
2.1.1.Contracted operations to be settled
Contracted operations to be settled (foreign currency): refer to not yet payed contracted transactions, which will be payed in two or three days.

2.1.2.Deposits from financial institution
Deposits from financial institution: refers to deposits in the BCB from foreign financial institutions.

2.1.3.Repurchase agreement

2.1.4.Derivatives
Derivatives (foreign currency): means the reverse operation of 1.2.4.Derivative. Sold position.

2.1.5.Credits to pay
Credit to pay (foreign currency): refers to allocation of Special Withdrawal Deposits (DES). Funds from International Monetary Funds (FMI).

2.1.6.Deposits in International Financial Organization
Deposits in International Financial Organization: refers mainly to deposits from FMI.
Do not enter in the FOF.

2.1.7.Other: Other (foreign currency)

Liabilities in local currency:
2.2.1.Contracted operations to be settled
Contracted operations to be settled: refer to not yet payed contracted transactions, which will be payed in two or three days.

2.2.2.Deposits from financial institution
Deposits from financial institution: refers, mainly, to compulsory deposits, which represent monetary policy instrument.

2.2.3.Repurchase agreement
Repurchase agreement: refer o the reverse operation corresponding to the asset account 1.2.3. Resale agreement.

2.2.4.Derivative
Derivative (foreign currency): Refer to the reverse operation of 1.2.4.Derivative. Sold position.

2.2.5.Liabilities with federal government

Liabilities with federal government: refer to the Unique Account of the National Treasure.

2.2.6.Credit to pay
Credit to pay: Refers to judicial orders to pay (precatory).

2.2.7.Deposits in International Financial Organization
Deposits in International Financial Organization: refer mainly to FMI deposits.
This account do not enter in the FOF.

2.2.8.Provisions (Allowance)
Provisions: refer to retirement benefits and health care benefits.

2.2.9.Other: Other

2.3.CIRCULATING: refer to balance of paper-currency and metal currency with people and financial institutions.*
2.4.NET WORTH: net worth of BCB.
These accounts do not enter in the FOF.*

*These accounts are not included in FOF BR because they refer to monetary funds.