

Title: Macro-Financial Linkages of the Brazilian Economy

Abstract

This article aims to identify the main paths through which financial shocks were transmitted to economic sectors in the Brazilian economy in the period before to the 2009 crisis. For this, the product multiplier (Leontief, 1936) was calculated applying the Expansion Factor Miyazawa (1976) on the financial flows of the Financial and Social Accounting Matrix of Brazil (FSAM) and decomposed into three parts: i) the total balance of production, income and final demand transactions; ii) the total balance when considering savings and gross fixed capital formation; iii) the total balance, including the financial account. The Brazilian FSAM is available in Lates (LATES, 2016) for the period 2005-2009. There are seven main groups of accounts: production account, activity account, factor account, current account, capital account, financial account and account of the rest of the world. They were built using the information from the Make and Use Tables (TRU) published by the Nucleo Regional de Pesquisa Econômica (NEREUS / USP); the Integrated Economic Accounts (IEC) of the Brazilian Institute of Geography and Statistics (IBGE); and the IBGE and Central Bank of Brazil Financial Account. The multiplier determines the impact of the exogenous variation of a unit of demand on the output of the economy. The decomposition of the multipliers showed that in 2006 and 2007 financial flows contributed negatively to the multiplier and in 2008 and 2009 contributed positively.

1. Introduction

At the beginning of the period analyzed in this study, there is a high level of liquidity in the international scenario, an increase in external demand driven by the "boom in commodities" with great growth in the world economy, especially in China. In Brazil, high interest rates works together with and economic growth, product and fixed investments growth. The year of 2007 represents a milestone in the increase in the flow of transacted resources in the Brazilian economy. In the same period there is growth in output and investment (LATES, 2016).

In 2008, the international scenario began to change, there was a contraction of liquidity and external demand, the fall of the Lehman Brothers bank culminated in the intensification of the international financial crisis, the "Subprime Crisis". However, the economic scenario in Brazil does not change immediately. In 2008, there was an increase in product and investment, although there was no reduction in

interest rates or an increase in the flow of funds. But in 2009, the scenario changes dramatically. There is a fall in interest rates, in the product and in the investments.

This article aims to identify the main paths through which financial shocks were transmitted to the productive sectors of the Brazilian economy in the period prior to the crisis of 2009. For this, applies the decomposition path analysis of the FSAM multipliers, which were calculated from of the Brazilian Financial and Social Accounting Matrix (FSAM), available for the period from 2005 to 2009 (LATES, 2016).

A FSAM provides a set of data that allows visualizing the interrelationships between the various agents in an economy. It unifies the Input-Output (IP) production flows with the income distribution, by the approach of the Social Accounting Matrix (SAM) and broadens, by inserting the financial flows, which represents the applications of the surplus of savings in financial assets and the financial liabilities raised to finance the excess of investment in fixed capital, allowing evidence of the contributions of financial flows to the formation of output, income and investments in the economy.

The FSAM product multipliers are multipliers of the Input-Output Methodology (LEONTIEF, 1936), expanded by the SAM multiplier matrix applying the Miyazawa External Multiplier (1976), to financial flows (changes in financial assets and liabilities). Thus, they represent the impact of a variation in the exogenous demand on the product of the sectors considering the whole flow of income, from the generation, in the production, to the application of surpluses (or obtaining resources) in financial assets (by liabilities).

The evolution of the FSAM multiplier can generate additional relevant information. For example, in 2007, traditional indicators such as the Gross Domestic Product (GDP) showed economic growth, while FSAM multipliers indicated a decline, that is, the capacity of each sector or economic program to generate increase in the product was decreasing. On the other hand, in 2009, there was a fall in the product of the economy while the FSAM multipliers increased.

So, what were the elements, the flows, that contributed to the multipliers of the period? With the decomposition of the multipliers it seeks to answer this question. The multiplier is decomposed into three components of the total effect: i) the balance of production, income, and final demand transactions - a real part of the economy; ii) the balance when considering saving and gross formation of fixed

capital - capital account; iii) the total balance including the financial account, completing the flow of income in the economy.

Identifying the contribution of each component is expected to help explain the causes of the movements observed in the period that led to the fall in output in 2009, revealing the paths in which financial shocks were transmitted to productive sectors in the period.

2 Matrix of Social and Financial Accounting

A Financial and Social Accounting Matrix (FSAM) is a matrix that conciles the Input-Output (IP) accounts, which refer to the inter-industrial flow of goods and services, with national income, Social Accounting Matrix (SAM) approach and, in addition, the flows of financial assets and liabilities, in a unified statistical system.

Figure 1 presents the semantic structure of FSAM, highlighting the main relationships between SAM and FSAM.

The first area (AREA 1) indicated in figure 1, represents the Matrix of Social Accounting of the Real Economy, without savings and capital goods account. The second area (AREA 2) shows the transformation of the saving of the institutions and contributions of each institutional agent to the gross formation of fixed capital. The last area (AREA 3) represents the financial module of SAM and the shaded cells indicate the flow of financial assets and liabilities. Cells in this area, according to Emini e Fofack (2004), represent the link between the real side and the financial side of the economy.

As can be seen, the first four blocks of FSAM accounts refer to the rows and columns that represent the flow of goods and services and the flow of value added, or production factors (IP Matrix), in addition to the other transactions between the agents Current Account and Capital Account. The last block is an extension, in which the Financial Account is inserted.

Produtos Insumos	Produção		Fatores	Conta Corrente das Instituições				Conta Capital das Instituições					Conta Financeira					Total		
	Bens	Setores		4	5	6	7	8	9	10	11	12	13	14	15	16	17		18	19
	1	2		3																
1 Bens																				
2 Setores																				
3 Fatores																				
4 Famílias																				
5 Empresas																				
6 Governo																				
7 Resto do Mundo																				
8 Famílias																				
9 Empresas																				
10 Sistema Financeiro																				
11 Banco Central																				
12 Governo																				
13 Resto do Mundo																				
14 Moeda Corrente																				
15 Depósitos																				
16 Ações																				
17 Empréstimos																				
18 Outros Fluxos Financeiros																				
19 Discrepância estatística																				
20 Total do Gasto																				

Figure 1: Relations between SAM and FSAM

Source: Wong et al. (2009)

With emphasis on the interrelations between economic agents, the aggregate of information available in the FSAM has been used in General Equilibrium Models to analyze the structure of production and income distribution, for poverty analysis (AGÉNOR, et al., 2005), to analyze public debt behavior, to investigate the relations between the financial side and the real side of the economy, to study the propagation of the mechanism of transmission of the deterioration of the accounting balance of companies, among other applications.

We do not intend to be exhaustive in this exhibition, but rather to highlight the multiplicity of FSAM applications for economies at various stages of development, which stimulated the development of current work. The FSAM approach was applied to the Cameroonian economy for the 1996 period, where Emini and Fofack (2004) constructed an FSAM with the objective of using it in an Integrated Macroeconomic Model of Poverty Analysis. They used the impact analysis to investigate the effects of economic policies.

Also with the objective of using it in Integrated Macroeconomic Models of Poverty Analysis, Jensen, et al. (2004a, 2004b and 2004c) developed Social Accounting Matrices with financial flows for Bolivia, Colombia (both with 2000 data) and Argentina (1997 data).

The first FSAM for the European Region was drawn up with data from the year 1999 by Jellema, et al. (2004). This matrix shows the relationships between European regions and can be used to analyze the economic structure, including the development of financial transactions.

For Turkey, using data for the year 1996, Aslan (2005) constructed an FSAM from the I-P Tables together with data from income and consumption surveys, as well as from the Central Bank of Turkey. In Pakistan, Waheed and Mitsuo (2006) constructed FSAM for the period 1999-2000. The objective was to create a database that would serve as a basis for use in a general equilibrium model with the aim of analyzing public debt behavior.

In China, Li (2008) constructed an FSAM for the period of 2002. The author presents and applies the impact analysis comparing two types of multipliers: SAM-Real (SAM) and FSAM (F-SAM), to investigate the relations between the financial side and the real side of the economy. Also with the objective of evaluating real and financial linkages, Leung and Secrieru (2012) used an FSAM for the year 2004 for the Canadian economy. In addition, they analyzed the sensitivity of the multipliers and the effects of the recent global financial crisis.

The FSAM approach was also applied in India (DEP PAL, et al., 2012), with the objective of analyzing the structure of production and income distribution among several groups of families. For Vietnam, Civardi (2010) extended the approach of Pyatt and Round (1985) by classifying the impact into four (4) distinct effects: direct-direct, direct-indirect, indirect-direct, and indirect-indirect.

For Japan, Ogawa, et al. (2012) constructed the FSAM for the period 1990 to 2000, with the objective of evaluating the propagation of the mechanism of transmission of the deterioration of the financial statements of financial and non-financial firms.

Dakila, et al. (2013), using the FSAM of the Philippines of 2009, applied the analysis of multipliers in three (3) stages: direct, indirect and induced effect. In addition, they calculated link multipliers for forward, backward and value-added multipliers.

Li (2008) and Leung and Secrieru (2012), seek to compare the multipliers with exogenous (SAM) and endogenous financial flows (FSAM) for China and Canada, respectively. Aray et al. (2018) present a structural analysis methodology for decomposition of FSAM multipliers to identify the main paths by which financial

shock are transmitted. The authors apply this methodology to Spain and show the effect that the shock causes in each flow, the income, savings, investments, changes in financial assets and liabilities.

2.1 FSAM Impact analysis

The Input-Output multiplier is defined as the indicator of how much is produced by sector for each monetary unit spent on final consumption (GUILHOTO, 2004).

X being the vector that represents the total production; A matrix of technical coefficients (dimension nxn, where n is the number of sectors) and Y the vector representing the demand after all, the Input-Output (I-P) model can be written, in matrix form, as:

$$X = AX + Y \quad (1)$$

$$X = (I - A)^{-1}Y \quad (2)$$

Where, $(I - A)^{-1}$ is the total requirements matrix or Leontief Inverse Matrix (LEONTIEF, 1936).

Considering the fixed production technology, the increase (or reduction) in the product of each industry (ΔX), derived from a hypothetical variation in the final demand of one or more industry (ΔY), is given by equation 3:

$$\Delta X = (I - A)^{-1}\Delta Y \quad (3)$$

As the matrix of total requirements, portrays the effect of variations of exogenous demand on the output of each sector, the sum of each column of this matrix indicates the impact of an additional unit on the final demand in each of the sectors located in the column. Thus the Input-Output multiplier is defined as the indicator of how much is produced by sector for each monetary unit spent on final consumption (GUILHOTO, 2004) and can be expressed by equation 4:

$$MIP_j = \sum_{i=1}^n b_{ij} \quad (4)$$

Where:

MIP_j is the multiplier of the product of the jth sector and b_{ij} is the jth element of the inverse Leontief matrix.

The multipliers indicate the impact that changes in the final demand or in each of its components (household consumption, government spending, investment and exports) would have on total production, employment, imports, taxes, wages, others.

In a similar way, algebraic multipliers can be developed to represent the impact of changes in exogenous demand on the product of the sectors, including other economic agents in the transaction system (PYATT, 1999).

In order to obtain the product multipliers by the Social and Financial Accounting Matrix (FSAM) approach, the external factor of Miyazawa (1976) is applied, relating the financial flows to the savings and investment flows, thus creating the link with income, value added and intermediate consumption.

According to Leung and Secrieru (2012), the relationship between the SAM and FSAM multipliers can be visualized by the FSAM partition in 4 blocks, as observed in equation 5:

$$A^{FSAM} = \begin{pmatrix} A^{SAM} & A_{12} \\ A_{21} & 0 \end{pmatrix}, \quad (5)$$

Where:

A^{SAM} represents the SAM Multipliers Matrix without the financial flows, excluding the rows and columns for government and external sector that are exogenous, A_{12} and A_{21} are the matrices of the FSAM borders. A_{12} includes the financial liabilities of all agents and A_{21} collects the financial assets of all agents. All elements are normalized in relation to the totals of the columns in which they are found.

The FSAM Leontief inverse, therefore, $(I - A^{FSAM})^{-1}$, whose partition can be written by equation 6, below:

$$(I - A^{FSAM})^{-1} = \begin{pmatrix} (I - A^{SAM}) & -A_{12} \\ -A_{21} & I \end{pmatrix}^{-1} \quad (6)$$

To simplify the visualization, equation 6 will be denoted by the terms of equation 7, below, and will be called the FSAM inverse Leontief of:

$$(I - A^{FSAM})^{-1} = \begin{pmatrix} F_{11} & F_{12} \\ F_{21} & F_{22} \end{pmatrix}^{-1} \quad (7)$$

This equation holds some important relationships.

Proposition 1 shows how the FSAM multipliers are related to the SAM multipliers (LEUNG and SECRIERU, 2012):

Proposition 1: the FSAM Leontief inverse $(I - A^{FSAM})^{-1}$ is related to the SAM Leontief inverse, $(I - A^{SAM})^{-1}$, by equations 8:

$$F_{11} = [I - (I - A^{SAM})^{-1}A_{12}A_{21}]^{-1}(I - A^{SAM})^{-1} \quad (8)$$

Proposition 1 shows how FSAM multipliers can be achieved through operations between their partitions $(A^{SAM}, A_{12}A_{21})$. Equation 8 shows that the financial multipliers are obtained by expanding the SAM multiplier matrix, $(I - A^{SAM})^{-1}$ by the factor $[I - (I - A^{SAM})^{-1}A_{12}A_{21}]^{-1}$ this factor is referred to as Miyazawa External Multiplier (1976).

The external multiplier shows the effect of changes in financial assets and liabilities, A_{12} and A_{21} , in the real economy, $(I - A^{SAM})^{-1}$.

2.2 Decomposition of FSAM multipliers

As presented by Defourny and Thorbecke (1984) complemented by Azis and Mansury (2003) and Aray, et al. (2018), the decomposition analysis proposes to detail the FSAM multiplier matrix in 3 parts:

$$A = A_A + A_B + A_C \quad (9)$$

Where:

A_A = Real economy;

A_B = Capital account;

A_C = Financial account.

The first component, the real part A_A , is represented by the group of accounts of the Social Accounting Matrix in which the account production, account factors and current account are endogenous while the capital and financial account are exogenous. The Matrix of Impact Multipliers M_A , which determines the total equilibrium of production, income and final consumption, given changes in vector $y_A = M_A x_A$, can be expressed by equation 10:

$$SAM_A = \begin{bmatrix} IO & 0 & C \\ VA & 0 & 0 \\ 0 & VA^* & PI \end{bmatrix} \quad (10)$$

Where:

IO is the Intermediate consumption;

VA is the value added paid by the productive sectors; VA * is the added value received by economic agents;

C is the final demand consumption;

PI are income transfers.

The second component, represented by the coefficients A_B are formed by the group of accounts of SAM_A + savings and investment (capital account becomes endogenous and financial account remains exogenous).

The total balance of Production, Income Distribution and Final Consumption, considering the formation of savings and investments in gross fixed capital formation, can be expressed by:

$$SAM_B = \begin{pmatrix} SAM_A & K \\ S & KT \end{pmatrix} \quad (11)$$

Where:

K is Investment in gross fixed capital formation;

S is the Gross Bouquet;

KT are capital transfers.

The multiplier matrix M_B that determines the total balance of output, income and final consumption when saving equals the investment in gross fixed capital formation, as $y_B = M_B x_B$.

The third component, A_C , includes the financial account, is the complete matrix formed by SAM_A + savings and investment + asset and liability flow.

$$FSAM = \begin{pmatrix} SAM_A & K & 0 \\ S & KT & FL \\ 0 & FA & 0 \end{pmatrix} \quad (12)$$

$$FSAM = \begin{pmatrix} SAM_A & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} + \begin{pmatrix} 0 & K & 0 \\ S & KT & 0 \\ 0 & 0 & 0 \end{pmatrix} + \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & FL \\ 0 & FA & 0 \end{pmatrix} \quad (13)$$

From equation 13 we obtain the multiplier matrix M_C that determines the equilibrium of production, income and final demand, in the capital and financial account expressed in the vector $y_C = M_C x_C$.

Equation 9 can be rewritten using the Taylor approximation.

$$\begin{aligned}
M_C &= (I - (A_A + A_B + A_C))^{-1} \\
&= I + (A_A + A_B + A_C)^1 + (A_A + A_B + A_C)^2 + (A_A + A_B + A_C)^3 \\
&= (I + A_A + A_A^2 + \dots) + (A_B + A_C + A_B^2 + A_C^2 + 2A_A A_B + 2A_B A_C + \dots)
\end{aligned}
\tag{14}$$

From this result, the matrix of M_C multipliers can be decomposed so as to show the relationships derived from the real part and the financial part of the economy.

$$\begin{aligned}
M_C &= (I - A_A)^{-1} + (A_B + A_C + A_B^2 + A_C^2 + 2A_A A_B + 2A_B A_C + \dots) \\
&= M_A - I + M_B + (A_C + A_C^2 + 2A_A A_B + 2A_B A_C + 2A_A A_C + \dots) \\
&= M_A - I + M_B + (M_C - M_A + I - M_B) \\
&= I + (M_A - I) + (M_B - M_A) + (M_C - M_B)
\end{aligned}
\tag{15}$$

Therefore, equation 15 expresses the variation of the endogenous accounts resulting from variations in the exogenous accounts:

$$dy_C = M_C dx_C = [I + (M_A - I) + (M_B - M_A) + (M_C - M_B)] dx_C \tag{16}$$

In this way, the matrix of multipliers will be decomposed into follow elements:

- i) I , which represents the initial shock;
- ii) $(M_A - I)$, represents the net contribution of the relations contained in production, income and final consumption;
- iii) $(M_B - M_A)$, represents the part of the effect caused by the relationships contained in the savings and investments flows in gross fixed capital formation;
- iv) $(M_C - M_B)$ = represents the part of the effect caused by the relationships contained in the variation of financial assets and liabilities.

3 Application in the Brazilian Economy

In the current study, the Brazilian Financial and Social Accounting Matrixes (FSAM) were used for the period from 2005 to 2009. The Brazilian FSAM allows us to delineate an overview of the Brazilian economy in the period. In addition to the

industrial information presented in the Input-Output Tables published by IBGE, FSAM shows the savings flows, fixed investments and financial flows that occurred in the period.

In order to support the understanding of the contribution of each group of FSAM elements (real economy, capital account and financial flows), the evolution of fixed investments, savings and net acquisitions of financial assets and liabilities by the economy and non-financial companies, of the FSAM itself, are presented.

Fixed investment in the Brazilian economy increases until 2008 and in 2009 there is a decrease compared to the previous year, as can be seen in figure 2, which shows the evolution of investments in fixed assets made by the productive agents over the years of 2005 and 2009.

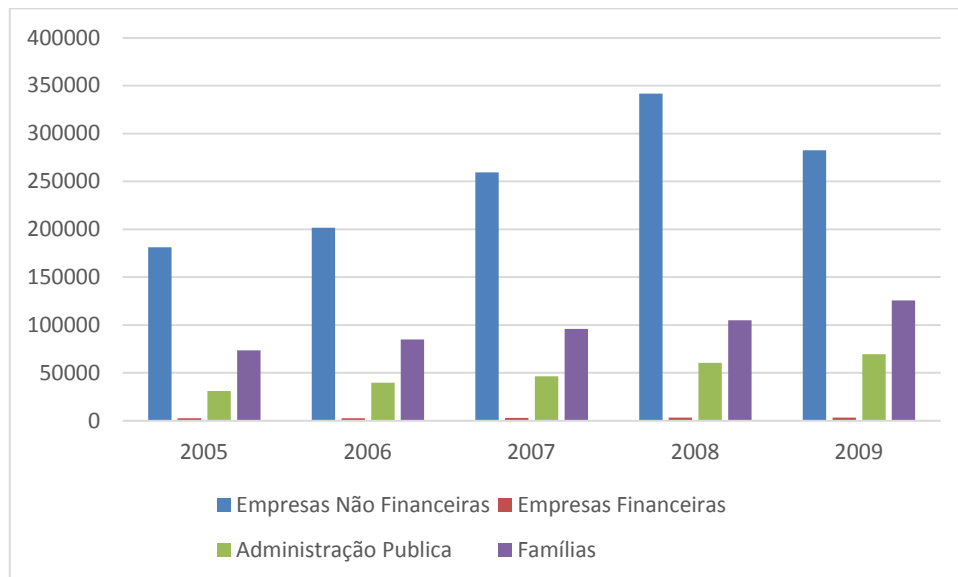


Figure 2: Evolution of Investments in Fixed Assets in Brazil, 2005 to 2009

Source: Burkowski, et al., 2015.

Analyzing the sources of financing used to finance investments, there is a significant increase in the total volume of resources in 2007, as can be seen in figure 3, which details the flow of investment resources (savings and financial liabilities)

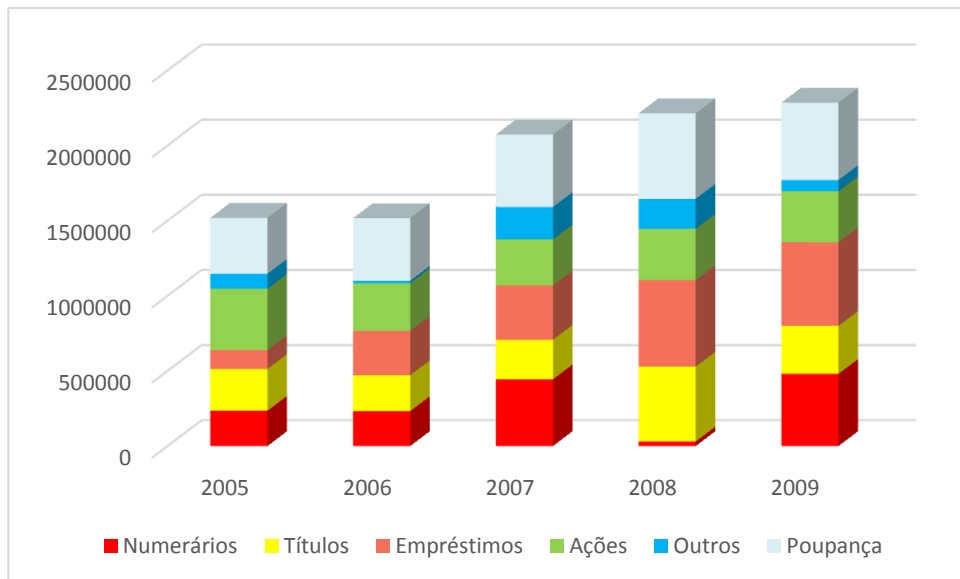


Figure 3: Participation of Sources of Financing in Brazil, 2005 to 2009

Source: Burkowski, et al., 2015.

Figure 3 shows that there is no great variation in savings, so the great increase in the total flow of resources in the Brazilian economy occurred in 2007 is due to the increase in the sources of financial resources, which represented, on average, 76% of sources of finance in the economy. Noteworthy is the evolution of cash and deposits in the year 2007.

The net asset variation and the net variation of financial liabilities in the Brazilian economy between 2005 and 2009 is shown in figure 4 and, as can be seen, there has been an increase in the net acquisition of financial assets in the period.

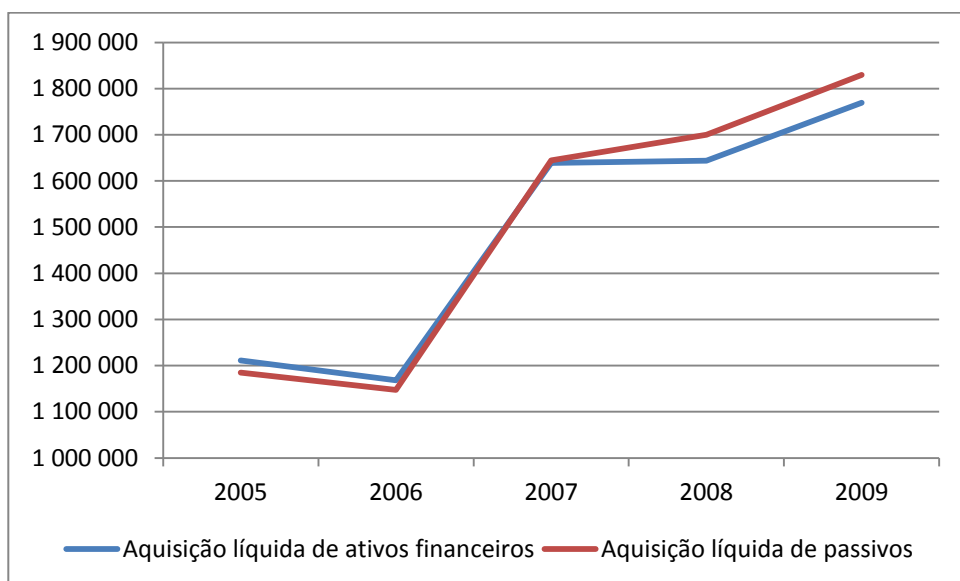


Figure 4: Net change in financial assets and liabilities - total of the economy, 2005 to 2009

Source: Prepared by the authors.

Figure 5 shows the net acquisition of financial assets and liabilities by non-financial corporations. There is an increase in the total acquisition of financial assets and liabilities by non-financial corporations in 2008.

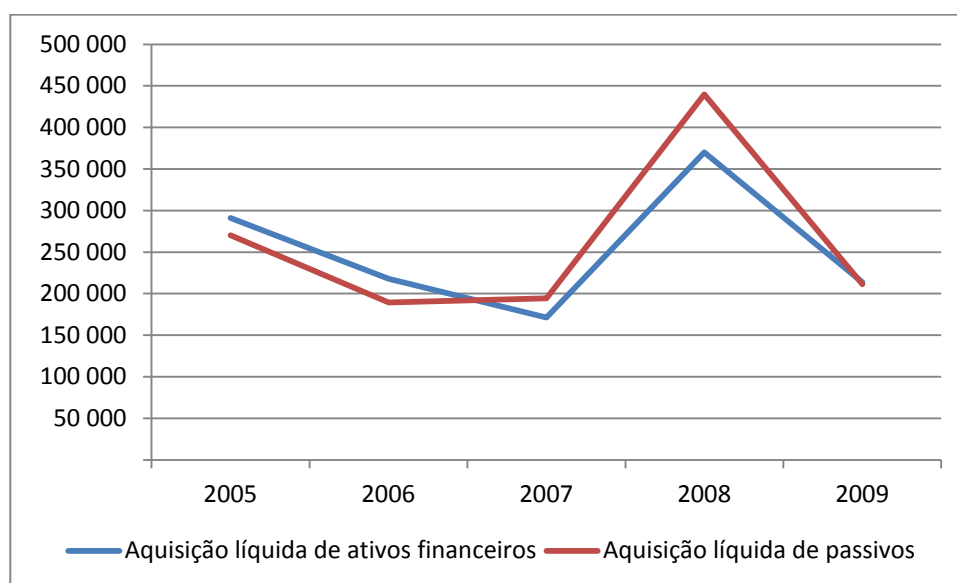


Figure 5: Net change in financial assets and liabilities - non-financial corporations, 2005 to 2009

Source: Prepared by the authors.

The change in assets over the year 2006 shows that non-financial corporations sought sources of financial resources but also made significant investments in financial assets.

Starting from the input-output multipliers, the Brazilian FSAM were transformed into sector-by-sector matrices, using the industry-based methodology. Then, the accounts related to the institutional agents Government and Rest of the World in the Sector x Sector matrix were considered exogenous.

Figure 6 shows the structure of the Brazilian FSAM Sector x Sector, organized in endogenous and exogenous accounts.

	Produtos/ Insumos	Receitas/Despesas	Fontes/Usos	Endógenas					Exógenas			Total	
				Produção Setores	Fatores	Conta Corrente	Conta Capital	Conta Financeira	Fatores	C. Corrente	C. Capital		Resto do Mundo
				1 a 56	57 e 58	59 a 61	62 a 64	65 a 71	1	2	3		4
Endógenas	1 a 56	Produção	Setores	Consumo Intermediário		Consumo Final	Formação Bruta de Capital Fixo			Consumo do Governo	Exportações		
	57	Fatores	Remunerações	Valor Agregado Líquido a Preços Básicos							Renda de Fatores Recebida		
	58		EOB										
	59	C. Corrente	Empresas Não Financeiras		Remuneração dos Fatores	Transferências Correntes				Transf. Corrente do Governo	Transf. Corrente Recebida		
	60		Empresas Financeiras										
	61		Famílias										
	62	C. Capital	Empresas Não Financeiras			Poupança	Transferências de Capital	Variação de Passivos		Transf. Capital do Governo	Transf. Capital Recebida		
	63		Empresas Financeiras										
	64		Famílias										
	65		Ouro e DES										
	66	C. Financeira	Numerário e depósitos				Variação de Ativos		Variação de Ativos				
67	Títulos, exceto ações												
68	Empréstimos												
69	Ações e outras participações												
70	Reservas técnicas de seguros												
71	Outros débitos/créditos												
Exógenas	1	C.Fatores	Impostos s Produção Liq. Subsídio	Impostos									
	2	C. Corrente	Governo		Impostos								
	3	C. Capital	Governo			Impostos							
	4	C. Resto do Mundo	Resto do Mundo	Importações		Transf.Corr.Exterio	Transf.Cap.aoExterio	Variação de Passivos					
Total	75	Total											

Figure 6 - Brazilian FSAM Sector x Sector, endogenous and exogenous accounts.

Source: Prepared by the authors.

The real part of the Brazilian economy is represented in figure 6, as the intersection of lines and columns 1 to 64, includes intermediate consumption, production factors and current and capital accounts for families and financial companies and non-financial companies, from where extracts the A^{\wedge} SAM (SAM standardized expenditure matrix). The matrix of interindustrial technical coefficients is represented by the first 56 crossings of figure 2.1, the matrix of endogenous final cost coefficients, is represented at the crossings between the first 56 lines with columns 59 to 64, the endogenous matrix of proportion of value inputs aggregate is shown by the vectors lines 57 and 58, the endogenous matrix of income distribution coefficients to the aggregate value categories is represented in the elements of the crossings between lines 59 to 61 with columns 57 and 58 and the endogenous matrix of distribution coefficients of income to institutions and families is represented by the elements of the crossings between the rows and columns 59 to 64 (each divided by the total column). The crossings of lines 65 to 71 with columns 64 to 66 represent the asset change that each institutional agent moved in the period and the crossings of lines 64 to 66 with columns 65 to 7 represent the variation of liabilities that each agent obtained in the period.

The multipliers were calculated by applying the external factor of Miyazawa (1973)

The product multiplier was calculated on 2 different levels:

i) N1, calculated by the sum of the columns that involve the intermediate flow, ie represents the impact of shocks on intermediate consumption;

(ii) N2, calculated by the sum of the columns that involve the entire FSAM (the intermediate flow, added value, current account, capital account and financial account);

The product multipliers for each activity sector, considering only the impact on the intermediate consumption, are presented in table 1.

Table 1 - FSAM multipliers - effect on intermediate consumption. Brazil, 2005-2009

Setores	2005	2006	2007	2008	2009	Média
Alimentos e Bebidas	3,96	3,88	3,86	3,88	4,08	3,93
Automóveis, camionetas e utilitários	3,88	3,81	3,75	3,66	3,85	3,79
Caminhões e ônibus	3,82	3,79	3,75	3,66	3,83	3,77
Artefatos de couro e calçados	3,85	3,79	3,73	3,64	3,73	3,75

Produtos do fumo	3,79	3,65	3,63	3,62	3,83	3,70
Peças e acessórios para veículos automotores	3,67	3,62	3,58	3,52	3,70	3,62
Defensivos agrícolas	3,63	3,63	3,59	3,49	3,69	3,61
Produtos de madeira - exclusive móveis	3,63	3,52	3,48	3,44	3,70	3,55
Celulose e produtos de papel	3,57	3,49	3,50	3,45	3,70	3,54
Pecuária e pesca	3,61	3,54	3,48	3,43	3,65	3,54
Eletrodomésticos	3,61	3,53	3,49	3,43	3,64	3,54
Álcool	3,53	3,44	3,44	3,45	3,82	3,54
Máquinas e equipamentos, inclusive manutenção e reparos	3,59	3,52	3,49	3,43	3,64	3,53
Serviços de alojamento e alimentação	3,55	3,47	3,45	3,44	3,65	3,51
Perfumaria, higiene e limpeza	3,52	3,50	3,46	3,43	3,60	3,50
Artigos do vestuário e acessórios	3,55	3,48	3,40	3,37	3,59	3,48
Tintas, vernizes, esmaltes e lacas	3,55	3,52	3,46	3,36	3,51	3,48
Cimento	3,46	3,33	3,48	3,45	3,62	3,47
Têxteis	3,51	3,44	3,39	3,36	3,59	3,46
Refino de petróleo e coque	3,46	3,49	3,35	3,41	3,56	3,45
Produtos e preparados químicos diversos	3,51	3,46	3,40	3,36	3,51	3,45
Outros produtos de minerais não-metálicos	3,47	3,43	3,42	3,35	3,57	3,45
Outros equipamentos de transporte	3,50	3,49	3,43	3,30	3,51	3,44
Máquinas, aparelhos e materiais elétricos	3,45	3,42	3,39	3,38	3,58	3,44
Móveis e produtos das indústrias diversas	3,48	3,42	3,40	3,36	3,56	3,44
Fabricação de aço e derivados	3,46	3,46	3,46	3,32	3,50	3,44
Produtos químicos	3,50	3,46	3,39	3,29	3,55	3,44
Produtos de metal - exclusive máquinas e equipamentos	3,44	3,42	3,40	3,36	3,53	3,43
Artigos de borracha e plástico	3,49	3,45	3,40	3,33	3,47	3,43
Saúde pública	3,43	3,44	3,35	3,34	3,54	3,42
Administração pública e seguridade social	3,43	3,41	3,36	3,34	3,52	3,41
Metalurgia de metais não-ferrosos	3,39	3,33	3,33	3,36	3,64	3,41
Educação mercantil	3,42	3,41	3,34	3,34	3,49	3,40
Material eletrônico e equipamentos de comunicações	3,41	3,39	3,39	3,28	3,45	3,38
Serviços prestados às famílias e associativas	3,40	3,37	3,31	3,31	3,52	3,38
Educação pública	3,38	3,38	3,31	3,30	3,49	3,37
Jornais, revistas, discos	3,40	3,36	3,32	3,27	3,48	3,37
Fabricação de resina e elastômeros	3,41	3,39	3,34	3,25	3,44	3,37
Outros da indústria extrativa	3,37	3,34	3,34	3,24	3,54	3,37
Minério de ferro	3,36	3,37	3,44	3,12	3,47	3,35
Transporte, armazenagem e correio	3,36	3,32	3,28	3,26	3,52	3,35
Saúde mercantil	3,38	3,33	3,28	3,27	3,47	3,34
Construção	3,34	3,31	3,27	3,27	3,52	3,34
Petróleo e gás natural	3,35	3,21	3,25	3,19	3,58	3,32
Produtos farmacêuticos	3,34	3,28	3,26	3,25	3,46	3,32
Serviços prestados às empresas	3,28	3,26	3,25	3,22	3,44	3,29
Serviços de informação	3,22	3,21	3,20	3,19	3,44	3,25
Serviços domésticos	3,28	3,26	3,18	3,16	3,34	3,24
Agricultura, silvicultura, exploração florestal	3,31	3,21	3,14	3,11	3,36	3,23
Intermediação financeira e seguros	3,21	3,17	3,12	3,17	3,36	3,21
Eletricidade e gás, água, esgoto e limpeza urbana	3,17	3,12	3,09	3,14	3,37	3,18
Comércio	3,17	3,14	3,10	3,09	3,32	3,16
Máquinas para escritório e equipamentos de informática	3,20	3,16	3,17	3,04	3,22	3,16
Aparelhos/instrumentos médico-hospitalar, medida e óptico	3,17	3,10	3,08	3,06	3,29	3,14
Serviços de manutenção e reparação	3,06	2,99	2,98	2,94	3,18	3,03
Serviços imobiliários e aluguel	2,71	2,65	2,67	2,68	2,97	2,74

Source: prepared by the authors.

The values presented in table 1 indicate the sum of the columns of the FSAM multiplier matrix. This sum represents the sector (or agent) multiplier, that is, the effect on the output of the economy caused by an increase in exogenous demand for this particular sector of activity (value added element and institutional sector). For example, in 2009 the variation of 1 monetary unit in the exogenous demand of the financial intermediation sector is capable of generating the variation of 2.21 monetary units in the total product of the other sectors of activity (3.21 is the multiplier denominated in red in table 1, with 1 being the initial shock, 2.12 is the effect in the other sectors, given the need for inputs from other sectors to supply this incremental demand).

Table 2 presents the FSAM multiplier for the various sectors of economic activity, considering all the circular flow of income.

Table 2 FSAM multiplier considering wide circular income flow - Brazil, 2005-2009

Setores	2005	2006	2007	2008	2009	Média
Serviços domésticos	9,27	9,49	9,02	9,01	9,60	9,28
Educação pública	9,06	9,22	8,80	8,79	9,43	9,06
Administração pública e seguridade social	8,95	9,07	8,70	8,65	9,33	8,94
Álcool	8,93	8,83	8,58	8,49	9,43	8,85
Alimentos e Bebidas	8,92	8,81	8,52	8,45	9,29	8,80
Serviços imobiliários e aluguel	8,89	8,60	8,46	8,51	9,52	8,80
Intermediação financeira e seguros	8,82	8,73	8,51	8,53	9,33	8,78
Educação mercantil	8,72	8,81	8,51	8,48	9,15	8,73
Pecuária e pesca	8,85	8,76	8,44	8,35	9,23	8,73
Saúde pública	8,67	8,78	8,41	8,52	9,14	8,70
Comércio	8,74	8,70	8,43	8,43	9,22	8,70
Serviços prestados às empresas	8,70	8,68	8,43	8,39	9,13	8,67
Produtos de madeira - exclusive móveis	8,65	8,60	8,32	8,23	9,11	8,58
Serviços de alojamento e alimentação	8,63	8,54	8,29	8,25	9,07	8,55
Serviços prestados às famílias e associativas	8,60	8,59	8,31	8,26	9,02	8,55
Produtos do fumo	8,62	8,57	8,28	8,19	9,02	8,54
Saúde mercantil	8,53	8,54	8,27	8,24	9,01	8,52
Construção	8,59	8,51	8,26	8,16	9,01	8,51
Artigos do vestuário e acessórios	8,64	8,55	8,22	8,08	8,90	8,48
Serviços de manutenção e reparação	8,50	8,40	8,18	8,16	9,03	8,45
Minério de ferro	8,46	8,29	8,12	8,21	9,05	8,43
Petróleo e gás natural	8,47	8,40	8,17	8,18	8,89	8,42
Jornais, revistas, discos	8,44	8,40	8,17	8,11	8,93	8,41
Serviços de informação	8,46	8,35	8,20	8,12	8,88	8,40
Agricultura, silvicultura, exploração florestal	8,54	8,41	8,08	7,92	8,95	8,38
Artefatos de couro e calçados	8,54	8,48	8,13	7,95	8,69	8,36
Transporte, armazenagem e correio	8,42	8,35	8,06	7,97	8,90	8,34
Produtos farmacêuticos	8,36	8,35	8,09	7,97	8,82	8,32

Móveis e produtos das indústrias diversas	8,41	8,32	8,07	7,95	8,80	8,31
Têxteis	8,51	8,35	8,01	7,89	8,76	8,30
Eletricidade e gás, água, esgoto e limpeza urbana	8,39	8,28	8,05	7,96	8,83	8,30
Produtos de metal - exclusive máquinas e equipamentos	8,30	8,18	7,94	7,81	8,68	8,18
Celulose e produtos de papel	8,18	8,19	7,92	7,77	8,65	8,14
Outros produtos de minerais não-metálicos	8,23	8,21	7,88	7,73	8,64	8,14
Cimento	8,21	8,18	7,84	7,64	8,57	8,09
Aparelhos/instrumentos médico-hospitalar, medida e óptico	8,06	8,05	7,83	7,74	8,60	8,06
Peças e acessórios para veículos automotores	8,08	8,12	7,87	7,69	8,43	8,04
Outros da indústria extrativa	8,15	8,04	7,78	7,62	8,48	8,01
Perfumaria, higiene e limpeza	8,11	8,06	7,77	7,60	8,49	8,01
Máquinas e equipamentos, inclusive manutenção e reparos	8,08	8,05	7,79	7,66	8,45	8,01
Fabricação de aço e derivados	7,98	7,86	7,74	7,59	8,34	7,90
Eletrodomésticos	7,92	7,94	7,74	7,59	8,27	7,89
Caminhões e ônibus	7,90	7,94	7,72	7,53	8,28	7,87
Automóveis, camionetas e utilitários	7,84	7,93	7,70	7,51	8,24	7,84
Máquinas, aparelhos e materiais elétricos	7,96	7,89	7,63	7,44	8,29	7,84
Tintas, vernizes, esmaltes e lacas	7,86	7,83	7,48	7,23	8,35	7,75
Defensivos agrícolas	7,87	7,90	7,54	7,34	8,09	7,75
Metalurgia de metais não-ferrosos	7,88	7,60	7,39	7,33	8,31	7,70
Produtos e preparados químicos diversos	7,77	7,78	7,46	7,17	8,03	7,64
Artigos de borracha e plástico	7,69	7,67	7,36	7,12	7,95	7,56
Outros equipamentos de transporte	7,52	7,59	7,30	6,94	7,78	7,43
Produtos químicos	7,51	7,44	7,13	6,76	7,90	7,35
Refino de petróleo e coque	7,36	7,31	6,99	6,92	8,03	7,32
Material eletrônico e equipamentos de comunicações	7,10	7,12	6,99	6,75	7,56	7,10
Fabricação de resina e elastômeros	7,36	7,30	6,89	6,48	7,27	7,06
Máquinas para escritório e equipamentos de informática	6,52	6,54	6,41	6,16	6,87	6,50

Source: prepared by the authors.

Both tables present the sectors organized in descending order (average for the 5 years), highlighting the sectors with greater capacity to leverage the economy, considering all the threads that occur in the economy. It is observed that Food and Beverages is the sector with greater capacity to leverage the economy and in the sequence Cars, vans and utilities, considering the productive connections. The most relevant sectors change considering all the circular flow of income, Domestic Services followed by Public Education present themselves with greater capacity to leverage the product of the economy. It should be emphasized that economic policies should be directed towards the sectors with the greatest multipliers.

The analysis of the structural decomposition of FSAM multipliers using the methodology described in Aray et al (2018) was followed. For FSAM multipliers

calculated on the two levels, the contribution of the parties related to the real economy, capital account and financial flows is evidenced.

Figure 7 shows the graph of the decomposition of the multipliers of the product in the first level (sum of the intermediate consumption), highlighting the increase in the product given the variation required in the intermediate consumption (decomposition of the multipliers shown in table 1), for the 3 sectors selected in the year of 2009.

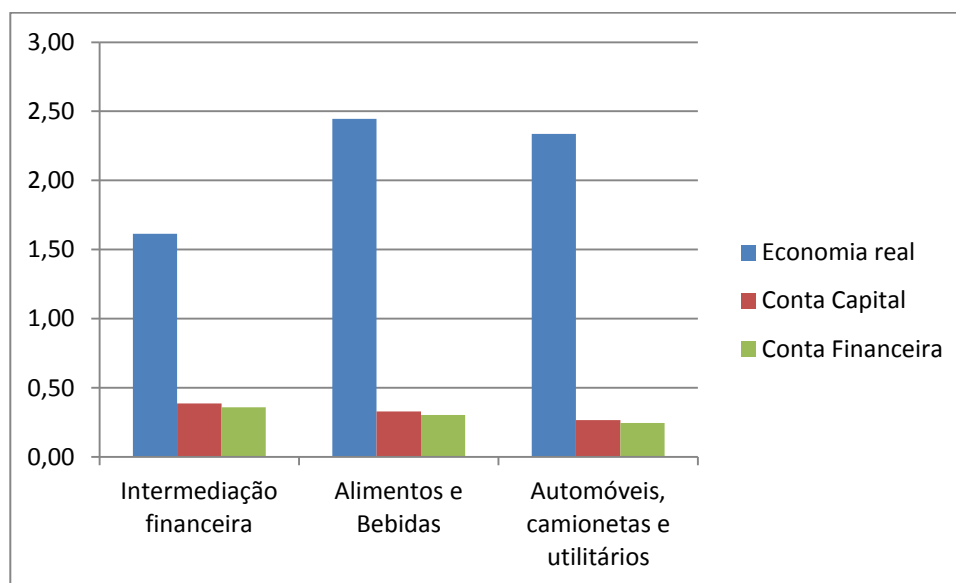


Figure 7: Path decomposition analysis of FSAM multipliers - effect on intermediate consumption, for selected sectors - Brazil, 2009

Source: prepared by the authors.

For all sectors analyzed (financial intermediation sector, food and beverage sector and Automobiles, vans and utilities sector), it is observed that the contribution of the part related to the productive sector of the economy is more relevant for the training of product multipliers, representing 60 to 80% of the multiplier. Showing that income is generated in the production is distributed among the economic agents and returns to the economy (via consumption) contributing largely to the product multiplier, indicating that the productive sector is the lever of the economy.

The contribution of the real part of the economy to the increase in total flows is also relevant, although, when considering other economic flows, the contribution of saving and investment and of financial flows becomes more visible.

Figure 8 presents the breakdown of the multipliers at the level that comprises the entire circular flow of income, that is, the multiplier effect in the product, given the variation required in intermediate consumption, added value, income transfers

(current account), in the allocation and saving and investment (capital account) and in the financial flows (financial account), that is, it is the total multiplier, considering all the economic transactions.

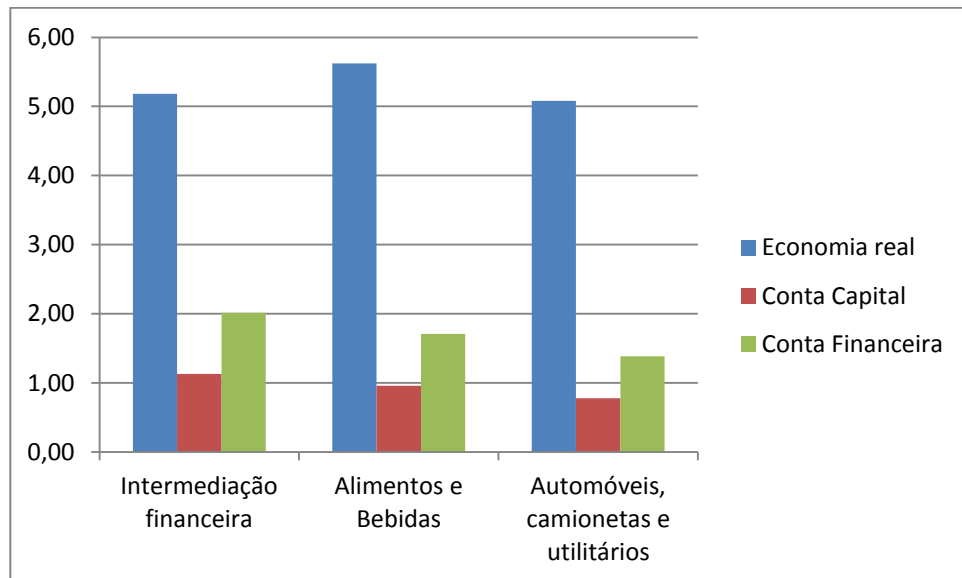


Figure 8: Path decomposition analysis of FSAM multipliers - total effect, for selected sectors - Brazil, 2009

Source: prepared by the authors.

For the Brazilian economy, in 2009, the product multiplier that considers every circular flow of income is much larger than the multiplier that considers only the intermediate consumption, since the flows of savings, investment in gross fixed capital formation and financial flows contributed to increase total output.

The evolutionary analysis of the multiplier decomposition adds relevant information as there are structural differences in behavior in the years prior to the crisis of 2009. The evolution of the decomposition of FSAM multipliers for the food and beverage sector summarizes the observed in the other sectors. The evolution of the decomposition in the first level of analysis, which represents the impact on the intermediate consumption, is presented in figure 9 and the decomposition in the second level of analysis, in which the total impact is considered is shown in figure 10.

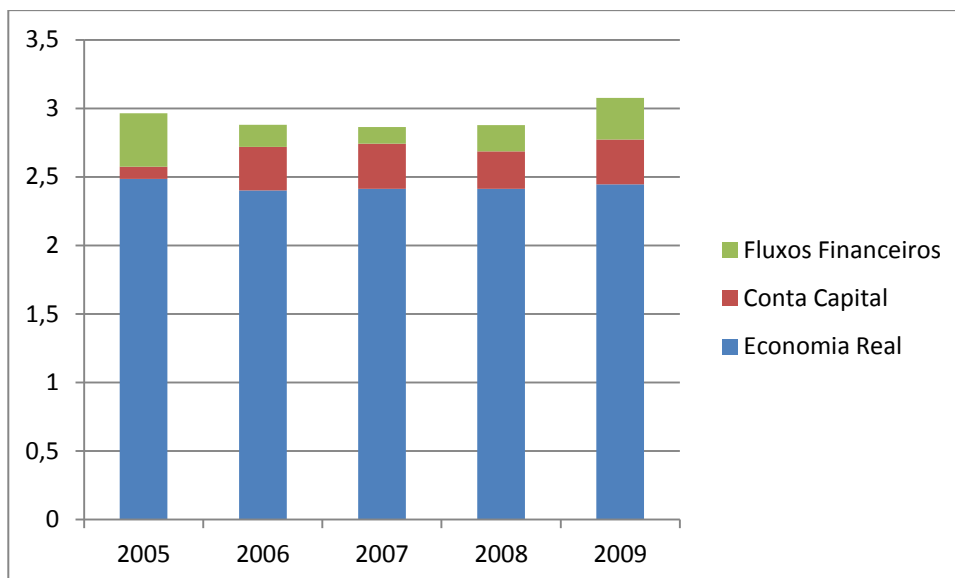


Figure 9: Evolution of FSAM multiplier decomposition - effect on intermediate consumption, Food and Beverage sector - Brazil, 2005-2009

Source: prepared by the authors.

The impact on the product, considering the effect on the intermediate consumption is caused mainly by the changes in the real part of the economy, as shown in figure 9. The total impact on the product receives contributions from the savings and investments flows and the financial flows in a varied way as shown in figure 10.

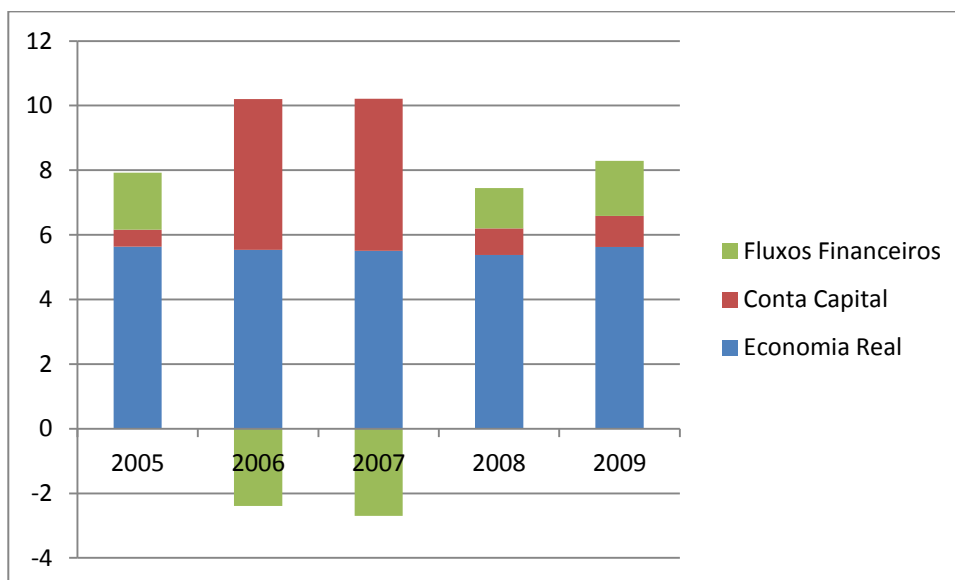


Figure 10: Evolution of FSAM multiplier decomposition - total effect, Food and Beverage sector - Brazil, 2005-2009

Source: prepared by the authors.

It should be noted that in 2006 and 2007, the contribution of savings and investment to the total multiplier is very relevant and the contribution of financial flows is negative. In 2008 and 2009, the financial contribution is positive and is more relevant than savings and investment flows.

The increase in fixed investments observed in the Brazilian economy explains the increase in the contribution of the capital account to the total multiplier in 2006 and 2007, however, can not be considered in isolation, since there is an increase in fixed investment in the Brazilian economy, including in 2008 (in which the contribution of savings and investment to the multiplier is reduced).

Asset variation greater than the net change in financial liabilities by non-financial corporations in 2006 indicates that the financial flow consumed the surplus income of entrepreneurs rather than directing it to the productive sector, which may help to explain the negative contribution of the financial part to the multiplier this year.

In addition, there was an increase in the flow of total financial resources by the economy in 2007, however, these resources are not directed immediately to the productive sector. In 2008 alone, resources were directed to non-financial companies. The concentration of financial flows in the financial market in 2007 may help to explain the negative contribution of the financial part in this year.

In 2008 and 2009, the financial contribution is positive. Analyzing the net funding of financial assets and liabilities by non-financial corporations, it is observed that in 2008 there was a large increase in the use of financial resources, and the increase in financial liabilities was greater than the increase in financial assets.

Therefore, in 2008, even without increasing the total net acquisition by the economy, there is a transfer of financial flows to non-financial companies. As the increase in financial assets of non-financial corporations is less than the increase in liabilities this year, resources directed to non-financial corporations were allocated to fixed investments, evidencing the positive contribution of financial flows to the product multiplier.

To detail this transfer of financial resources among the agents, Figure 11 highlights the variation of the loans account from 2005 to 2009, showing the total value of the flow, the total flow of financial companies and the total flow of non-financial companies . Total flow, total transacted by financial companies and the total transacted by non-financial companies.

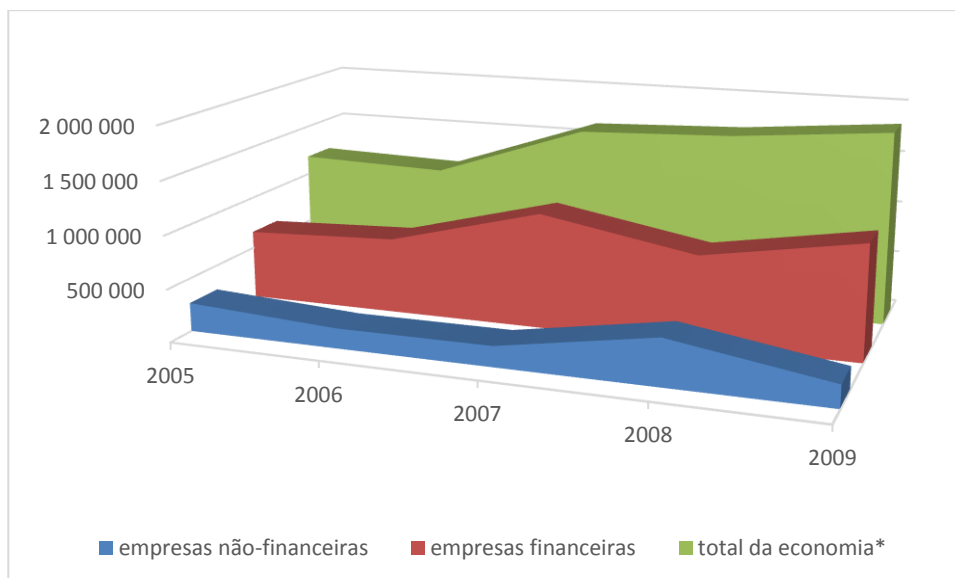


Figure 11: Net change in loans - total of the economy, financial companies and non-financial corporations, 2005 to 2009

Source: prepared by authors.

It is noted that it was through loans that the financial resources were transferred from financial firms to non-financial corporations. Indicating that the positive contribution of the financial part in the 2008 multiplier may have been caused by the transfer of financial resources to the non-financial sector (productive sector), especially through loans.

In 2009, financial resources were once again concentrated in financial companies, there was a reduction in the acquisition of assets and liabilities by non-financial corporations. Not only loans, but all sources of financial financing decrease and the savings generated in 2009 also decrease. However, the fall in fixed investment in 2009 was proportionately higher and there was also a decrease in the interest rate of the economy by monetary policy discouraging financial investments, so the few financial liabilities obtained were allocated to fixed investments contributing positively to the product multiplier.

4 Concluding remarks

In the period between 2005 and 2009 the multipliers of the Brazilian FSAM showed an evolution in the opposite direction of the total product of the economy. From 2005 to 2007 the FSAM multiplier decreases as the total output of the

economy grows. From 2007 to 2008, the multiplier grows and overall product growth slows. In 2009 the multiplier grows even more as the total output of the economy falls.

The results of the decomposition of the multipliers show that during the years of 2006 and 2007, the contribution of the financial sector is negative. The surplus of income generated in production not allocated to fixed investments was invested in financial investments and did not return to the product, was embedded in the financial system.

On the other hand, in 2008, the targeting of financial resources loans to non-financial corporations (productive sector) financed the excess of investments in relation to savings in the current account of the period and leveraged the product, evidencing the positive contribution of the financial flows to the product multiplier in 2008 and 2009.

This concludes the structure of financial flows observed until 2007, indicating that the financial sector was important to absorb the excess of international liquidity, but this increase in financial resources did not contribute to the total product of the economy in the period. In 2008, changes in the structure of financial flows were able to direct resources from the financial sector to the productive sector and to contribute to the total product that year and the following year in which there is a fall in the total product of the Brazilian economy.

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