AN ANALYSYS OF BRAZILIAN AGRICULTURE USING THE FOCUS OF A SOCIAL ACCOUNTING MATRIX (SAM), 1985 – 1995

Armando Vaz Sampaio[1]
Joaquim Bento de Souza F. Filho[2]

Abstract

The objective of this article is to analyze the relation between Brazil's agriculture sector and the country's other economic sectors in the years 1985 and 1995. Between 1985 and 1995, the Brazilian economy went through structural changes. These changes can be analyzed by examining inter-sector relations and income and expenditure flows within the Brazilian economy, particularly the agriculture sector, using a social accounting matrix (SAM) for 1985 and 1995 and calculating its multipliers (M_a). The results show a fall in agriculture sector labor as a percentage of GDP at factor cost over those ten years: in 1985, agriculture sector labor represented 2.06% of the Brazilian GDP; in 1995 it only represented 1.17%. Agriculture sector exports as a percentage of total sector production also shrank between 1985 and 1995, falling from 3.72% of total sector production in 1985 to 1.64% in 1995. The results show that, on the whole, SAM multipliers were higher in 1985 than in 1995, indicating that exogenous demand shocks had a greater impact on Brazilian manufacturing activities in 1985 than in 1995. This result can be attributed to the growing trade openness of the Brazilian economy over this period.

---

[1] Joint Professor of the Department of Economics – UFPR – avsampai@sociais.ufpr.br
[2] Associated Professor of the Department of Economics, Sociology and Administration – ESALQ/USP – jbsferre@carpa.ciagri.usp.br

Key words: Social Accounting Matrix (SAM), Multipliers, Multi-sector model

1. Introduction

The process of price stabilization causes changes in a country's production structure, product demand, service sector structure, etc. Such changes are reflections of implemented economic policies and the existing macroeconomic scenario. In order to understand these changes, it is necessary to examine the behavior of each sector and the modifications of income and expenditure flows that have occurred within the economy. The Brazilian economy in 1985 was different from the country's economy in 1995. In 1985, inflationary pressure was high, there was a firm policy of export promotion, and various stabilization plans were implemented. In the 1990s, economic liberalization and implementation of the "Real Plan" were the chosen tonics for the Brazilian economy. The effect of these policies is analyzed in 1995. In the following study, Brazil's economic structure, particularly its agriculture sector's, is analyzed using a social accounting matrix (SAM) and its calculated multipliers (M_a) to examine inter-sector relations and income and expenditure flows in 1985 and 1995.

2. Material and Method

The development of the SAM was motivated to reconcile the national accounts' structure with input-output analysis, thus making it possible to collect income and expenditure flows within the economy separate from sectoral relations. A SAM should be built as a function of the problem meant to be analyzed, meaning that there is no standard SAM that would serve every purpose.

While the definition of accounts in a SAM is varied, all SAMs satisfy certain conventions. The rows represent receipts within the

economy and the columns represent expenditures within the economy and they should always balance; that is, the total of the rows must equal the total of the columns, and the number of rows is the same as the number columns. Thus, the SAM is defined as a square matrix.

A compiled SAM is formed by 57 sectors: account activities (21 sectors); account product (21 sectors); factors market (4 accounts); households (2 accounts); taxes (2 accounts); government (1 account); margins (1 account); capital (1 account); stocks (1 account) and rest of world (1 account). The criterion for aggregation of the sectors in an input-output matrix is shown in Appendix 1. According to the proposed matrix, the number of sectors is the same for account activities and for account products, which means that each sector produces one product only. Two production factors were considered: capital remuneration and labor (gross operational surplus, GOS). These production factors were further divided into rural and urban, and the household account was also subdivided into rural and urban.

In order to calculate the SAM multipliers, it is necessary to divide the SAM into two account groups, endogenous accounts and exogenous accounts. In a typical Keynesian version, it is assumed that households are endogenous and that consumption depends on income distribution. Therefore, the endogenous accounts are account activities, account product, factors market, and households, which together total 48 sectors. The exogenous accounts are government, taxes, margins, account capital, stocks, and rest of world, which together total 9 sectors.

The next step is to obtain an expenditure coefficient matrix, A_n, by dividing each element of the transactions matrix (group of endogenous accounts) by the sum of the column's vector. The A_n matrix is, therefore, a square matrix 48 x 48 in size. Medium exit propensity, A_l, represents the exits of the endogenous accounts and is calculated by dividing each element of the exogenous accounts matrix by the column's vector. The sum of the columns of matrices A_n and A_l equals a unit. Table 1 shows

a simplified SAM structure . Considering the exogeneity of some accounts, a SAM is transformed into a multi-sector model of an economy, integrating the production sector, household receipts and expenditures, and the macroeconomic balance (Pyatt and Round, 1985, Batista and Thomas, 1998).

Table 1. Simplified structure of an estimated social accounting matrix (SAM)

Income\Expenditure	Activities	Product	Production Factors	Endogenous institutions	Exogenous Accounts	Total Receipts
Activities	0_{11} (21x21)	A_{12} (21x21)	0_{13} (21x4)	0_{14} (21x2)	X_1 (21x9)	Y_1
Product	A_{21} (21x21)	0_{22} (21x21)	0_{23} (21x4)	A_{24} (21x2)	X_2 (21x9)	Y_2
Production Factors	A_{31} (4x21)	0_{32} (42x21)	0_{33} (4x2)	0_{34} (4x2)	X_3 (4x9)	Y_3
Endogenous institutions	0_{41} (2x21)	0_{42} (2x21)	A_{43} (4x4)	0_{44} (2x2)	X_4 (2x9)	Y_4
Exogenous Accounts	M_{51} (9x21)	M_{52} (9x21)	M_{53} (9x4)	M_{54} (9x2)	Z_{55} (9x9)	Y_5
Total Expenditures	Y_1	Y_2	Y_3	Y_4	Y_5	

Source: Sampaio (2000).

Analytically, total receipts (the sum of the rows) of each endogenous account equal the sum of the product of the expenditures coefficients and the corresponding income plus the exogenous receipts (government, rest of world, account capital); that is

$$y_n = A_n y_n + x \qquad (1)$$

where y_n represents a column vector (48 x 1) of total receipts of 48 endogenous accounts, x is a column vector (48 x 1) of the total exogenous incomes, and A_n is an expenditure coefficient matrix (48 x 48) of the endogenous accounts. Equation 1 is used to determine the multipliers (M_a) of a SAM size (48 x 48) and its exit multipliers ($A_l M_a$) of size (9 x 48).

$$y_n = (I - A_n)^{-1} x = M_a x \quad (2)$$

$$L = A_\ell \ (I - A_n)^{-1} x = A_\ell M_a x \quad (3)$$

where L is related to exits (endogenous account leakages, taxes, imports, etc.)

Equation 1 is used to calculate the endogenous income (yn) associated with a variation of exogenous variables (x) where Ma is given. Each cell of the multipliers matrix can be interpreted as a change in the total income (direct and indirect) of the matrix's rows induced by an exogenous injection of an income unit in the matrix's columns (Bautista and Thomas, 1998; Bautista et al. 1999). This multiplier depicts the connections between the production sectors (Leontief's input-output matrix) and connections with consumption expenditure induced by changes in the production activities by means of household income effects. This interpretation is subject to limitations of SAM based analyses, which assumes that the adjustments occur solely on the demand side, the effects of changes in relative prices and monetary effects are absent, the exports are determined exogenously, and the accounts government and capital are exogenous. As it has been assumed that the supply of products and services is perfectly elastic, the product level responds rapidly to an increase in demand at a certain price level (fixed prices). As a consequence of these hypotheses, the multipliers have a larger response to exogenous shocks when compared to the models that deal with prices endogenously (AEG, applied general equilibrium models). Thus, when multipliers of the models with endogenous and exogenous prices are compared, they will inform the lower and the upper limits provoked by a change in real income.

3. Results Discussion

The relations between the 57 accounts that compose a SAM,

the criterion for sector aggregation of an input-output matrix, and other SAM construction details are presented by Sampaio (2000). Considering that gross domestic product (GDP) at market prices is calculated as the sum of aggregate value and indirect taxes and fees, it is possible to calculate the contribution of each sector to Brazilian GDP in 1985 and 1995 (Table 2). It can be observed that the participation of the Agriculture sector in GDP decreased, from 9.37% of GDP in 1985 to 8.04% of GDP in 1995, while GDP participation of the service sector increased, from 32.92% of GDP in 1985 to 40.58% of GDP in 1995. This reflects commonly noted effect: as a country's economy develops and its per capita GDP increases, the relative importance of agriculture within its economy decreases.[3]

Between 1985 and 1995, Brazil suffered a series of structural changes that can be noted in Tables 2 and 3. Table 3 shows that between 1985 and 1995 the participation of labor in total Brazilian GDP increased 7.15% in sector 21 (Services) while decreasing in most other sectors, among them Sectors 3 (Metal manufacture), 4 (Mechanical engineering) and 6 (Transport material)

[3] This is a long-term tendency. The opposite can occur in the short-term. see Bacha and Rocha (1999).

Table 2 - Contribution of each sector in GDP mp (%) - (1985 – 1995)

	Sectors	1985 GDP %	1995 GDP %
1	Agriculture	9.37	8.04
2	Mining and Non-metallic minerals	4.03	2.26
3	Metal manufacture	3.64	2.81
4	Mechanical Engineering	2.80	2.18
5	Electrical Engineering	2.56	2.19
6	Transport Material	3.03	2.63
7	Timber, Furniture, Cellulose, Paper and Printing	2.95	2.15
8	Chemicals, Pharmaceuticals and Perfumes and Plastic	6.73	5.92
9	Textiles, Clothes, Footwear, Leather and Hides	4.00	2.11
10	Coffee Industry	0.48	0.26
11	Vegetable products processing	1.60	1.19
12	Meat Production	0.69	0.80
13	Dairy Industry	0.36	0.38
14	Sugar Industry	0.39	0.24
15	Vegetable Oil Production	0.43	0.33
16	Other Food Products(animal food)	1.59	1.84
17	Various Industries	1.32	1.27
18	Energy, Water, Sanitation and Communication	2.96	4.29
19	Construction	5.23	7.81
20	Transport and Commerce	12.91	10.72
21	Services	32.92	40.58
	GDP	100.00	100.00

Source: Sampaio (2000).
mp = at market prices

Since aggregate labor participation in GDP in 1985 and 1999 was practically unaltered, moving from 39.59% to 40.64%, there must have been intense labor market restructuring as the increase in the use of labor in the service sector labor was compensated for by an almost equal decrease in labor use in the industrial and agricultural sectors (Melo et al., 1998 and Ramos and Reis, 1997). Melo et al. (1998) and Ramos and Reis (1997) verified intense labor heterogeneity in the service sector, with the creation of skilled employment opportunities in some sub-sectors and the more intense creation of unskilled, unregistered, though not necessarily low-pay, employment in the commerce sub-

sector among others. According to these authors, the national accounts item "other services" includes a great quantity of low-skilled labor and was responsible for approximately 50% of jobs created within the service sector.

Table 3. Participation of labor, capital (EOB)[1] and taxes in GDP at factor cost 1985 - 1995. (%)

		Labor		Capital		Taxes	
		1985	1995	1985	1995	1985	1995
1	Agriculture	2.06	1.17	8.23	7.61	-0.30	-0.32
2	Mining and Non-metallic minerals	0.86	0.49	2.94	1.27	0.00	0.13
3	Metal Manufacturing	1.46	0.81	2.14	1.50	-0.10	0.26
4	Mechanical Engineering	1.32	0.70	1.22	1.19	0.02	0.16
5	Electrical Engineering	0.71	0.42	1.31	1.10	0.02	0.14
6	Transport material	0.98	0.62	1.12	1.15	-0.03	0.20
7	Timber, Furniture, Cellulose, Paper and Printing	0.90	0.76	1.77	0.96	0.01	0.15
8	Chemicals, Pharmaceuticals and Perfumes and Plastic	1.63	1.03	3.93	3.92	-0.02	0.43
9	Textiles, Clothes, Footwear, Leather and Hides	1.17	0.61	2.57	0.91	0.00	0.15
10	Coffee Industry	0.06	0.05	0.28	0.16	-0.01	0.02
11	Vegetable products processing	0.30	0.19	0.72	0.41	-0.15	0.09
12	Meat Production	0.16	0.17	0.26	0.31	0.01	0.08
13	Dairy Industry	0.08	0.06	0.15	0.16	0.00	0.04
14	Sugar Industry	0.10	0.08	0.17	0.07	-0.01	0.03
15	Vegetable Oil Production	0.08	0.04	0.31	0.18	0.00	0.05
16	Other Food Products(animal food)	0.44	0.40	0.45	0.61	-0.01	0.13
17	Various Industries	0.41	0.26	0.77	0.56	-0.02	0.03
18	Energy, Water, Sanitation and Communication	1.22	1.76	1.71	1.98	0.01	0.21
19	Construction	2.01	1.12	3.74	7.07	0.06	0.46
20	Transport and Commerce	5.54	4.69	10.00	6.42	-0.69	0.51
21	Services	18.08	25.23	17.70	17.50	0.13	1.35
	Total	39.59	40.64	61.48	55.05	-1.07	4.30

Source: Sampaio (2000)

[1] OGS = operational gross surplus, [2] taxes and production subsidies

Between 1985 and 1995, a great change can be noted in taxes and production subsidies. In 1985, many sectors were still receiving some form of government subsidy, which is why the figures in the Taxes column can be negative, as in Sector 11 (Processing vegetable products) and Sector 14 (Sugar industry). Aggregate 1985 taxes represented – 1.07% of GDP at factor cost, a figure that rose to 4.3% in 1995. This

difference is a reflection of economic policy changes between 1985 and 1995 In 1985, Brazil was at the final stage of imports-substitution cycle with the implementation of III NDP (National Development Plan) while in 1995, post Real Plan Brazil pursued intense fiscal adjustment policy (Kon, 1999).

A country's level of performance and the openness of its economy can be analyzed by juxtaposing the country's export and import levels. The three columns of Table 4 show the importance of exports in relation to GDP in Column a, the participation of exports in each sector's total supply in Column b, and the participation of each sector's exports in the country's total export volume in Column c. Table 5 uses the same column headings, but the figures apply to the participation of imports in GDP at market prices.

In 1985, the value of exports corresponded to 12.52% of Brazilian GDP; in 1995 export value fell to 7.58% of GDP. According to Frischtak and Pessoa (1999), Brazil's export performance began weakening in the late 1980s due to the termination of an export policy that stimulated entry into foreign markets. The policy change came as a result of the Cruzado Plan, which brought development accompanied by low inflation levered by the domestic market's dynamism and an almost exclusive focus on short-term goals, particularly the control of inflationary pressures. Later, in the aftermath of implementation of the Real Plan's first stabilization measures in June and July of 1994, the currency was re-valued and the population (particularly societies lower economic levels) saw their real incomes grow. Yet, though the stabilization measures succeeded in reducing inflation levels, they also led to a gradual loss of whatever dynamism could be found in the Brazilian export sector. For the sake of comparison, the exports of South Korea and the Philippines represented 25.69% and 21.37% of their respective GDPs in 1985.

We observe in Table 4 that Sector 10 (Coffee industry) and Sector 15 (Vegetable Oil industry) are very export oriented. In 1985, 38.19% of the coffee and 30.57% of vegetable oil produced in Brazil

were exported, representing 5.46% and 5.17% of Brazil's total export earnings. Despite a general fall in exports from 1985 to 1995, some sectors improved their export performance, especially the Sugar Industry (Sector 14). Due largely to product pricing in the domestic market, sugar exports as a percentage of total Brazilian sugar production increased between 1985 and 1995, from 12.78% of total production in 1985 to 31.70% of total production in 1995. Sectors 21 (Services), 20 (Transport and commerce) and 3 (Metal Manufacturing) contributed the most to the total value of Brazilian exports in both 1985 and 1995: over 10%.

Table 4. Exports by sector in relation to GDP at market prices (%, a),and in relation to the total supply of the sector (%, b), and participation of the sector's exports in Brazil's total exports (%, c). 1985 & 1995.

		% GDP (a)	% GDP (a)	% TS (b)	% TS (b)	Particip.(c.)	Particip.(c.)
		1985	1995	1985	1995	1985	1995
1	Agriculture	0.55	0.20	3.72	1.64	4.38	2.65
2	Mining and Non-metallic minerals	0.79	0.43	12.47	11.69	6.32	5.68
3	Metal Manufacturing	1.27	0.97	11.21	12.93	10.15	12.76
4	Mechanical Engineering	0.34	0.29	6.89	9.09	2.69	3.87
5	Electrical Engineering	0.33	0.30	7.24	7.56	2.60	3.97
6	Transport material	0.88	0.63	14.61	11.55	7.03	8.32
7	Timber. Furniture. Cellulose. Paper and Printing	0.32	0.47	5.40	10.30	2.52	6.21
8	Chemicals. Pharmaceuticals and Perfumes and Plastic	1.71	0.53	9.21	4.34	13.69	6.98
9	Textiles. Clothes. Footwear. Leather e Hides	0.73	0.45	8.20	9.85	5.84	5.95
10	Coffee Industry	0.68	0.24	38.19	30.03	5.46	3.15
11	Vegetable products processing	0.48	0.27	15.61	10.68	3.82	3.62
12	Meat Production	0.26	0.16	10.58	6.43	2.11	2.06
13	Dairy Industry	0.00	0.00	0.26	0.17	0.02	0.02
14	Sugar Industry	0.14	0.24	12.78	31.70	1.15	3.14
15	Vegetable Oil Production	0.65	0.39	30.57	24.55	5.17	5.17
16	Other Food Products(animal food)	0.12	0.14	3.84	3.96	0.99	1.83
17	Various Industries	0.11	0.15	4.25	7.61	0.88	1.93
18	Energy. Water. Sanitation and Communication	0.02	0.01	0.31	0.19	0.12	0.14
19	Construction	0.00	0.00	0.03	0.00	0.03	0.00
20	Transport and Commerce	1.57	0.89	6.96	4.93	12.53	11.73
21	Services	1.57	0.82	3.46	1.49	12.50	10.82
	Total	12.52	7.58	6.80	4.61	100.00	100.00

Source: Sampaio (2000) TS = total supply, Particip. = participation

Table 5 shows the great behavioral change in importation between 1985 and 1995 — a reflection of early 1990s trade liberalization and exchange rate overvaluation, a situation that was further aggravated in the second half of the 1990s. It can be observed that total imports represented 7.23% of Brazilian GDP in 1985 and 9.04% in 1995, as most sectors augmented their imports in1995. The share of Sector 9 imports (Textiles, Clothes etc.) in total Brazilian importation increased between 1985 and 1995, moving from 1.03% in 1985 to 4.21% in 1995; and the share of Sector 9 imports in total domestic Sector 9 supply grew from 0.74% in 1985 to 6.43% in 1995. It is important to observe that while some sectors' imports represent less than 1% of total Brazilian importation in both years (Column c), a large increase in the flow of imported goods into these sectors' domestic supplies can often be noted (Column b), e.g., Sector 13 (Dairy industry).

Sector 1 (Agriculture) also demonstrates this type of import behavior. While the share of total Brazilian importation represented by Sector 1 imports decreased between 1985 and 1995 (5.08% vs. 3.95%), the share of Sector 1 imports in total domestic Sector 1 supply increased over the same period (2.17% vs. 2.47%). It is possible that the absolute amount of Sector 1 imports actually increased.

Between 1985 and 1995, Sector 8 (Chemicals) imports increased as a portion of total Brazilian importation (14.92% vs. 18.08%) while Sector 2 (Mining and non-metallic minerals) imports decreased as a portion of total Brazilian importation. This reveals Sector 8's dependence on foreign supplies and the considerable growth in the domestic production of petroleum, a Sector 2 product.

Table 5. Imports by sector in relation to GDP at market prices (%, a),and in relation to the total supply of the sector (%, b), and Participation of the sector's imports in Brazil's total imports (%, c). 1985 & 1995.

		% GDP (a) 1985	% GDP (a) 1995	% TS (b) 1985	% TS (b) 1995	Particip.(c.) 1985	Particip.(c.) 1995
1	Agriculture	0.37	0.36	2.17	2.47	5.08	3.95
2	Mining and Non-metallic minerals	2.73	0.60	27.31	11.80	37.78	6.65
3	Metal Manufacturing	0.23	0.38	1.96	4.81	3.16	4.24
4	Mechanical Engineering	0.42	0.81	7.12	18.35	5.84	8.91
5	Electrical Engineering	0.62	1.38	9.71	21.16	8.54	15.25
6	Transport material	0.37	1.01	4.74	12.65	5.08	11.19
7	Timber. Furniture. Cellulose. Paper and Printing	0.07	0.20	0.97	3.63	0.95	2.19
8	Chemicals. Pharmaceuticals and Perfumes and Plastic	1.08	1.64	4.97	10.38	14.92	18.08
9	Textiles. Clothes. Footwear. Leather e Hides	0.07	0.38	0.74	6.43	1.03	4.21
10	Coffee Industry	0.00	0.00	0.03	0.05	0.01	0.00
11	Vegetable products processing	0.06	0.10	1.48	2.77	0.86	1.06
12	Meat Production	0.02	0.04	0.67	1.13	0.30	0.39
13	Dairy Industry	0.01	0.08	0.80	5.00	0.17	0.84
14	Sugar Industry	0.00	0.00	0.09	0.28	0.02	0.02
15	Vegetable Oil Production	0.04	0.05	2.14	3.41	0.54	0.55
16	Other Food Products(animal food)	0.06	0.17	1.15	3.27	0.77	1.91
17	Various Industries	0.10	0.34	3.13	11.28	1.39	3.72
18	Energy. Water. Sewerage and Communication	0.01	0.16	0.13	2.37	0.09	1.72
19	Construction	0.00	0.00	0.00	0.00	0.00	0.00
20	Transport and Commerce	0.65	0.46	8.25	6.12	8.96	5.14
21	Services	0.33	0.90	0.73	1.60	4.52	9.95
	Total	7.23	9.04	3.92	5.51	100.00	100.00

Source: Sampaio (2000) TS = total supply, Particip. = participation

Table 6 is a resume of total Brazilian income in 1985 and in 1995 with all the information extracted from the SAM. One can note a trade surplus equaling 5.3% of GDP in 1985 and trade deficit equaling 1.46% of GDP in 1995. This demonstrates a decline in the Brazilian export sector's performance, as previously mentioned. One can also see a rise in the direct taxation of economic agents, moving from 11.68% of GDP in 1985 to 14.82% of GDP in 1995, and an increase in government consumption spending and transfer payments. This shows a government effort to cover increased spending by increased taxation. Interestingly, government investment also increased in 1995 relative to 1985, which can perhaps be explained by the influx of foreign capital through privatization.

Using the SAM, we can study the behavior of domestic demand components. Government consumption as a portion of total domestic demand increased 2.96% between 1985 and 1995, moving from 7.20% of total domestic demand in 1985 to 11.16% in 1995. This implies that consumption was an important factor in the increase of the government's deficit. Yet, the participation of intermediate consumption in GDP fell 7.76% between 1985 and 1995 (47.47% vs. 39.71%), as some sectors cut production and substituted imports. When non-aggregated sectors are analyzed, we note that there are sectors in which family consumption represents over 50% of total sector demand, such as in Sectors 12 (Meat production) and 13 (Dairy industry). On the other hand, there are sectors in which intermediate consumption represents over 50% of the sector's total domestic demand, as is the case for Sectors 1 (Agriculture), 14 (Sugar) and 15 (Vegetable oils). The participation of final demand components in other sector's domestic demand is shown in an analysis by Sampaio (2000).

Table 6. National income and Account Product of Brazil - 1985 - 1995 - PIB at market prices

Year 1985 - Cr$ 10^9					
EXPENDITURE	Amount	%GDP	INCOME	Amount	%GDP
Private Consumption	783840	55.37	Remunerations (Salaries)	1281005	90.49
Private Investment	322399	22.77	Other payment to **factors**	-13542	-0.96
Government Consumption	193589	13.67	Indirect taxes and fees	148186.8477	10.47
Government Investment	40942	2.89			
Exports	177297	12.52			
Imports	-102417	-7.23			
Gross Domestic Product	1415650	100	Gross Domestic Product	1415650	100
Account Government			External account		
Government Consumption	193589	13.67	Imports	102417	7.22
Government Investment	40942	2.89	- Exports	-177297.0683	-12.52
Government transfers	4140.154419	0.29			
- Indirect taxes and tariffs	-148186.848	-10.47			
-Direct taxes	-165364	-11.68			
Government deficit	-74880	-5.30	Trade deficit	-74880	-5.30
Year 1995 - R$ 1000					
EXPENIDTURE	Amount	%GDP	Income	Amount	%GDP
Private Consumption	381573098	56.29	Remunerations (Salaries)	582221559	85.89
Private Investment	144929061	21.38	Other payment to **factors**	26166843	3.86
Government Consumption	133640712	19.71	Indirect taxes and fees	69497447.5	10.25
Government Investment	27674724	4.08			
Exports	51382308.06	7.58			
Imports	-61314054	-9.04			
Gross Domestic Product	677885849.5	100	Gross Domestic Product	677885850	100
Account Government			External account		
Government Consumption	133640712	19.71	Imports	61314054	9.04
Government Investment	27674724	4.08	- Exports	-51382308.06	-7.58
Government transfers	18548194.68	2.74			
- Indirect taxes and tariffs	-69497448	-10.25			
-Direct taxes	-100434438	-14.82			
Government deficit	9931746	1.46	Trade Deficit	9931746	1.46

Source: Sampaio (2000)

SAM Multipliers

Fixed price multipliers are capable of showing various inter-sectoral relations both regarding the endogenous accounts, that is, how

an exogenous demand shock affects the economy, and the exogenous[4] accounts, which refer to a demand shock affecting the economy's "exits" (e.g. imports and taxes). In the paragraphs to follow we are going to analyze several graphs that explain this matter further. The matrices of SAM's multipliers for years 1985 and 1995 demonstrate these inter-relations (Sampaio, 2000). In these matrices, each cell shows a variation in total income by sector for endogenous accounts induced by an "injection" of a unit of exogenous income (demand-side shock), which stimulates various sectors of the economy. The cells can represent both Leontief's input-output table and new inter-relations between consumption expenditures provoked by changes in productive activities and these changes direct and indirect effects on household income.

Graph 1 shows the effect of the exogenous demand shock in each sector on the Agriculture sector (Sector 1). As expected, the effect of this shock is the most intense when originated within Sector 1 itself. Likewise, we can observe that the Agriculture sector is more sensitive to incentives originating in the sectors close to it, such as the agro-industry sectors – Sector 10 (Coffee Industry), Sector 11 (Vegetable product processing), Sector 12 (Meat Production), Sector 13 (Dairy Industry), Sector 14 (Sugar Industry), and Sector 15 (Vegetable Oil Processing).

It is also possible to observe the effect of this stimulus in both 1985 and 1995. It can be derived that the exogenous demand shock provoked a very intense reaction in all sectors in 1985 relative to 1995. This was due to the fact that the level of imports in 1995 was higher than in 1985, making it possible for the demand shock to cause an increase in importation and a decrease in the domestic production effort, which in turn contributed to the multipliers being lower in 1995.

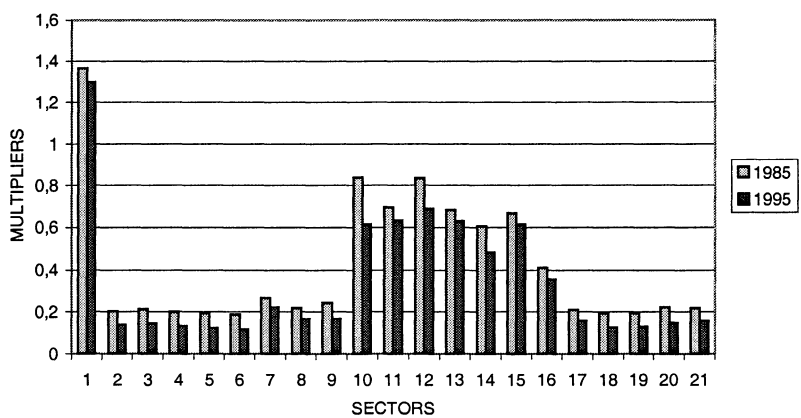
The difference in multipliers between these two years can also

---

[4] The term exogenous is related to a necessity to divide the SAM into endogenous and exogenous accounts in order to calculate its multipliers. It has no *strito sensu* of an exogenous variable detrmined outside the model.

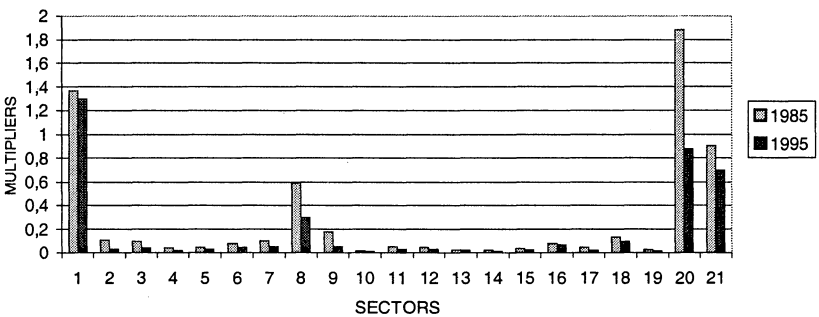
be a reflection of the growth in the economy's efficiency (in order to generate a monetary unit of a product, a smaller quantity of input is needed) and the further stabilization of relative prices in 1985. According to Scatolin (1998), the main source of Brazil's structural change between 1980 and 1995 was domestic demand expansion, as export expansion would have had a smaller impact on a large country with a large population, such as Brazil.'

Having calculated the SAM multipliers for the years 1985 – 1995, Santana and Carvalho (1994) found that their magnitude was highest in 1985. These results correlate with the effects of the policy of import substitution (II NDP, 1975-1979), which had its biggest impact in 1985, as analyzed by Gremaud and Pires (1999). The change in relative prices between goods and services from 1985 to 1995 can be attributed to lower values of the multipliers, which could also have influenced the fall in all sectors' production levels in 1995 relative to 1985.



Graph 1. Effect of a demand shock by sector on the agriculture sector
Source: Sampaio (2000).

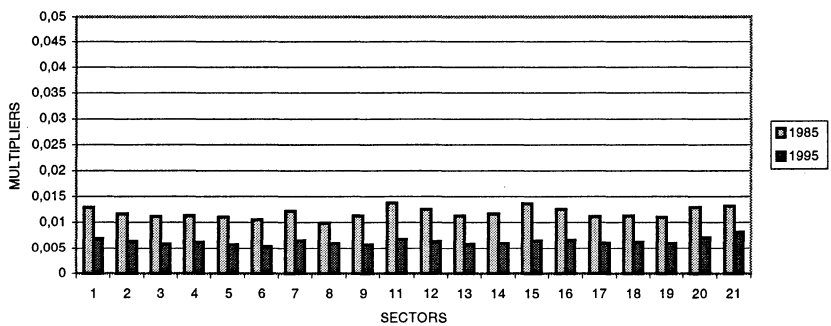
Graph 2 portrays the effects of a demand shock in the Agriculture sector on all other sectors and shows that agriculture has a small effect on other sectors. The sectors most responsive to the Agriculture sector ordered by diminished response are Sectors 20 (Transport and Commerce), 21 (Services), 8 (Chemicals, Pharmaceuticals and Plastic), and 9 (Textiles, Clothes, Footwear). A low multiplier value means that Sector 1 (Agriculture) possesses low backward linkage, a result of the sector's low *backward connection index* (Rasmussen-Hirschaman index, Guilhoto et al. 1994).



Graph 2. Effect of a shock in demand in the agricultural sector on other sectors
Source: Sampaio (2000).

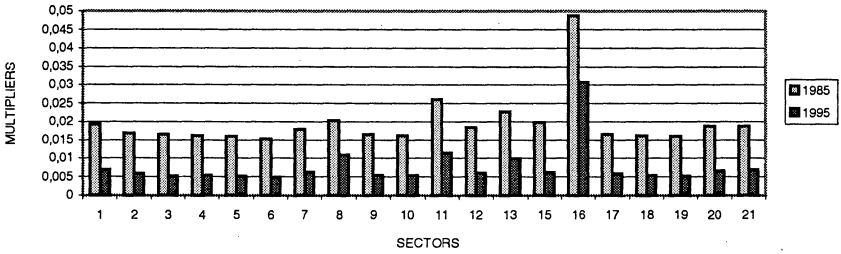
Just as we analyzed the effect on the Agriculture sector when there is an exogenous demand shock (incentive) in other sectors, including the Agriculture sector itself, it is also interesting to see the effect of an exogenous demand shock on the other sectors, particularly on the agro-industrial sectors. Graphs 3 and 4 show this relation, highlighting the effect on Sectors 10 (Coffee Industry) and 14 (Sugar Industry). Ignoring the stimulus of a sector on itself, it can be observed in Graph 3 that a demand shock in the rest of the economy has a very small impact on Sectors 10 (Coffee Industry) and 14 (Sugar Industry). Despite the low value of the multipliers, it is possible to note a behavioral difference between Sectors 10 and 14. The sugar industry (Graph 4) is

more sensitive to demand shocks from other sectors, especially from Sector 16 (Animal Food), than is the coffee industry (Graph 3). One should bear in mind that sugar byproducts are primary sources of fiber in animal feed and provide more minor raw material for the animal food industry in general, which also uses some 20% of the yeast from alcohol fermentation as a protein source. Alcohol production, however, was aggregated into Sector 8 in the SAM's structure. Considering the preceding, perhaps the existing relation between Sectors 14 and 16 is not sufficiently close to explain the magnitude of these multipliers, especially for the year 1985. Therefore, a sector's higher or lower degree of sensitivity to an exogenous demand shock ought to be analyzed with care due to methodological limitations influencing numeric effects (multipliers). Even so, it is interesting to analyze Sectors 10 and 14 separately since they react differently to an exogenous demand shock.



Graph 3. Effect of a demand shock by sector on the coffee industry (sector 10)

Source: Sampaio 2000.



Graph 4. Effect of a demand shock by sector on the sugar industry sector (sector 14).
Source: Sampaio (2000).

4. Conclusions

The results of this paper show important differences in the structure of Brazil's economy between 1985 and 1995. Over this period, there was an increase in the relative importance of Sector 21 (Services) and Sector 18 (Energy, Communications) as the development of new information technologies caused the channeling of larger investments into Sector 18, a tendency also found in other countries. This in turn made Sector 21 grow; e.g. growth in banking and tourism as a consequence of shorter working hours and increased life expectancy. On the other hand, the relative importance of the industrial and agricultural sectors declined.

This change had reflections on the labor market since those sectors whose relative importance rose demonstrate large heterogeneity in employment creation, labor qualification, and work quality. This labor market restructuring can be identified by the growing importance of the labor factor in the Service sector. Service sector labor represented 18.08% of Brazilian GDP at a factor cost in 1985 and grew to represent 28.23% of GDP in 1995. We also note a large increase in overall taxation, which grew from -1.07% of GDP at factor cost in 1985 to

4.3% of GDP in 1995, the result of fewer subsidies and government imposed fiscal adjustments. In 1995, some components that had reduced overall taxation in 1985 no longer existed: the IPI credit premium for exporters, the payment of crop failure debts incurred by farmers affiliated to PROAGRO (agricultural subsidies), and subsidies to the sugar and the petroleum derivatives industries (FIBGE, 1997).

As a result of economic policies, there was a general decrease in exports and increase in imports between 1985 and 1995; though, some sectors behaved otherwise, e.g., the Sugar Industry's (Sector 14) share of total Brazilian exports rose from 1.15 % to 3.14% between 1985 and 1995.

In the analysis of the SAM multipliers (M_a), we observed that they were higher in 1985 than in 1995. One of the important factors contributing to this result was a trade opening policy implemented in the early 1990s, which intensified after 1994 with the introduction of Real Plan. An interesting suggestion for future research would be to subdivide the 1985 to 1995 period, analyzing the year 1990 to see if the multipliers' ($M_{a)}$ behavior remains the same or influences some other component, such as a change in relative prices.

References

BACHA, C.J.C.; ROCHA, M.C. Desempenho da agropecuária Brasileira no período de 1987-1998. In: Anais do XXXVII Congresso Brasileiro de Economia e Sociologia Rural, Foz de Iguaçu, 1999. **Anais**. Paraná: 1999

BAER, M. O impacto do choque externo e as conseqüências da política de ajuste adotada (1980 – 1985); In: BAER, M **O rumo perdido, a crise fiscal e financeira do Estado Brasileiro**. São Paulo: Paz e Terra, 1993 cap. 3, p.71-117.

BAUTISTA, M.R.; THOMAS, M. **Agricultural Growth Linkages**

in Zimbabwe: Income and Equity Effects. Washington, IFPRI, TMD, 1998. 15p. (IFPRI. . International Food Policy Research Institute, TMD. Trade and Macroeconomics Division, , Discussion Paper, September,. nº 31)

BAUTISTA, R.M.; ROBINSON, S.; EL-SAID, M. **Alternative Industrial Development Paths for Indonesia: SAM and CGE Analyses**. Washington IFPRI, TMD, 1999. 20p. (IFPRI. International Food Policy Research Institute, TMD. Trade and Macroeconomics Division, , Discussion Paper, May nº 42)

FRISCHTAK, C.R; PESSOA, C.M.S. Política Industrial e Expansão das Exportações – Uma proposta de Ação. **In XI Fórum Nacional** – A Crise Mundial e a Nova Agenda de Crescimento, Rio de Janeiro, 17 – 20 maio de 1999. 34p.

FUNDAÇÃO INSTITUTO BRASILEIRO DE GEOGRÁFIA E ESTATISTICA. **Sistema de Contas Nacionais, Tabelas de Recursos e Usos – Metodologia**. Rio de Janeiro: IBGE, Diretoria de Pesquisas – DPE, 1997, 55p.

GREMAUD, A . P. e PIRES, J. M. II Plano Nacional de Desenvolvimento – II PND (1975-1979); In KON, A.(Org.) **Planejamento no Brasil II**. São Paulo, Editora Perspectiva, 1999, 310p. cap. 3, p.67-101.

GUILHOTO, J.M.M, et al. Índices de ligações e setores-chave na economia brasileira: 159/80. **Pesquisa e Planejamento Econômico**, v.24, n.2, p.287-314, 1994.

KON, A O Plano Cruzado; In KON, A.(Org.) **Planejamento no Brasil II**. São Paulo, Editora Perspectiva, 1999, 310p. cap. 4, p.103-121.

MELO, H.P. et al. O Setor Serviços no Brasil: Uma Visão Global, IPEA -**Texto para Discussão,** Nº 549, março 1998, 43p.

PYATT, G.; ROUND, J. I. Accounting and fixed-price in a social accounting matrix framewoerk. In: PYATT, G.; ROUND. J.I.A (Ed.) **Social Accounting Matrices - A Basis for Planning**. Washington:

The World Bank. 1985. cap 9, p.186-206.
RAMOS, L e REIS, J. G. Emprego no Brasil: os anos 90, in **Brasil Desafios de um País em Transformação**, José Olympio ed. p.218-246, 1997.
ROBINSON, S. Multisectoral Models, cap. 18. in CHENERY, H.; SRINIVASAN, T.N. (Eds.). **Handbook of Development Economics** Vol II, Elsevier Science Publishers, 1989.
SAMPAIO, A. V. Análise da Agricultura utilizando multiplicadores da matriz de contabilidade social (SAM), 1985 – 1995. Piracicaba, 2000. 230p. Tese (Doutorado) – Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo.
SANTANA, A.C. e CAMPOS, A C. Análise intersetorial da economia brasileira: uma aplicação da matriz de contabilidade social. **Revista de Economia e Sociologia Rural.** v.32, n.1, p.7-22, jan/março 1994.
SCATOLIN, F.D. Crescimento e Mudança Estrutural na Economia Brasileira: 1959-1995. In: I Encontro de Economia e Econometria da Região Sul, Florianópolis, 1998. **Anais**. Santa Catarina: 1998.

Apêndice 1. Sector aggregation of an input-output table in 21 sectors

	Input-Output Table Sectors	SAM Sectors	
01	Agropecuária	1	Agriculture
02	Mineral extraction	2	Mining and Non-metallic minerals
03	Petroleum and Gas EXtraction		
04	Non-metallic minerals		
05	Steel production	3	Metallurgy
06	Non-ferrous Metallurgy		
07	Other Metallurgy		
08	Machines and Tractors	4	Mechanics
10	Electric Material	5	Electric Material
11	Electronic Equipment		
12	Cars, Trucks and Buses	6	Transport Material
13	Other Vehicles and Parts		
14	Wood and Furniture	7	Wood and Furniture, Cellulose, Paper and Printing
15	Papelão e Gráfica		
16	Rubber Industry	17	Various Industries
17	Chemical Elements	8	Chemicals, Pharmaceuticals, Perfumes and Plastic
18	Petroleum Refining		
19	Various Chemicals		
20	Pharaceuticals and Perfumes		
21	Plastic Articles		
22	Textile Industry	9	Textile, Clothing, Footware, Leather and Hides
23	Clothing Articles		
24	Footware Manufacturing		
25	Coffee Industry	10	Coffee Industry
26	Processing of Vegetable Prodcuts	11	Processing of Vegetable Prodcuts
27	Abate de Animais	12	Abate de Animais
28	Dairy Industry	13	Dairy Industry
29	Sugar Industry	14	Sugar Industry
30	Vegetable Oil Production	15	Vegetable Oil Production
31	Other Food Prodcuts	16	Other Food Products (animal food)
32	Various Industries	17	Various Industries
33	Sevices. Public Utilities	18	Energy, Water, Sanitation and Communication
34	Civil Engineering	19	Civil Engineering
35	Commerce	20	Transport and Commerce Marrgins
36	Transport		
37	Communications	18	Energy, Water, Sanitation and Communication
38	Financial Institutions	21	Services
39	Serviços Prestados às Famílias		
40	Services Provided to Companies		
41	Estate Rents		
42	Public Administartion		
43	Private Non-mercantile services		
46	Financial Dummy		

Source: Sampaio (2000)