ESTIMATING AND MEASURING THE AGRIBUSINESS GDP AN APPLICATION TO THE BRAZILIAN ECONOMY, 1994 TO 2000*

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Abstract – Through the use of input-output analysis and the system of national account, this paper presents new methodological insights in ways to estimate and to measure the Agribusiness GDP of a nation. The GDP of the Agribusiness is also estimated for two major complexes: a) Vegetal Products and b) Animal Products. Each of the Agribusiness complexes is divided into four components: a) input to agriculture; b) agriculture; c) agriculture based industry; and d) final distribution. Using data for the Brazilian economy it was possible to measure the GDP of Brazilian Agribusiness, which were estimated to be around 27% of the Brazilian GDP in 2000.

Key Words: Agribusiness, GDP, Input-Output

1. Introduction

The discussion on the economic development on the impacts on sectorial activities of the economy in capitalistic countries has

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historically focussed on long-enduring trends of the transforming process of the society based on urban-industrial activities in which the role of the primary sector is to transfer capital, labour, and to generate foreign exchange for importing of capital goods, as observed by Bacha & Rocha (1998). According to this traditional concept, the vegetal/animal sector gradually becomes relatively less important in the composition of the Gross Domestic Product (GDP) of the economies, taking over a secondary role in the economic process of the countries.

This traditional and stationary formula of the area, however, has been more and more set aside by economic analysts in favor of a systemic view of the vegetal/animal sector, inserting the new dynamics of the rural sectorial transformation including the integrating approach of production chain – the agribusiness -, a reflex of profound structural changes in world economy (Streeter et al, 1991; Furtuoso, 1998).

Along the past decades, the vegetal/animal sector, following up these transformations, has evolved and become more modern, inserted into the market economy, forming complex storing, processing, industrialization and distribution networks, with an increasing consolidation of the agriculture/industry relationship and deepening of technological, productive and financial relations. Basically this process resulted in the structuring of a modern industrial park providing capital goods and input for that area, a sector called the rising tides of the farm. On the other hand, the ebb tide sector was formed, including the segments accounting for industrialization and distribution.

This new agriculture reality, as a strategic element of a large business branch in modern economy, shows a strong segment, highly dynamic and thoroughly connected to the economy, with a relevant performance in the economic development process. The "new agricultural economy" – the agribusiness – demands breaking with classical precepts of the analyses of agriculture, and it is fundamental to stress that the agribusiness development is the most efficient way for a country to add value over the produced agriculture product,

favoring new markets allowing larger exports, generating income and taxes for the country, as observed by Lauschner, 1993; Santana, 1994, and others.

In that scenario, this paper intends to measure the Brazilian agribusiness GDP in the period comprising 1994-2000, decomposing these estimates into two major subcomplexes – agriculture and animal products – which form this economic segment, as well as to detect the participation of the processing sectors (agriculture-based industry) composing the Brazilian agribusiness, in order to identify some courses of its development, especially in the process of intensification of the commercial opening and structural changes characterizing the period under analysis.

Next section describes the methodology adopted in the process of measuring the agribusiness GDP, incorporating a methodological approach that eliminates the issue of double counting usually found in these estimates. The following sections present the results of the Brazilian agribusiness calculation with conclusions and final implications.

2. Conceptual and methodological Aspects

Agribusiness is formally defined as a set formed by successive activities attached to the production and transformation of vegetal/animal and forest products (Muller, 1989). This set of agricultural and industrial activities is interdependent although heterogeneous as to the importance degree in the evolution of the complex. This definition was named "agribusiness" by Davis & Goldberg (1957), who described it as the "total sum of the agricultural operations and distribution of agricultural supplies; the operations of production in a farm; and storing, processing and distribution of agricultural products and items produced thereof". In Brazil, the systemic approach was first adopted by Araújo et al (1990).

One must emphasize, however, that although the systemic approach in agriculture is increasingly more widespread in the literature of economics, the adopted methodological formulations are con-

flicting, resulting in unlike values on the contribution of the segment to the formation of the Gross Domestic Product (Farina, 1988; Montoya & Finamore, 2001).

Using the macroeconomic concepts as adopted in the National Accounting System, Nunes & Contini (2000) measured the GDP of the Brazilian agroindustrial complex of 1996. CAI's activities and products ranked as agroindustry and services were separated as activities Exclusive to CAI and Partially Belonging to CAI. For the activities with non-CAI predominance, one considered only the proportion of input originated from CAI for the production value and intermediary consumption. For prevailingly non-CAI activities only the proportion of CAI-deriving input to the production value and of the intermediary consumption was considered. For prevailingly CAI product activities, the ones not belonging to it were subtracted, adopting the same proportionality procedure.

The concern with the need for an improved methodology to measure this important business branch as well as the real magnitude of its GDP in the post-Real period is the reason of this research. Knowing this economic indicator is fundamental, as a subsidy, to economic policy makers and decision takers in governmental and private scopes.

For the analysis of the Brazilian agribusiness covering the 1994-2000 period one used the input-output matrix, developed by Leontif (1951), which is integrated into the national accounts system.

Besides measuring the Agribusiness as whole for the economy, in this paper the Agribusiness was also measured for two major complexes: Vegetal Products and Animal Products. Further methodological discussions on the estimation of the Agribusiness Complex can be found on the works of Furtuoso (1998), Furtuoso, Barros and Guilhoto (1998), and Guilhoto, Furtuoso, and Barros (2000).

The total GDP value of the Agribusiness in each complex will also be divided into 4 aggregates: I) inputs; II) the sector itself; III) industrial processing; and IV) distribution and services.

The procedure adopted to estimate the Agribusiness GDP is through the scope of the Product, i.e., by estimating the value added at market prices, and, it is tanking into consideration the methodol-

ogy presented by the System of National Accounts defined by the United Nations (SNA, 1993), where the input-output matrices are integrated in this system.

The value added at market prices is given by the sum of the value added at basic prices with indirect net taxes less the financial dummy, resulting in:

$$VA_{PM} = VA_{PB} + INL - FDu \qquad (1)$$

where:

VA_{MP} = Value added at market prices
VA_{BP} = Value added at basic prices
INT = Indirect net taxes
FDu = Financial dummy

To estimate the GDP of **Aggregate I** (input for vegetal and animal production) one uses the information available in the input-output tables regarding the input values acquired by the Vegetal and Animal sectors. The columns with input values are multiplied by the respective coefficient of value added (CVA_i).

The Coefficients of the Value Added for each sector (CVA_i) are obtained by dividing the Value Added at Market Prices (VA_{MP})of a given sector by its respective output (X_i), i.e.,

$$CVA_i = \frac{VA_{PM_i}}{X_i} \qquad (2)$$

Thus, the double-counting issue presented by previous Agribusiness GDP estimates in the Brazilian Economy when input values were considered, instead of the value added effectively generated by it, is eliminated. In that sense the GDP of the **Aggregate I** is given by:

$$GDP_{I_k} = \sum_{i=1}^{n} z_{ik} * CVA_i \qquad (3)$$

$k = 1, 2$ vegetal and animal sectors
$i = 1, 2, ..., 43$ all the economic sectors

where:

GDP_{I_K} = GDP of aggregate I (input) for vegetal (k=1) and animal (k=2)

Z_{Ik} = total input value of sector i for either vegetal or animal

CVA_i = value added coefficient of sector i

For the total Aggregate I we have:

$$GDP_I = GDP_{I_1} + GDP_{I_2} \qquad (4)$$

where:

GPD_I = GDP of aggregate I

and the other variables are as previously defined.

The estimates for the **Aggregate II** (the sector itself, vegetal and animal) considers the value added generated by the respective sectors, subtracting the values used as input from the value added of these sectors, thus the double-counting issue found in the previous Agribusiness GDP estimates for the Brazilian economy is again eliminated. Then one has:

$$GDP_{II_k} = VA_{MP_k} - \sum_{i=1}^{2} z_{ik} * CVA_i \qquad (5)$$

$k = 1, 2$

where:

= GDP of aggregate II for vegetal ($k = 1$) and animal ($k = 2$) and the other variables are as previously defined.
For the total Aggregate II we have:

$$GDP_{II} = GDP_{II_1} + CDP_{II_2} \qquad (6)$$

where:

GDP_{II_k} = GDP of aggregate II

and the other variables are as previously defined.

To define the composition of the **Aggregate III** (agriculture based industries) several indicators were adopted as for instance: a) the main demanding sectors of agricultural products obtained by input-output matrix estimation; b) the share of agricultural input in the intermediate consumption the agroindustrial sectors; and c) the economic activities carrying out the first, second and third transformation of agricultural raw materials. In this way, the agriculture based industries are the following activities: i) Wood and Wood Products; ii) Pulp, Paper and Printing; iii) Processing of Chemical Elements (Alcohol); iv) Textile; v) Clothing; vi) Footwear, Leather and Skins; vii) Coffee Industry; viii) Vegetal Products Processing; ix) Animal Slaughtering; x) Dairy Industry; xi) Sugar Industry; xii) Vegetal Oil Processing; and xiii) Other Food Products.

The input-output matrix data for 1995 shows that out of the total output of vegetal and animal production for intermediary purposes, 21.8% is absorbed by the rural sector, 71.8% is sold to the agriculture based industries and only 6.4% is designated to the remaining sectors.

In the estimation of **Aggregate III** (Agriculture Based Industries) one adopted the summation of the value added generated by the agroindustrial sectors subtracted from the value added of these sec-

tors that have been used as input in the Aggregate II. As previously mentioned, this subtraction is done to eliminate the double-counting found in previous Agribusiness GDP estimates, as so, one has that:

$$GDP_{III_k} = \sum_{q \in k} VA_{MP_q} - z_{qk} * CVA_q \qquad (7)$$

$k = 1, 2$

where:

CDP_{III_k} = GDP of aggregate III for vegetal products ($k = 1$) and animal products ($k = 2$)
and the other variables are as previously defined.

For the total Aggregate III we have:

$$GDP_{III} = GDP_{III_1} + GDP_{III_2} \qquad (8)$$

where:

CDP_{III} = GDP of aggregate III

and the other variables are as previously defined.

In the case of **Aggregate IV**, regarding the Final Distribution, one considers the aggregated value of the Transportation, Commerce and Service sectors. Out of the total value obtained for these sectors only the part corresponding to the share of the agricultural and agroindustrial products is designated to the Agribusiness in the final product demand. The approach adopted in the estimation of the final distribution value of the industrial agribusiness can be represented by:

$$GFD - INT_{FD} - IP_{ED} = DFD \tag{9}$$

$$VAT_{MP} + VAC_{MP} + VAS_{MP} = TM \tag{10}$$

$$GDP_{IV_k} = TM * \frac{FD_k + \sum_{q \in k} FD_q}{DFD} \qquad k = 1,2 \tag{11}$$

where:

GFD = global final demand
INT_{FD} = indirect net taxes paid by the final demand
IP_{FD} = imported products by the final demand
DFD = domestic final demand
VAT_{MP} = value added of the transportation sector at market prices
VAC_{MP} = value added of the commerce sector at market prices
VAS_{MP} = value added of the service sector at market prices
TM = trading margin
FD_k = final demand of vegetal (k =1) and animal (k =2)
FD_q = final demand of the agroindustrial sectors
= GDP of aggregate IV for vegetal (k =1) and animal (k =2)
For the total Aggregate IV we have:

$$GDP_{IV} = GDP_{IV_1} + GDP_{IV_2} \tag{12}$$

where:

GDP_{IV} = GDP of aggregate IV

and the other variables are as previously defined.

The Agribusiness GDP for each sub-complex is given by the sum of its aggregates as:

$$GDP_{Agribusiness_k} = GDP_{I_k} + GDP_{II_k} + GDP_{III_k} \tag{13}$$

where:

$GDP_{Agribusiness}$ = GDP of the agribusiness for vegetal products (k =1) and animal products (k =2)

and the other variables are as previously defined.

The total Agribusiness GDP is given by:

$$GDP_{Agribusiness} = GDP_{Agribusiness_1} + GDP_{Agribusiness_2} \quad (14)$$

where:

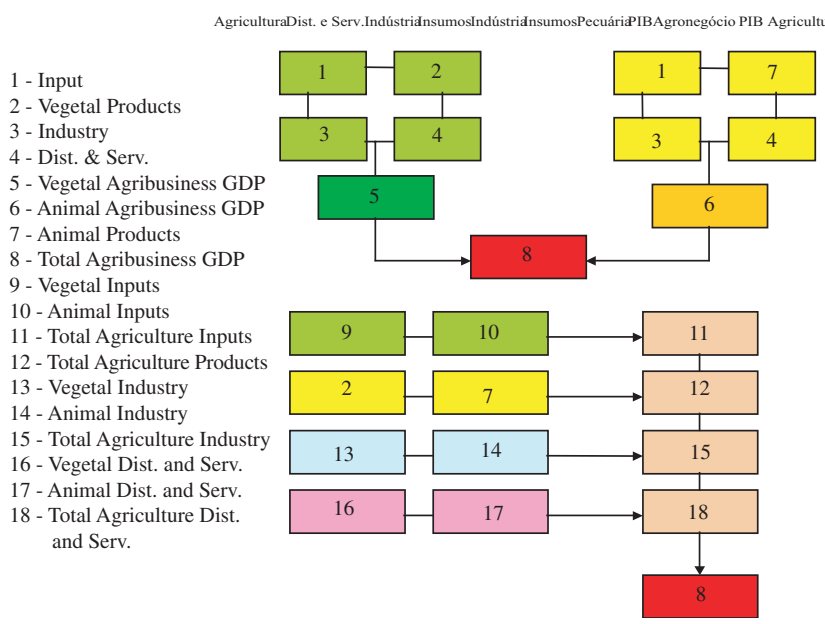
$GDP_{Agribusiness}$ = Agribusiness GDP

and the other variables are as previously defined.

The methodology described above is showed in Figure 1. In this way, the Agribusiness GDP can be obtainable either by the weighed sum of the aggregates GDP or by the weighed sum of the GDP of the Vegetal and Animal Products.

Figure 1. Obtaining the Agribusiness GDP.

To obtain the contribution of each industrial sector to the Agribusiness GDP the following is done: a) the agribusiness value is estimated, should there be no industrial sectors, according to the methodology described above; and b) also according to this methodology, each industrial sector is inserted, one by one, into the agribusiness complex, thus, by subtraction it is possible to estimate the contribution of each processing industry to the total agribusiness.



3. The Brazilian Agribusiness, 1994 to 2000

The results for the Brazilian Agribusiness point out the importance that such complex has played in the national economy, accounting for approximately 27% of its GDP in 2000.

Table 1 presents the shares of the Agribusiness GDP in the Brazilian economy for the 1994-2000 period. The Brazilian Agribusiness GDP accounted for 30.4% of Brazil's GDP in 1994, having a declining trend until 1997 (27.7%). These numbers of agribusiness GDP participation in the National GDP differ from the 20.6% estimated by Nunes & Contini (2000). Although the work by ABAg derives from the same calculation bases as this paper, the input-output matrix of 1996–IBGE, these differences are explained by distinguished methodological issues. In order to calculate the Brazilian agribusiness in this paper, one adopted the methodology by Guilhoto et al (2000), representing a consolidation of several methodological procedures used for this type of calculation,

besides introducing procedures that eliminate the issue of double counting found in these estimates.

The GDP of the Brazilian Agribusiness for 2000 was estimated to be US$ 167.7 billions. Which represent a small growth over the value observed in 1994 (US$ 163.0 billion) and being the same value as the one observed for 1995.

The Brazilian economic development process has followed a trend of economic development of capitalistic countries presenting distinguished sectorial growth rates among agriculture, industry, services, in which the industrial and service sectors tend to have growth rates higher than agriculture, in long term.

In a dynamic agricultural sector inter-connected to the rest of the economy, linked to strong rising and ebb tides, its growth pattern becomes more complex and depending on the combination of its various components (primary, secondary and tertiary).

Although the value of the Brazilian agribusiness in the 1994-2000 period did not change in practical absolute terms, its participation in the national GDP tends to descend. This reduction occurs especially because of the dynamics of other industrial complexes and of the service sectors. It is important to consider the structural changes by which the country has undergone as well as the economic opening process which marks the entire decade of the 90s and reflect on this result, since they lead the total GDP to grow more rapidly than the agribusiness GDP.

The real annual variation of the Brazilian agribusiness GDP at market prices for the 1994-2000 period shows lower growth rates than the national GDP growth rate, except for the 98-99 biennial. In 2000, the national GDP grew approximately 4.00% while the agribusiness had a lower pace (0.10%), an indication that the agribusiness lost participation in the GDP. It is a fact that the strong exchange recognition starting in 1994 – beginning of the Real Plan – which permeated almost the entire decade, gave rise to a strong reduction in the agriculture prices received by Brazilian farming producers. According to Homem de Mello (1998), in the 1989/96 period a real recognition of the exchange rate of 40.5% occurred, while real

farming prices had a reduction of 41.1%, thus drastically affecting the agricultural profitability. In an economy that is open to the international trade, the valorizing of the exchange rate is a key factor to the profitability of producing activities, especially agriculture, traditionally turned to the foreign market.

One also observes that in this period the governmental support was reduced through a lesser use of the fomenting instruments to the expansion of the Brazilian vegetal/animal production, which surely implied a retraction in the agribusiness GDP. The public sector expenses underwent a drastic reduction starting in 1986, as stress Bacha & Rocha (1998) and Barros (1995).

Table 1

Agribusiness and Brazilian GDP: 1994 to 2000

Year	Agribusiness GDP US$ Billion*	Agribusiness GDP Growth Rate (%)	Brazilian GDP US$ Billion*	Agribusiness GDP Share (%)
1994	163	-	535.2	30.4
1995	167.7	2.92	557.8	30.1
1996	165	-1.62	572.6	28.8
1997	163.5	-0.89	591.3	27.7
1998	164.5	0.58	592.6	27.8
1999	167.5	1.85	597.3	28
2000	167.7	0.1	621.2	27

Source: CNA/CEPEA Research Data.

* The values for 2000 were converted from Brazilian Reais to U.S. dollars using the average exchange rate for this year. The results for the remaining time period were obtained by applying over the 2000 values the real growth rates, in Brazilian Reais, observed from 1994 to 1999.

Table 2 shows the evolution of the Brazilian Agribusiness GDP, both in global terms (total) and for the two sub-complexes, with corresponding segments for the 1994-2000 time period.

The shares of the components of the Agribusiness GDP (Tables 3 and 4) show that the input contribution has a growing trend for the total complex in the period. In the industrial sector the rising tide shows an insertion into the agribusiness tending to a higher technical agriculture reflected on an increased input participation from 4.6% to 5.7% of the total between 1994 and 2000. This increased amount of agricultural input is certainly due, in a great deal, to the behavior of

the prices of these products in that period. Regarding the evolution of the prices of agricultural input, Homem de Mello (1998) shows that an expressive price reduction occurred in the 1990s caused by a strong exchange valorization, by relevant tariff reductions and by expressive efficiency gains in the companies.

The total agriculture have shown declining results from 1994 through 1997, an inverse trend was recorded from 1998 to 2000. The data referring to the agricultural prices show that considerable reductions occurred in the 1990s. Between 1989 and 1997 the indexes of the agricultural prices dropped from 100.0 to 72.4 (Homem de Mello, 1998). In its turn, except for the year 1994, one verifies a falling trend in the relationship of received prices/paid prices in the decade, which can partially explain the behavior of the farming added value in this period. It is interesting to note that in 1997 favorable foreign prices of some commodities were recorded, especially soybean. In addition, productivity gains[3] occurred and the the ICMS was inserted into agricultural exports (Kandir Law), which may have acted as compensating variables on the agriculture in the late 1990s.

The evolution of the Brazilian Agribusiness composition also shows the high shares of the Agriculture Based Industries and the Distribution segment, showing values always above 30%. In 2000 the Agriculture Based Industries and Distribution segments had a share of respectively 33.1% and 33.2% for the total Complex.

Tables 2 to 4 show the structure of the two major complexes of the Brazilian Agribusiness – Vegetal and Animal, in 2000 the Vegetal Agribusiness GDP of US$ 115.5 billions represented 18.6% of Brazil's GDP, while the Animal Agribusiness GDP, US$ 52.2 billions, corresponded to 8.4% of Brazil's GDP. In the case of the vegetal, the higher GDP share is justified by the diversity of the agricultural sector that has a higher number of processing industries than the animal sector.

The aggregate value derived from vegetal and animal products are made up by its output destiny, i.e.: a) inputs used in the agri-

[3] Studies by Gasques and Conceição (1997) pointed an increased productivity in the Brazilian agriculture.

culture; b) inputs used by the industries; c) exported; and d) final consumption by the families and the government. Given the above, one has that the value of the Total Agriculture GDP in 2000 was of US$ 47.0 billions. Splitting the Total Agriculture GDP by the sub-complexes one has that in 2000 the total GDP for the Vegetal and Animal production was, respectively, of US$ 24.9 billions and US$ 22.1 billions (Table 2).

Table 2 - Brazilian Agribusiness GDP, 1994 to 2000 (US$ Billion of 2000*)

Complex	1994	1995	1996	1997	1998	1999	2000
Agriculture	163	167.7	165	163.5	164.5	167.5	167.7
Non Ag. Input	7.6	7.2	7.4	7.3	7.7	9	9.5
Total Agriculture	46	46.8	45.3	44.7	47.5	47.4	47
Used as Input	7	6.8	6.9	6.8	7.2	7.2	7.1
Sold	39	40	38.5	37.9	40.3	40.2	39.9
Industry	54.7	58.7	56.1	56.4	53.5	54.9	55.5
Distribution	54.7	54.9	56.2	55.1	55.8	56.2	55.6
Vegetal	117.5	119.7	118.6	118.8	117.8	117.9	115.5
Non Veg. Input	5.1	4.8	5	5	5.2	6	6.2
Vegetal	27	26.8	26.9	26.8	28.2	26.8	24.9
Used as Input	4.2	4	4.2	4.2	4.4	4.2	3.9
Sold	22.8	22.8	22.7	22.6	23.8	22.6	21
Industry	46.3	49.3	46.7	47.5	44.9	46.2	46.7
Distribution	39.2	38.6	40	39.5	39.4	39	37.9
Animal	45.4	48.1	46.4	44.7	46.7	49.6	52.2
Non Anim. Input	2.5	2.4	2.3	2.3	2.4	3	3.4
Animal	19	20	18.5	17.9	19.3	20.7	22.1
Used as Input	2.8	2.8	2.7	2.6	2.8	3	3.2
Sold	16.2	17.2	15.8	15.3	16.4	17.6	18.9
Industry	8.4	9.4	9.4	9	8.6	8.7	8.8
Distribution	15.5	16.3	16.1	15.6	16.4	17.2	17.8

Source: CNA/CEPEA Research Data.

* The values for 2000 were converted from Brazilian Reais to U.S. dollars using the average exchange rate for this year. The results for the remaining time period were obtained by applying over the 2000 values the real growth rates, in Brazilian Reais, observed from 1994 to 1999.

Table 3 - Brazilian Agribusiness Share Inside Each Complex, 1994 to 2000 (%)

Complex	1994	1995	1996	1997	1998	1999	2000
Agriculture	100	100	100	100	100	100	100
Non Ag. Input	4.6	4.3	4.5	4.4	4.7	5.4	5.7
Total Agriculture	28.2	27.9	27.5	27.3	28.9	28.3	28
Used as Input	4.3	4.1	4.2	4.1	4.4	4.3	4.2
Sold	23.9	23.8	23.3	23.2	24.5	24	23.8
Industry	33.6	35	34	34.5	32.5	32.8	33.1
Distribution	33.6	32.8	34	33.7	34	33.5	33.2
Vegetal	100	100	100	100	100	100	100
Non Veg. Input	4.3	4	4.2	4.2	4.5	5.1	5.3
Vegetal	23	22.4	22.7	22.6	24	22.7	21.5
Used as Input	3.6	3.4	3.5	3.5	3.7	3.5	3.4
Sold	19.4	19.1	19.1	19.1	20.2	19.2	18.2
Industry	39.4	41.2	39.4	40	38.1	39.2	40.4
Distribution	33.3	32.3	33.7	33.3	33.5	33.1	32.8
Animal	100	100	100	100	100	100	100
Non Anim. Input	5.4	5	5.1	5.1	5.2	6.1	6.5
Animal	41.8	41.6	39.8	40	41.2	41.6	42.4
Used as Input	6.1	5.8	5.8	5.8	6	6.1	6.2
Sold	35.7	35.7	34	34.2	35.2	35.6	36.2
Industry	18.6	19.5	20.3	20.1	18.4	17.6	16.9
Distribution	34.2	33.9	34.8	34.9	35.1	34.7	34.1

Source: Table 2.

Table 4 - Share in the Brazilian Agribusiness GDP, 1994 to 2000 (%)

Complex	1994	1995	1996	1997	1998	1999	2000
Vegetal	72.1	71.3	71.9	72.7	71.6	70.4	68.9
Non Veg. Input	3.1	2.9	3	3.1	3.2	3.6	3.7
Vegetal	16.6	16	16.3	16.4	17.2	16	14.8
Used as Input	2.6	2.4	2.5	2.5	2.7	2.5	2.3
Sold	14	13.6	13.8	13.8	14.5	13.5	12.5
Industry	28.4	29.4	28.3	29	27.3	27.6	27.8
Distribution	24	23	24.3	24.2	24	23.3	22.6
Animal	27.9	28.7	28.1	27.3	28.4	29.6	31.1
Non Anim. Input	1.5	1.4	1.4	1.4	1.5	1.8	2
Animal	11.6	11.9	11.2	10.9	11.7	12.3	13.2
Used as Input	1.7	1.7	1.6	1.6	1.7	1.8	1.9
Sold	9.9	10.2	9.6	9.3	10	10.5	11.3
Industry	5.2	5.6	5.7	5.5	5.2	5.2	5.3
Distribution	9.5	9.7	9.8	9.5	10	10.3	10.6

Source: Table 2.

Regarding the annual growth of the sub-complexes one verifies that the Animal complex was the one presenting best results in 1999 and 2000, with real growth rates of 6.19% and 5.17%, respec-

tively, in comparison with those of 0.13% and –2.03% for the Vegetal complex (Table 5).

These results confirm the favorable performance of the Brazilian animal sector which has increasingly intensified meat (beef, pork, and poultry) production in this decade. Between 1993 and 2000 the production of meat, expressed as carcass weight, grew approximately 72.19%, reaching 10.3 million tons (Silva, 2001). The percent of production growth gain for poultry, pork, and beef, is respectively, 155.36%; 52.35% and 24.84%. According to Bacha & Rocha (1998), this growth is due both to the increase of the number of animals slaughtered and to the elevation of the mean yield of meat per slaughtered animal. Therefore, one verifies that these results reflect yield increments but also indicate a specialization in the production and commercialization. The animal sector outstand both for its total net assets and for the value added to the final product commercialized.

As to the international trade, the meat sector has shown gains and is one of the options of the exporting roll of the vegetal/animal sector. The volume of the total growth of the exported beef, pork and poultry *in natura* between 1993 and 2000 was 85.77%, going from 675 to 1.254 million tons (Silva, 2001). Despite the optimistic number achieved by the animal agribusiness, the growth rate recorded for the total subcomplex and for the animal production is lower than the growth accumulated in the input segment year in the 1999/2000 biennial, thus confirming the historical trend of income transference from producers to the industrial segment.

Considering that the Agribusiness is a segment with agents from the primary (agriculture), secondary (industry), and tertiary (services) sectors, the changes in the GDP will be a function of the relative variation of its components.

Table 5 - Brazilian Agribusiness Growth Rates, 1995 to 2000 (%)

Complex	1995	1996	1997	1998	1999	2000
Agriculture	2.92	–1.62	–0.89	0.58	1.85	0.1
Non Ag. Input	–4.08	1.67	–1.32	5.68	16.87	6.35
Total Agriculture	1.8	–3.19	–1.42	6.23	–0.11	–0.90
Used as Input	–2.02	0.46	–1.42	6.23	–0.11	–1.12
Sold	2.48	–3.81	–1.42	6.23	–0.11	–0.86
Industry	7.29	–4.39	0.57	–5.27	2.71	1.02
Distribution	0.45	2.24	–1.84	1.31	0.61	–0.96
Vegetal	1.79	–0.88	0.19	–0.88	0.13	–2.03
Non Veg. Input	–5.18	3.75	–0.35	4.95	13.63	3.24
Vegetal	–0.63	0.07	–0.21	5.24	–5.13	–7.14
Used as Input	–4.18	3.61	–0.25	5.28	–4.96	–7.14
Sold	0.03	–0.55	–0.20	5.24	–5.16	–7.14
Industry	6.64	–5.38	1.68	–5.48	2.93	1
Distribution	–1.36	3.61	–1.22	–0.24	–1.10	–2.93
Animal	5.84	–3.46	–3.62	4.44	6.19	5.17
Non Anim. Input	–1.78	–2.49	–3.39	7.28	23.84	12.5
Animal	5.26	–7.56	–3.19	7.71	7.25	7.19
Used as Input	1.25	–4.07	–3.24	7.75	7.46	7.19
Sold	5.94	–8.14	–3.18	7.71	7.21	7.19
Industry	10.83	0.81	–4.94	–4.16	1.57	1.17
Distribution	5.02	–1.02	–3.38	5.23	4.74	3.49

Source: Table 2.

The results show that out of the components considered for the estimation of the Total Agribusiness GDP in 1999, only the Total Agriculture had a negative variation of –0.11%, significantly contrasting with the positive performance of 6.23% reached in 1998. One can also observe that the Inputs, the Agriculture Based Industries, and Distribution had positive variations in 1999, with respectively, real growth rates of 16.87%, 2.71% and 0.61%. In 2000, however, negative results were observed for the Agriculture and Distribution segment, with respectively, variations of –0,90 and –0,96 (Table 5).

Considering the annual growth rates of the components of the Vegetal Agribusiness GDP one notices that only the Input and Industry segments had a positive performance in 1999, with growth rates, respectively, of 13.63% and 2.93%, compensating the negative results of Agriculture (–5.13%) and Distribution (–1.10%). For 2000, only the industry kept a positive growth rate of 1.00% (Table 5).

The drop of real prices of main agricultural products and elevation of input prices accounted for that. Although in the 1990s an increase of agriculture productivity occurred, it was not enough to thrust the agriculture, which reached a production of only 80 million tons of grains (CAN, 2001).

Despite the negative context presented by the farming segment, the Animal Agribusiness Complex showed a positive performance from 1998 to 2000. Thus, in that complex the growth rates in 1999 were respectively 23.84%, 7.25%, 1.57% and 4.74% for the input, animal, processing and services segments. This complex has showed a similar performance for 2000 (Table 5).

When measured by a broader concept, the sectoral GDP data from 1994-2000 allows a more accurate technical evaluation regarding the sectoral performance of the Brazilian Agribusiness. These results are shown in Tables 6 and 7. The activity regarding the vegetal and animal products also includes the value of the inputs used plus the value aggregated with the distribution of the vegetal and animal products; the value for the agriculture based industries also includes the value aggregated with the distribution of the industries production. Using this broader concept, the value of the agricultural sector was responsible, in 2000, for 42.2% of Brazil's Total Agribusiness GDP.

Concerning the agriculture sector, the decrease of the GDP value in 1996 and 1997 can be interpreted as an economic backward movement (US$65,8 billions in 1996 and US$ 64,3 billions in 1997). After this period there was a recovery in 1998, 1999 and 2000, with growth rates of 8.02%, 1.77% and 0.10%, respectively. One should point the highly positive performance of the Animal sector in the more recent period, 1998 to 2000, with growth rates of 9.55%, 8.48% and 7.71%, respectively, which certainly reflected on the positive result of the rural sector in that triennial (8.02%, 1.77% and 0.10%, respectively).

Table 6 - Sectoral Distribution of the Brazilian Agribusiness GDP, 1995 to 2000 (US$ Billion of 2000*)

Sector	1994	1995	1996	1997	1998	1999	2000
Agriculture (1)	66.7	67.8	65.8	64.3	69.5	70.7	70.8
Vegetal (1)	39.4	39.1	39.2	38.8	41.6	40.4	38.1
Animal (1)	27.3	28.7	26.6	25.5	28	30.3	32.7
Wood & Wood Products(2)	8.3	8.7	8.5	8.2	7.6	7.6	7.9
Pulp, Paper & Printing(2)	7.2	9	8.4	8	7.5	9	10.6
Chemical Elem. (Alcohol) (2)	7.9	6.2	6	7.4	6.3	7.1	7.2
Textile Industry(2)	7.4	7.6	6.9	6.3	5.4	5.7	5.6
Clothing Industry(2)	8	8.4	8.3	7.4	7.1	6	5.8
Footwear Industry(2)	4.6	4.3	4.3	4.1	3.3	3.1	3
Coffee Industry(2)	3.7	3.1	3.2	3.1	4.1	4.4	4.3
Vegetal Products Processing(2)	12.9	12.7	13.5	14.3	13.1	12.4	11.2
Animal Slaughtering(2)	9.8	10.4	10.6	10.3	10.5	11.7	11.8
Dairy Industry(2)	3.8	4.6	4.9	4.9	5	4.5	4.7
Sugar Industry(2)	2.8	2.5	2.5	2.6	2.6	2.5	2.9
Vegetal Oil Processing(2)	4.8	4.5	4.5	5.1	4.8	4.6	3.7
Other Food Products(2)	15.3	17.8	17.6	17.6	17.8	18	18.2
Total	163	167.7	165	163.5	164.5	167.5	167.7

Source: CNA/CEPEA-USP Research Data.
(1) These values refer to the sum of the aggregated value generated by: a) the sector; b) the inputs used; and c) the distribution.
(2) These values refer to the sum of the aggregated value generated by: a) the industrial sector; and b) the distribution.
* The values for 2000 were converted from Brazilian Reais to U.S. dollars using the average exchange rate for this year. The results for the remaining time period were obtained by applying over the 2000 values the real growth rates, in Brazilian Reais, observed from 1994 to 1999.

Table 7 - Real Growth Rates (%) of the Sectoral Distribution of the Brazilian Agribusiness GDP, 1995 to 2000

Sector	1995	1996	1997	1998	1999	2000
Agriculture	1.67	–2.99	–2.20	8.02	1.77	0.1
Vegetal	–0.75	0.27	–1.00	7.01	–2.75	–5.61
Animal	5.1	–7.36	–3.97	9.55	8.48	7.71
Wood & Wood Products	4.99	–2.29	–2.73	–8.03	0.41	3.55
Pulp, Paper and Printing	24.85	–6.49	–5.22	–6.14	20.81	17.94
Chemical Elem. (Alcohol)	–20.98	–4.02	24.67	–15.28	12.97	1.18
Textile Industry	2.3	–8.49	–9.70	–13.13	5.77	–1.78
Clothing Industry	5.5	–1.43	–9.87	–5.21	–14.76	–4.42
Footwear Industry	–5.11	–1.19	–4.58	–19.01	–6.61	–1.38
Coffee Industry	–15.38	4.1	–3.58	32.11	7.09	–3.54
Vegetal Products Processing	–1.61	6.12	5.94	–7.90	–5.73	–9.88
Animal Slaughtering	6.55	2.25	–3.43	1.96	11.67	0.84
Dairy Industry	22.38	5.8	–1.31	2.57	–9.72	3.76
Sugar Industry	–7.98	–3.57	4.21	–0.13	–1.34	12.91
Vegetal Oil Processing	–5.71	0.89	12.42	–6.50	–3.17	–18.94
Other Food Products	16.25	–1.15	–0.27	1.06	1.51	1.07
Total	**2.92**	**–1.62**	**–0.89**	**0.58**	**1.85**	**0.1**

Source: Table 6

More recently, despite the not so significant growth of the Total Agribusiness GDP (1.85%) in 1999 and 2000 (0.10%), some industrial sectors managed to overcome the drawbacks and present

highly satisfactory results. The Pulp, Paper and Printing industry had a GDP growth of 20.81% and 17.94% in 1999 and 2000, respectively, going from US$ 7.5 billions in 1998 to US$ 9.0 billions in 1999 and US$ 10.6 in 2000 (Table 6 and 7).

In the case of the Chemical Elements (Alcohol) industry the GDP growth in 1999 was 12.97%, reaching the mark of US$ 7.1 billions. In 2000, this segment had a growth of 1.18%. The Animal Slaughtering industry recorded a significant variation of 11.67% in 1999, increasing its aggregated value from US$ 10.5 billions in 1998 to US$ 11.7 billions in 1999. In 2000 the growth was only of 0.84%. The Coffee and Textile industries had growth rates of 7.09% and 5.77%, respectively, in 1999. In 2000, diverging from these results, the segments had results of –3.54% and 1.78%, respectively. Among the sectors, the poorest performance was that of the Clothing industry, which has been showing negative growth rates since 1996, with a reduction of 14.76%, with its GDP in 1999, going from US$ 8.4 billions in 1995 to US$ 5.8 billions in 2000. The Vegetal Oil Processing Industry is also other sector that is loosing share in the agribusiness, going from a value of US$ 4.8 billion in 1994 to a value of US$3.7 billion in 2000 (Tables 6 and 7).

The results obtained for the Brazilian Agribusiness confirm the behavior trend observed in highly industrialized economies, in which the share of the agriculture based industries and final distribution tends to be more and more representative in the value of the output sold by farmers. In that process, the vegetal and animal sector becomes less important in the composition of the Agribusiness output, with a relative sector's income decrease as can be observed in the works of Davis and Goldberg (1957), Lipton et al. (1998), Lauschner (1993), and Malassis (1968).

Through the data presented here, it is possible to see that the Brazilian agriculture is inserted into the current trend of the world's economy by adapting itself to the situation of the consumers, concentrated on the urban regions, with sophisticated consuming structures in which a larger participation of industrialized and diversified products is a constant demand.

In short, the Brazilian Agribusiness adds value on the agricultural raw materials in which the warehousing, processing and final distribution sector tends to be more representative of the total value of the output sold to the consumer, thus dominating the agriculture/ industry relationships.

In that sense, it is fundamental to take into account the necessary organization of farming producers into associations, cooperatives or other alternative means to support rural producers, as it allows rural workers to face the challenges of this new agrarian pattern, leading to a relative reduction of the rural sector in relationship with the other Agribusiness components.

4. Final Comments

By analyzing the results presented in this paper, one can infer the complexity of the Brazilian economy, which presents an advanced stage of a productive structure with a high interlinking degree among the national productive sectors.

As to the Agribusiness results, the empirical data show the fundamental role that this segment has performed in the Brazilian economy, responsible for approximately 27% of its GDP in 2000. In regards to the participation structure of the two major complexes of the Brazilian Agribusiness – Vegetal and Animal – one observes that the GDP of the Vegetal Agribusiness represents, around 20% of the Brazilian GDP, while the GDP of the Animal Agribusiness corresponds to approximately 8% of the Brazilian GDP. In the case of the Vegetal, the higher GDP share is explained in great part by the diversity of the agricultural sector, which has a larger number of processing industries than the animal sector. These results point out the importance and dependence of the other sectors of the economy in the agriculture, the share of 7.6%, in 2000, of the Brazilian agriculture in the national GDP is multiplied approximately 3.6 times when the Agribusiness concept is used.

Specifically with regards to the annual growth of the sub-complexes, one verifies that the Animal Product segment was the one presenting best results in the last years of analysis.

As to the share of the components of the Agribusiness GDP, one observes that the input contribution tended to grow for the total complex during the analyzed period, especially in the last three years (1998 to 2000). Although the Agriculture segment has presented a decreasing trend from 1994 to 1997 this has reversed in more recent years.

The evolution of the Brazilian Agribusiness composition also shows a high share of the Industry and the Distribution segments, as each segment has a share of around 33% of the total Agribusiness chain. This confirms that the processing and final distribution sectors are higher impulse vectors on the total value of the output sold to consumers, consolidated on the strong net connecting agriculture and industry.

One should stress that the basic methodology adopted here is integrated into the UN System of National Accounts and at the same time prevents the double count problem presented in usual works of Agribusiness GDP estimation. Due to the use of this new methodology one believes that the results achieved provide an accurate picture of what has been happening to the Brazilian Agribusiness, so as to provide the economic agents with subsidies for decision-making, besides decisively contributing to the methodological improvement of this sort of research.

Despite the study made here, there are still some questions left out and that need to be uncovered, like, how to measure the contribution of the a given culture to the agribusiness, how the regions interact among themselves in generating the value of the agribusiness, how the agriculture can take advantage of this more advanced and integrated process of production, and what should be the future of the agriculture in this new integrated setting.

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