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Energy versus food: How do countries differ?

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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. 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. The GDP of the Agribusiness was also estimated for two major complexes: a) Vegetal Products and b) Animal Products. Each of the Agribusiness complexes was divided into four components: a) inputs to agriculture; b) agriculture; c) agriculture based industry; and d) final distribution. From a disaggregated perspective regarding the composition of the Agribusiness, the results point out that the agriculture based industries and the final distribution components are dynamic poles in this agrarian transformation process. The contribution of the different sectors to the Agribusiness GDP confirm that the Agribusiness adds value to the agricultural raw materials, with the warehousing, processing and final distribution sectors tending to be more and more representative in the value of the output sold to the consumer.

Key Words: Agribusiness, GDP, Input-Output, Brazil.

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1. INTRODUCTION

With the post-war worldwide technological revolution of agriculture, the farming activities underwent a large expansion and increasing specialization, decisively influenced by the economical development and growing urbanization. Such process basically imposed a new agricultural order in which the modern farmer is an expert involved with cultivation and animal breeding operations thus transferring the functions of storing, processing and distribution of vegetal/animal products as well as the supply of input and production factors to organizations other than the farm.

Previously focusing on self-sufficiency, agriculture was updated and introduced into the market economy constituting new links or segments to the feeding system. 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, complex storing, transportation, processing, industrialization and distribution networks were formed – **the ebb tide** sector.

To date the value of the agriculture-related activities performed outside the farms are substantially higher than those of the total operations performed therein. As an example, LIPTON et al (1998) points the case of the United States, according to 1996 data, the share of Farming in the Food and Fiber System is only 7.1%, while Inputs have a share of 29.6% and Manufacturing and Distribution a share of 63.3%. The GDP of the Food and Fiber System was estimated by the authors to be US\$ 997.7 billion, i.e., 13.1% of United States GDP. The System employs a total of 22,694 thousand workers, which represent 16.9% of total U.S. employment, with the rural jobs representing only 1% of the total jobs of the country.

As a result of such phenomenon, the traditional economy concept that classifies the different activities as “primary, secondary and tertiary” sectors as separate and not integrated led to an analysis focusing on an interlinked system of production, processing and distribution of farming-originated products – **the Agribusiness**.

The pioneering academic contribution to quantify such conceptual approach was done by Davis & Goldberg (1957) when they created the term **Agribusiness**. Making use of input-output matrix techniques developed by Wassily Leontief (Leontief, 1951), the authors studied the transformations and restructuring of agriculture. By analyzing the problems related to the agricultural sector of the economy they stated that these were much more complex and not limited to an

ordinary rural activity. That explains the need of dealing with agricultural problems under a systemic focus (Agribusiness) instead of a static one (agriculture).

Such expansion and specialization process of the agriculture is known to have occurred homogeneously in all regions of the planet, for it depends on the economic and social stage of development of each one of them. Namely, the participation and interaction of the agents – farmers, input suppliers and production factors, processors and distributors – occurred in different degrees in the various levels of the agricultural-feeding system (Pinazza & Araújo, 1993).

This worldwide transformation process also occurred in the Brazilian agriculture system with the agriculture and the stock raising activities being redirected, updated and integrated into the market. The transformations and restructuring of the rural sector started in the 1950s with and effective participation of the Brazilian government.

During the post-1950s period, the modernization process of the agriculture begins a more advanced phase, i.e., that of the industrialization, “... which represents the fundamental qualitative change in the long process of transformation of technical grounds, thus making the modernization process irreversible” (See Kageyama, 1990).

A great deal of these transformations were intensified by: a) the National System of Rural Credit through the use of subsidized credit; and b) by the II National Development Plan (1974/79) that made it ease to import agriculture machinery. (Barros, 1983)

This process helped in the consolidation of the Brazilian Agribusiness, that took place through the intersectoral integration among the industries that produce for the agriculture, the agriculture itself, the processing industries, and the distribution. The agricultural production then becomes part of a chain and depends on the industry dynamics, that is, there is an increasing integration between agriculture and industry in which the agriculture/industry cut becomes less important.

In view of these considerations, it is clear that the integration between agriculture and industry implies a real restructuring of the rural sector, establishing deep technological, productive, financial and business relationships with the other economy activities.

In Brazil, surveys on Agribusiness are scarce, and the researches available constantly involve problems regarding scope and periodicity. In features regarding the feeding issue the functional

approach still prevails, as in the economic literature the analysis of agriculture so to speak also prevails. The Brazilian Institute of Geography and Statistics (IBGE) releases information on national accounts, integrated with input-output tables, such that from this data it is possible to make a study of the Brazilian agriculture in the Agribusiness scope developed this paper.

In this way, this paper presents the estimation made for the Brazilian Agribusiness GDP in the 1994/2000 time period. From these results it is possible to make economic evaluations so as to subsidize sectoral policy planning to the agribusiness management, as well as to detect fundamental elements of this new agricultural pattern, in order to help redirect the rural producer as an economic agent. The Brazilian Agribusiness GDP estimates are also decomposed into two major complexes, Vegetal and Animal products.

The next section will present the methodology developed in this work, section 3 will present the results for the Brazilian economy, while the final remarks are made in the last section.

2. METHODOLOGY TO MEASURE THE BRAZILIAN AGRIBUSINESS SYSTEM

Besides measuring the Agribusiness as whole for the Brazilian economy, in this paper the Agribusiness was also measured for two major complexes: Vegetal Products and Animal Products.¹

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 Brazilian Agribusiness GDP is through the scope of the Product, i.e., by estimating the value added at market prices.²

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:

$$VA_{MP} = VA_{BP} + INT - FDu \quad (1)$$

where:

¹ See Furtuoso (1998), Furtuoso, Barros and Guilhoto (1998), and Guilhoto, Furtuoso, and Barros (2000) for further methodological details on the composition of the Brazilian Agribusiness Complex.

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.,

$$CVA_i = \frac{VA_{MP}}{X_i} \quad (2)$$

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:

$$GDP_{I_k} = \sum_{i=1}^{43} z_{ik} * CVA_i \quad (3)$$

$k = 1, 2$ vegetal and animal sectors

$i = 1, 2, \dots, 43$ 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:

² The methodology presented here takes into consideration the use by IBGE of the System of National Accounts defined by the United Nations (SNA, 1993), where the input-output matrices are integrated in this system.

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

where:

$$GDP_I = \text{GDP of aggregate I}$$

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:

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

$$k = 1, 2$$

where:

$$GDP_{II_k} = \text{GDP of aggregate II for vegetal } (k = 1) \text{ and animal } (k = 2)$$

and the other variables are as previously defined.

For the total Aggregate II we have:

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

where:

$$GDP_{II} = \text{GDP of aggregate II}$$

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 sectors 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:

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

$$k = 1, 2$$

where:

GDP_{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:

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

where:

GDP_{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:

$$GFD - INT_{FD} - IP_{ED} = DFD \quad (9)$$

$$VAT_{MP} + VAC_{MP} + VAS_{MP} = TM \quad (10)$$

$$GDP_{IV_k} = TM * \frac{FD_k + \sum_{q \in k} FD_q}{DFD} \quad (11)$$

$k = 1, 2$

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_{IV_k} = GDP of aggregate IV for vegetal ($k=1$) and animal ($k=2$)

For the total Aggregate IV we have:

$$GDP_{IV} = GDP_{IV_1} + GDP_{IV_2} \quad (12)$$

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:

$$GDP_{Agribusiness_k} = GDP_{I_k} + GDP_{II_k} + GDP_{III_k} + GDP_{IV_k} \quad (13)$$

where:

$GDP_{Agribusiness_k}$ = 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.

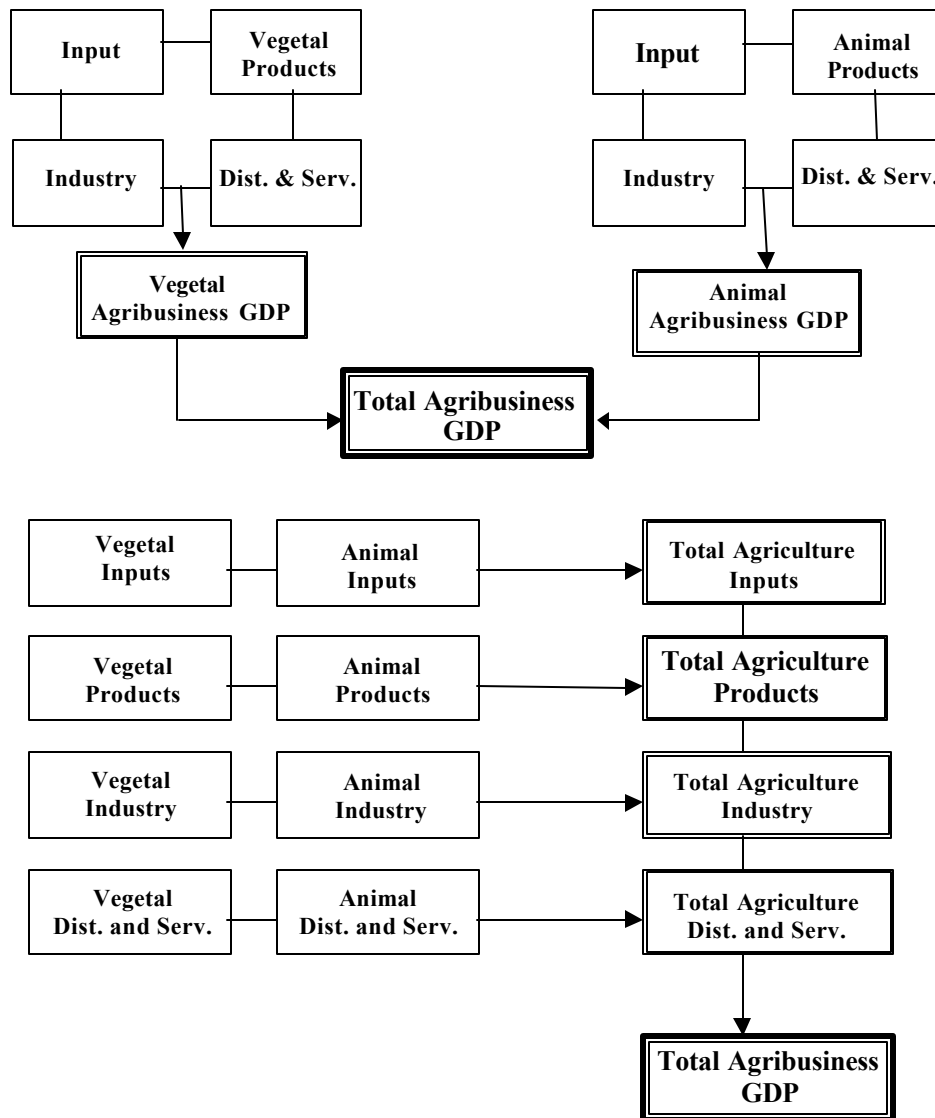


Figure 1. Obtaining the Agribusiness GDP

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%).

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.

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	163.0	-	535.2	30.4
1995	167.7	2.92	557.8	30.1
1996	165.0	-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	28.0
2000	167.7	0.10	621.2	27.0

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.

Complex	1994	1995	1996	1997	1998	1999	2000
Agriculture	163.0	167.7	165.0	163.5	164.5	167.5	167.7
Non Ag. Input	7.6	7.2	7.4	7.3	7.7	9.0	9.5
Total Agriculture	46.0	46.8	45.3	44.7	47.5	47.4	47.0
Used as Input	7.0	6.8	6.9	6.8	7.2	7.2	7.1
Sold	39.0	40.0	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	5.0	5.0	5.2	6.0	6.2
Vegetal	27.0	26.8	26.9	26.8	28.2	26.8	24.9
Used as Input	4.2	4.0	4.2	4.2	4.4	4.2	3.9
Sold	22.8	22.8	22.7	22.6	23.8	22.6	21.0
Industry	46.3	49.3	46.7	47.5	44.9	46.2	46.7
Distribution	39.2	38.6	40.0	39.5	39.4	39.0	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	3.0	3.4
Animal	19.0	20.0	18.5	17.9	19.3	20.7	22.1
Used as Input	2.8	2.8	2.7	2.6	2.8	3.0	3.2
Sold	16.2	17.2	15.8	15.3	16.4	17.6	18.9
Industry	8.4	9.4	9.4	9.0	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.

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. Although vegetal and animal have shown declining results from 1994 through 1997, an inverse trend was recorded from 1998 to 2000.

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 he agriculture, 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.

Table 3
Brazilian Agribusiness Share Inside Each Complex (%)

Complex	1994	1995	1996	1997	1998	1999	2000
Agriculture	100.0	100.0	100.0	100.0	100.0	100.0	100.0
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	28.0
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	24.0	23.8
Industry	33.6	35.0	34.0	34.5	32.5	32.8	33.1
Distribution	33.6	32.8	34.0	33.7	34.0	33.5	33.2
Vegetal	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Non Veg. Input	4.3	4.0	4.2	4.2	4.5	5.1	5.3
Vegetal	23.0	22.4	22.7	22.6	24.0	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	40.0	38.1	39.2	40.4
Distribution	33.3	32.3	33.7	33.3	33.5	33.1	32.8
Animal	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Non Anim. Input	5.4	5.0	5.1	5.1	5.2	6.1	6.5
Animal	41.8	41.6	39.8	40.0	41.2	41.6	42.4
Used as Input	6.1	5.8	5.8	5.8	6.0	6.1	6.2
Sold	35.7	35.7	34.0	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 (%)

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	3.0	3.1	3.2	3.6	3.7
Vegetal	16.6	16.0	16.3	16.4	17.2	16.0	14.8
Used as Input	2.6	2.4	2.5	2.5	2.7	2.5	2.3
Sold	14.0	13.6	13.8	13.8	14.5	13.5	12.5
Industry	28.4	29.4	28.3	29.0	27.3	27.6	27.8
Distribution	24.0	23.0	24.3	24.2	24.0	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	2.0
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	10.0	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	10.0	10.3	10.6

Source: Table 2.

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

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

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.

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 8.66%, 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).

Table 5
Brazilian Agribusiness Growth Rates (%)

Complex	1995	1996	1997	1998	1999	2000
Agriculture	2.92	-1.62	-0.89	0.58	1.85	0.10
Non Ag. Input	-4.08	1.67	-1.32	5.68	16.87	6.35
Total Agriculture	1.80	-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	1.00
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	12.50
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.

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 5.17% and 2.93%, compensating the negative results of Agriculture (-

5.16%) and Distribution (-1.10%). For 2000, only the industry kept a positive growth rate of 1.00% (Table 5).

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 15.07%, 7.21%, 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).

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 losing 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.

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 ⁽²⁾	39.4	39.1	39.2	38.8	41.6	40.4	38.1
Animal ⁽³⁾	27.3	28.7	26.6	25.5	28.0	30.3	32.7
Wood & Wood Products ⁽⁴⁾	8.3	8.7	8.5	8.2	7.6	7.6	7.9
Pulp, Paper & Printing ⁽⁴⁾	7.2	9.0	8.4	8.0	7.5	9.0	10.6
Chemical Elem. (Alcohol) ⁽⁴⁾	7.9	6.2	6.0	7.4	6.3	7.1	7.2
Textile Industry ⁽⁴⁾	7.4	7.6	6.9	6.3	5.4	5.7	5.6
Clothing Industry ⁽⁴⁾	8.0	8.4	8.3	7.4	7.1	6.0	5.8
Footwear Industry ⁽⁴⁾	4.6	4.3	4.3	4.1	3.3	3.1	3.0
Coffee Industry ⁽⁴⁾	3.7	3.1	3.2	3.1	4.1	4.4	4.3
Vegetal Products Processing ⁽⁴⁾	12.9	12.7	13.5	14.3	13.1	12.4	11.2
Animal Slaughtering ⁽⁴⁾	9.8	10.4	10.6	10.3	10.5	11.7	11.8
Dairy Industry ⁽⁴⁾	3.8	4.6	4.9	4.9	5.0	4.5	4.7
Sugar Industry ⁽⁴⁾	2.8	2.5	2.5	2.6	2.6	2.5	2.9
Vegetal Oil Processing ⁽⁴⁾	4.8	4.5	4.5	5.1	4.8	4.6	3.7
Other Food Products ⁽⁴⁾	15.3	17.8	17.6	17.6	17.8	18.0	18.2
Total	163.0	167.7	165.0	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 the agriculture sector, the inputs used by the sector and the distribution value of the vegetal and animal products.
- (2) These values refer to the sum of the aggregated value generated by the vegetal sector, the inputs used by the sector and the distribution value of the agricultural products.
- (3) These values refer to the sum of the aggregated value generated by the animal sector, the inputs used by the sector and the distribution value of the animal products.
- (4) These values refer to the sum of the aggregated value generated by the industrial sector plus the distribution value of the processed products.

* 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	0.10
Vegetal	-0.75	0.27	-1.00	7.01	-2.75	-5.61
Animal	5.10	-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	2.30	-8.49	-9.70	-13.13	5.77	-1.78
Clothing Industry	5.50	-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	4.10	-3.58	32.11	7.09	-3.54
Vegetal Products	-1.61	6.12	5.94	-7.90	-5.73	-9.88
Processing						
Animal Slaughtering	6.55	2.25	-3.43	1.96	11.67	0.84
Dairy Industry	22.38	5.80	-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	0.10

Source: Table 6

5. CONCLUSIONS

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 with 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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