AGRICULTURE AND PRODUCTIVE STRUCTURE OF THE STATE OF MATO GROSSO, BRAZIL: AN INPUT-OUTPUT APPROACH

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ABSTRACT: The purpose of this paper is to empirically show the relative importance of the agricultural sector in the productive framework of Mato Grosso State (Brazil), an inter-regional input-output model for two regions: Mato Grosso and the rest of Brazil for 1999.

The idea was to identify the most important sectors of the economies in question, their connections and the propagation of impacts between regions, besides verifying the impact on the Mato Grosso soybean exports on the total production of other activities. The hypothesis on the importance of the primary sectors for the state economy has been confirmed, and some agricultural sectors and others directly linked to them have been found to be key-sectors, or centres of economic growth in the region under study. Special mention should be given to soybean cultivation in Mato Grosso state, which shows a high employment and income multiplying effect on the economy, as well as being a centre of economic growth and major exporter, attracting exchange gains to the country and positively impacting the production of other sectors. Finally, this paper provides a useful tool for drafting public policies for Mato Grosso state.

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1. Introduction

Brazilian agriculture is historically very relevant for the domestic and overseas macroeconomic equilibrium: the domestic balance is related to steady food prices, achieved by increasing the supply to meet the growing demand for food. The foreign balance occurs with the participation of agricultural exports that, besides a steady balance of payments, also help accumulate foreign currency.

According to the data of the Brazilian National Agriculture Confederation and Sao Paulo University Centre of Advanced Studies in Applied Economics (CNA/ESALQ, 2003), the 2001 GDP (Gross Domestic Product) for the Brazilian agricultural sector of R$ 99.40 billions (around U$ 35 billion) contributed with around 8% of the national GDP, which according to the National Accounts data published by the Brazilian Geography and Statistics Institute (IBGE), was R$ 1.200,06 billion at 2001 current prices. Moreover, the Brazilian agribusiness GDP, including everything from primary production to the processing industry, inputs and services, was R$ 344.95 billion in 2001, around 28% of the total Brazilian GDP.

Soybean is one of the most outstanding crops in Brazilian agriculture, so much so that it is responsible for around 23.5% of the global soybean supply, according to statistics of the UN Food and Agriculture Organization (FAO, 2003). Today Brazil is the second world ranking soybean producer, losing only to the USA and ahead of Argentina and China, for example. Another important aspect of the soybean complex for the national economy is in relation to its overseas market share, with exports of around 24% of Brazilian agribusiness and around 10% of all Brazilian exports.

It is worth mentioning now that Mato Grosso state is the top soybean producer and exporter. In 2002, its exports were around US$ 736 million, approximately 24% of the Brazilian GDP with soybean grain exports that same year (MDIC, 2003). Besides being prominent as the national leader in soybean producer and exporter, Mato Grosso is also currently top ranking in terms of soybean productivity.

The expansion and development of agriculture create conditions for national economic development, such as the transfer of capitals and manpower to other sectors, generation of foreign currency, and the creation of a consumer market, for example. The growth of the soybean crop for Brazil in general, and for Mato Grosso in particular, has been responsible for accelerating the mechanization of the farming sector, upgrading the transport system, extending the agricultural boundary, furthering international trade, and so on.

In this paper, analyses will be made with a theoretical and empirical focus on the participation of agriculture in the Mato Grosso state economy. The analytical method adopted is known as an *input-output* model, which, among other benefits, analyses the economy as an integrated system of input and output flows and transfers from one sector to another. Consequently, depending on their destination, all products may be inputs, inasmuch as they are used by another system in the chain.

2. The Roles of Agriculture in Economic Development

Antle (1999) points out that agriculture in the 20th century was characterized by technological innovation that, in principle, started in the developed world and spread to developing countries, in what was called a "green revolution". The immediate consequence was the increase in production of farm produce on a much higher scale than the demand for food.

Johnston & Mellor (1961) argue that the dichotomy between agriculture and industry is false, which is why it is fundamental to evaluate the interrelationship between them. The authors show that agriculture in developing countries corresponds to 40%-60% of the national income, and manpower to 50%-80%. The relative decline in the agricultural sector allows the generation of capital to spread to other sectors.

Two factors lead to structural changes in the economy, as follows: (1) the income-elasticity of demand for food is less than the unit; (2) the possibility of further agricultural production with a reduction in manpower by increasing productivity (Johnston & Mellor, 1961).

In short, Johnston & Mellor (1961) present five proposals that make agriculture essential for economic growth:

- Economic development is characterized by the increase in demand for agricultural products, therefore agriculture must increase the food supply;
- Increase in exports, since the increase in income is essential in the early stages of development;
- Transfer of manpower to other sectors of the economy;

- Agriculture is the dominant sector in underdeveloped countries and it, therefore, is important to transfer the volume of capital necessary to investments in other sectors;
- The increase in the income of the rural population is an important incentive for industrial growth, since it eventually creates a consumer market.

Kuznets (1964) divides the contribution of agriculture in three fronts: output, market and factors. The growth inside the sector itself already influences the increase in the national product. The market contribution is related to the possibility of an output and input exchange with the other sectors of the economy, including foreign sectors. Finally, the contribution of factors occurs by transferring and/or lending funds to finance the growth of non-agricultural sectors.

Schuh (1989), in a recent broader analysis, associates the development of agriculture to the best income distribution, sustainable economic growth and increase in the trade balance.

Figueiredo (2003) points out that the development of Brazilian agriculture over the last 30 years radically changed the technological pattern of that sector, which was then characterized by the use of agricultural machinery, fertilizers, defensives and improved seeds. The dynamics established by Johnston & Mellor (1961) indicate that Brazilian agriculture was no longer the main sector in terms of job and income, since there was a sharp transition to an eminently urban economy in a short space of time.

3. Methodology

3.1 Data source

The interregional input-output model was used as a source of data for Mato Grosso State and the rest of Brazil in 51 sectors, for the year 1999.

From the coefficients of Leontief's inverse matrix, calculations were made of type 1 job and income multipliers types, as well as the Hirschman-Rasmussen linkage indices and pure linkage indices, in order to characterize the productive structure of the regions and identify the sectors as centres of economic growth in Mato Grosso State. Moreover, production and added value were calculated and generated in the overall economy, to meet the demand for soybean exports from Mato Grosso.

4. Theoretical Model

Although Wassily Leontief's input-output model was originally designed to study the domestic relations of a nation's economy, recent interest in economic analysis at a regional level has induced changes to the models, with a view to adapting them for investigations of certain regions and their relations with the others. Numerous examples of input-output models and applications for regional studies can be found from models in one region and even in several regions and/or countries, or international blocs.

The early regional studies using input-output models refer to papers by Isard & Kuenne (1953) and Miller (1957) who, through the national matrix of technical coefficients A, in conjunction with an adjustment process, estimated characteristics of some regional economies, since they did not have specific regional coefficients. This adjustment process consists of estimated percentages of supply to each sector in a certain region. Later, models appear for more than one region, one of which worth mentioning is the interregional.

The intersectoral flows in a given economy may be represented by the following system

$$X = AX + Y \tag{1}$$

where X is an (nx1) vector with the value of the total production in each sector, Y is an (nx1) vector with values for the final demand, and A is an (nxn) matrix with the technical coefficients of production (Leontief, 1951). In this model, the final demand vector can be addressed as exogenous to the system, so that the level of total production can be determined by the final demand, as follows

$$X = BY \tag{2}$$

$$B = (I - A)^{-1} \tag{3}$$

where B is an (nxn) matrix of the Leontief inverse.

In equation (2) it is possible to assess the impact of the final demand on total production, and from there, on employment, imports, wages, and so on.

To estimate the induced effect, that is, how much was the increase in employment, for example, for the economy, given the consumption of the newly employed, the family consumption can be endogeneized in the model, so that

$$\overline{A} = \begin{vmatrix} A & H_c \\ H_r & 0 \end{vmatrix} \tag{4}$$

where $\overline{A}$ is the new matrix of technical coefficients with size (n+1)x(n+1), H_r is a (1xn) vector with the income coefficient in each sector, and H_c is an (nx1) vector with family consumption coefficients.

Therefore, the new production and final demand vectors would be given by ($\overline{X}$, (n+1)x1) and ($\overline{Y}$, (n+1)x1) respectively. They would be represented as

$$\overline{X} = \begin{vmatrix} X \\ X_{n+1} \end{vmatrix} \tag{5}$$

and

$$\overline{Y} = \begin{vmatrix} Y^{*} \\ Y_{n+1} \end{vmatrix} \tag{6}$$

The Leontief system would then be represented by:

$$\overline{X} = \overline{B}\overline{Y} \tag{7}$$

$$\overline{B} = I - \overline{A} \tag{8}$$

where $\overline{B}$ is an $((n+1)x(n+1))$ matrix of the Leontief inverse, taking into consideration the induced effect.

4.1. Multipliers

It is possible to measure from the multiplier results the direct and indirect effects of a change in the final demand over production, income, employment, for example (see Miller & Blair, 1985).

From the Leontief inverse matrix (*B*) defined above, type I production multiplier for each economic sector is as follows

$$P_j = \sum_{i=1}^{n} b_{ij} \qquad j = 1,\ldots,n \tag{9}$$

where Pj is the production multiplier for sector j, and bij is an element of matrix B.

ype II production multiplier, that takes into consideration the induced effect, is as follows

$$\overline{P}_j = \sum_{i=1}^{n} \overline{b}_{ij} \qquad j = 1,...,n \tag{10}$$

where $\overline{P}_j$ is the production multiplier for sector j and $\overline{b_{ij}}$ is an element of matrix $\overline{B}$.

To estimate employment multipliers, the coefficients of employment must first be estimated, as follows

$$w_j = \frac{e_j}{x_j} \tag{11}$$

where w_j is the employment coefficient in sector j, e_j is total employment in sector j, and x_j is the production level in sector j.

The total employment of type I (E_j) and type II ($\overline{E}_j$), generated in sector j is as follows

$$E_j = \sum_{i=1}^{n} w_i b_{ij} \tag{12}$$

$$\overline{E}_j = \sum_{i=1}^{n} w_i \overline{b}_{ij} \tag{13}$$

where b_{ij} and $\overline{b}_{ij}$ are elements of the B and $\overline{B}$ matrices described above.

Employment multipliers, that is, how much employment is generated in the economy for each person employed in a given sector, are given by equations (14) and (15) below, for the cases of type I (W_j) and type II ($\overline{W}_j$) multipliers

$$W_j = \frac{E_j}{w_j} \tag{14}$$

$$\overline{W}_j = \frac{\overline{E}_j}{w_j} \tag{15}$$

4.2. The Rasmussen/Hirschman Approach

The work of Rasmussen (1956) and Hirschman (1958) led to the development of linkage indices that have now become part of the generally accepted procedures for identifying key sectors in the economy. Define b_{ij} as a typical element of the Leontief inverse matrix, B; B^* as the average value of all elements of B, and if $B_{\bullet j}$ and $B_{i\bullet}$ are the associated typical column and row sums, then the indices may be developed as follows:

Backward linkage index (power of dispersion):

$$U_j = \left[B_{\bullet j} / n\right] / B^* \tag{16}$$

Forward linkage index (sensitivity of dispersion):

$$U_i = \left[B_{i\bullet} / n\right] / B^* \tag{17}$$

One of the criticisms of the above indices is that they do not take into consideration the different *levels* of production in each sector of the economy, which it is done by the pure linkage approach presented in the next section.

4.3. The Pure Linkage Approach

As presented by Guilhoto, Sonis & Hewings (1996) the pure linkage approach can be used to measure the importance of the sectors in terms of production generation in the economy.

Consider a two-region input-output system represented by the following block matrix, A, of direct inputs:

$$A = \begin{vmatrix} A_{jj} & A_{jr} \\ A_{rj} & A_{rr} \end{vmatrix} \tag{18}$$

where A_{jj} and A_{rr} are the quadrate matrices of direct inputs within the first and second region, and A_{jr} and A_{rj} are the rectangular matrices showing the direct inputs procured by the second region and vice versa.

From (18), the following expression can be formulated:

$$B = (I - A)^{-1} = \begin{pmatrix} B_{jj} & B_{jr} \\ B_{rj} & B_{rr} \end{pmatrix} = \begin{pmatrix} \Delta_{jj} & 0 \\ 0 & \Delta_{rr} \end{pmatrix} \begin{pmatrix} \Delta_j & 0 \\ 0 & \Delta_r \end{pmatrix} \begin{pmatrix} I & A_{jr}\Delta_r \\ A_{rj}\Delta_j & I \end{pmatrix} \tag{19}$$

where:

$$\Delta_j = \left(I - A_{jj}\right)^{-1} \tag{20}$$

$$\Delta_r = \left(I - A_{rr}\right)^{-1} \tag{21}$$

$$\Delta_{jj} = \left(I - \Delta_j A_{jr} \Delta_r A_{rj}\right)^{-1} \tag{22}$$

$$\Delta_{rr} = \left(I - \Delta_r A_{rj} \Delta_j A_{jr}\right)^{-1} \tag{23}$$

By using this breakdown (equation 19), it is possible to reveal the production process in an economy as well as derive a set of multipliers/linkages.

From the Leontief formulation:

$$X = \left(I - A\right)^{-1} Y \tag{24}$$

and using the information contained in equations (19) through (23), a set of indexes can be derived to be used: a) to rank the regions in terms of their importance in the economy; b) to see how the production process occurs in the economy.

Equations (19) and (24) give the following:

$$\begin{pmatrix} X_j \\ X_r \end{pmatrix} = \begin{pmatrix} \Delta_{jj} & 0 \\ 0 & \Delta_{rr} \end{pmatrix} \begin{pmatrix} \Delta_j & 0 \\ 0 & \Delta_r \end{pmatrix} \begin{pmatrix} I & A_{jr}\Delta_r \\ A_{rj}\Delta_j & I \end{pmatrix} \begin{pmatrix} Y_j \\ Y_r \end{pmatrix} \tag{25}$$

leading to definitions for the Pure Backward Linkage (PBL) and Pure Forward Linkage (PFL), as follows

$$\begin{aligned} PBL &= \Delta_r A_{rj} \Delta_j Y_j \\ PFL &= \Delta_j A_{jr} \Delta_r Y_r \end{aligned} \tag{26}$$

where PBL will give the pure impact on the rest of the economy of the value of the total production in region j, $\left(\Delta_j Y_j\right)$. in other words, the impact that is free from a) the demand inputs that region j makes from region j , and b) the feedbacks from the rest of the economy to region j

and vice-versa. The PFL will give the pure impact on region j of the total production in the rest of the economy $(\Delta_r Y_r)$.

As the PBL and PFL are shown in current values, the pure total linkage (PTL) can be obtained by adding the two previous indices, as follows

$$PTL = PBL + PFL \tag{27}$$

The pure linkage indices can also be standardized by the average value of the sectors in the economy so that the standardized indices show how often a sector is bigger or smaller than the average sector in the economy. Accordingly, it is possible to use these indices for a direct comparison of the productive structure of economies with different sizes and currencies. Similarly, they allow for a time comparison in economies with inflation, or change in currency.

5. Results and Discussion

5.1 Intersectoral linkage indices

The Rasmussen-Hirschman indices and standardized pure linkage indices were calculated to identify the key-sector (or development centre-regions) of the State. The presented values relate to the average of the economy, and those over 1 denote that the level of chaining of the sector is higher than the others' average; therefore, these represent key-sectors for the region's economic development.

5.1.1 Rasmussen-Hirschman indices

Figure 1 shows that, according to Rasmussen-Hirschman indices, the main sectors in Mato Grosso with strong backward linkages, which makes the economy more dynamic by distinguishing major goods and services purchasers in the other activities, are practically all directly related to the primary sector.

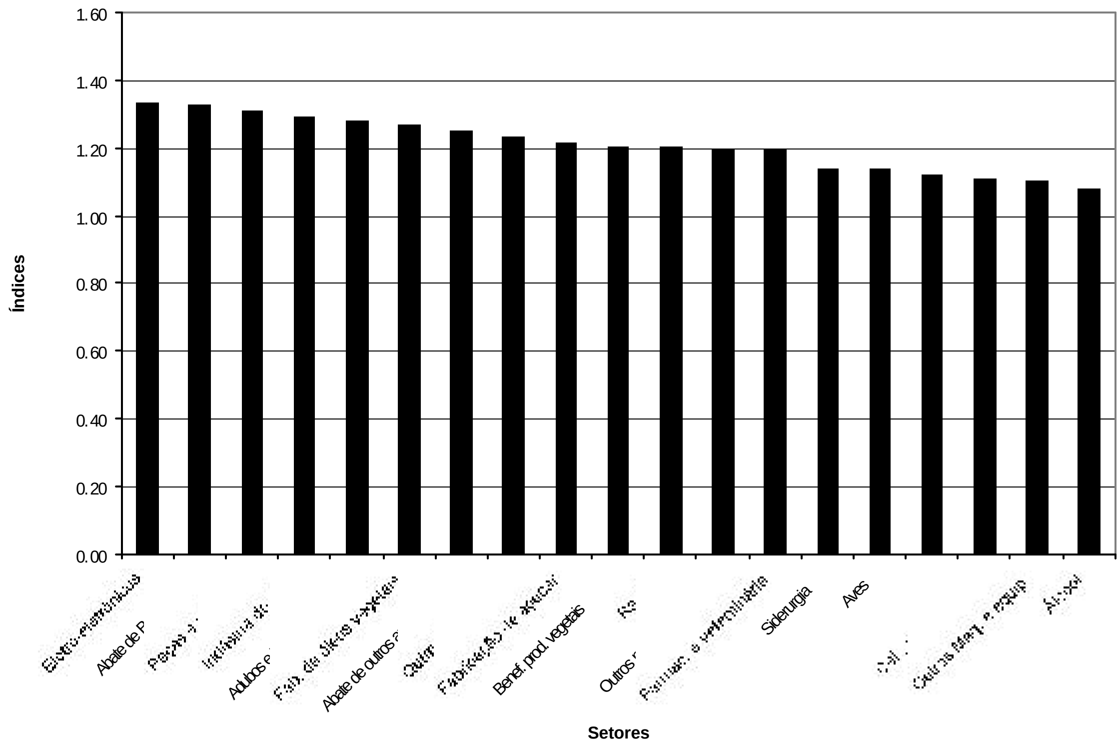

Figure 1 - Hirschman-Rasmussen backward indices (Mato Grosso).

Even though, the main sectors with strong forward linkages, which make the economy more dynamic by highlighting as a important raw-material sellers, are shown in Figure 2. It should be noted that some of these activities are primary sectors, including the soybean and beef cattle sectors, which are very important for the state economy due to respective production volumes.

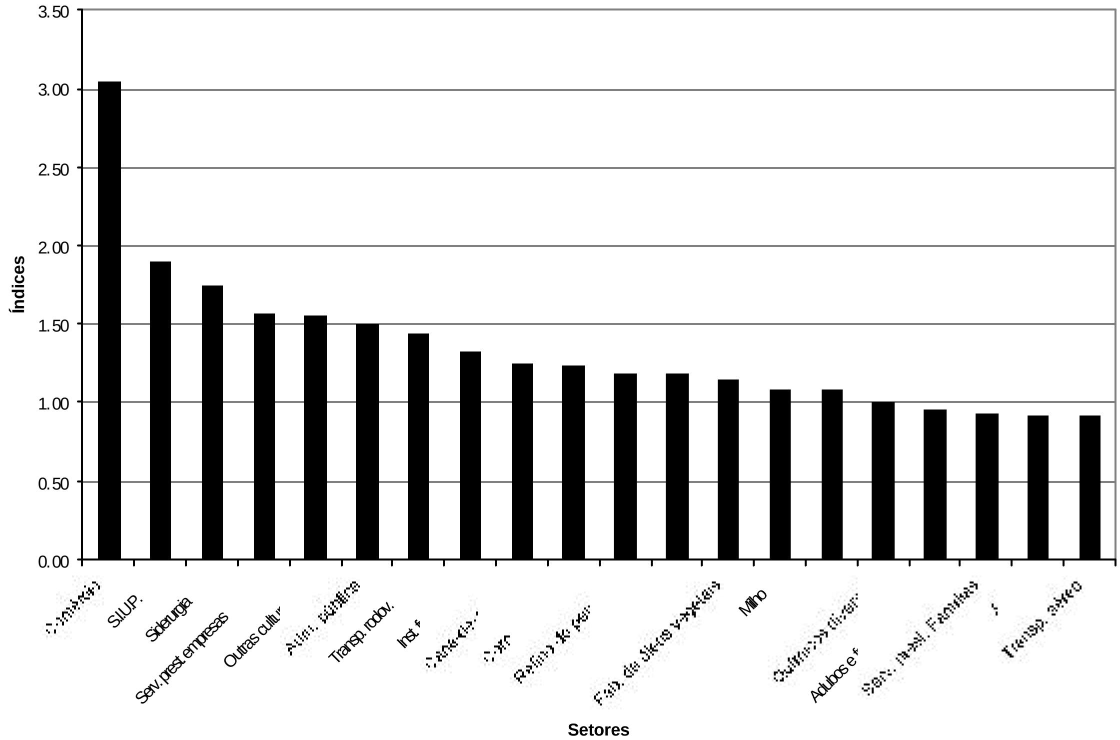

Figure 2 - Hirschman-Rasmussen forward indices (Mato Grosso).

However, although Rasmussen-Hirschman indices are widely used for identifying key-sectors, especially when analysing the productive structure of each economy, they do not consider the value of the total production of the industries, pointing only to the linkage degree of each of the rest. Therefore, the analysis should be complemented by the pure linkage indices, which consider the production value of each sector.

5.1.2 Standard pure linkage indices

Values of all standard pure linkage indices over 1 identify the sectors in question as key sectors or centres of economic growth, by evidencing both their procurement ratios and their sale ratios in the economy. It is interesting to observe that, when considering the total production value of each activity, some primary sectors and others directly related them, gain a position in the ranking, in terms of relative importance of its trade relations in the economy, as in the case of the following sectors: vegetable oil manufacture, soybean, beef cattle, cattle slaughter, and so on.

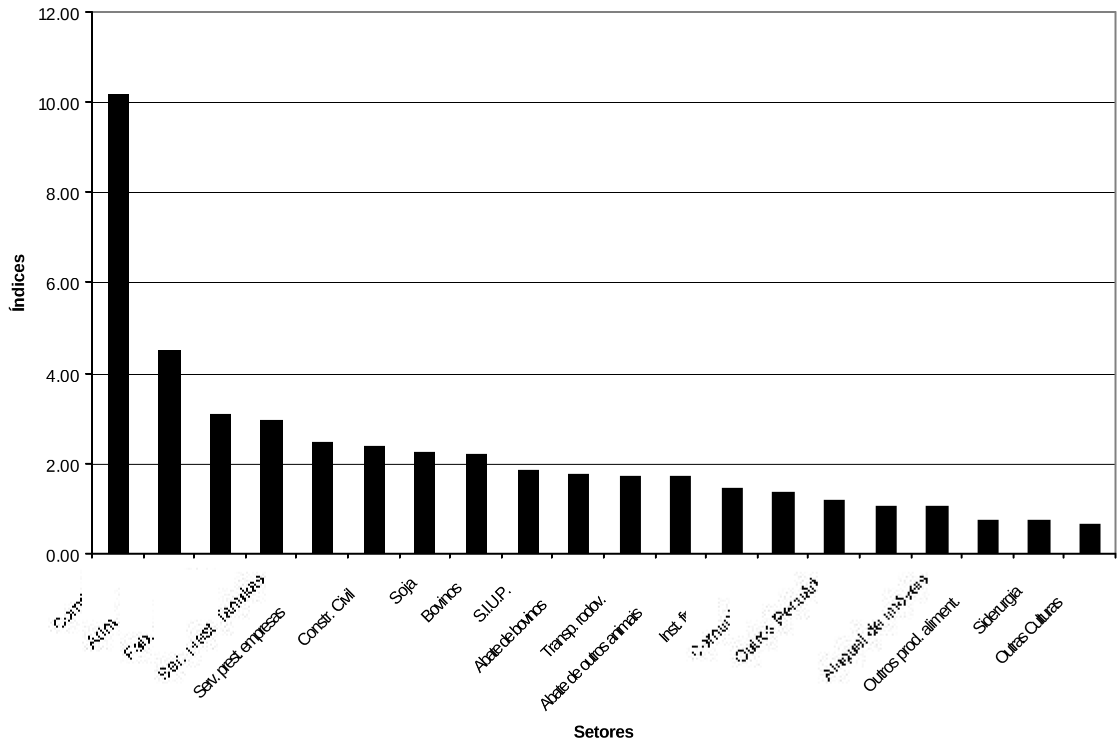

Figure 3 – Standardized total pure linkage indices (Mato Grosso).

5.2 Job generation in the economy

With regard to the job generation capacity in the economy, it was found that, when the final demand is met in the soybean sector in Mato Grosso at one million reais, eight jobs are directly generated in this particular activity, 31 jobs in other activities, and 72 jobs, when considering the induced effect for the endogeneized consumption of the families in the system, as shown in Table 2. This same relationship is also valid for the other sectors in that Table. So the capacity of direct job generation in the soybean sector is, in fact, modest, because this is a highly mechanized sector and relatively capital-intensive, and, on empirical evidence found in the analysis of the productive structure of Mato Grosso, the sectors with these characteristics show a relatively low capacity of direct job generation compared to a high job multiplying capacity in the input supply activities for its production.

Other sectors, such as the soybean sector, also show this important characteristic for the economy, as follows: sugar cane, slaughter of cattle and other livestock, vegetable oil manufacture, and fertilizers. The beef cattle sector, besides directly employing a reasonable number of people in its activity, is also distinguished as a major job multiplier in the rest of the economy.

On the other hand, poultry, plant extractivism and forestry sectors, in contrast to the others, are relatively labour-intensive according to the results for Mato Grosso, due to a high capacity for direct job generation, compared to its respective job multiplying capacities, which is also an important characteristic for the economy.

Table 2. Direct, indirect and induced job generation for the variation of one million reais of final demand – Mato Grosso.

No.	Sectors	Direct	Indirect	Induced
2	Soybean			
1	Sugarcane	8		1
7	Beef cattle			
6	Poultry	233	91	80
10	Plant extractivism	160	31	83
	Forestry	100	35	91
	Cattle slaughter			
	Slaughter of other livestock			
	Plant oil manufacture			
24	Fertilizers	9	29	71

This list of job multipliers is still to be confirmed by another indicator. Table 3 shows type I multipliers for some sectors in Mato Grosso and the rest of Brazil, so that a comparison can be made between the job multiplying capacity by the sectors in one region or another.

Thus, the vegetable oil manufacturing sector ranks first in terms of job multiplying capacity in the economy in both regions. The slaughter of cattle and other livestock and fertilizer sectors, both in Mato Grosso and the rest of Brazil, show a high job multiplying capacity, and are first ranking. In fact, the primary sectors of soybean, sugarcane and beef cattle in Mato Grosso report an even higher job multiplying capacity in the economy, when compared to these same sectors in the rest of Brazil.

Table 3. Job multipliers for sectors in Mato Grosso and the rest of Brazil.

		Mato Grosso		Rest of Brazil	
No.	Sectors	Order	Type 1	Order	Type 1
2	Soybean			38	1.51
1	Sugarcane				
7	Beef cattle				
6	Poultry				
10	Plant extractivism				
	Forestry				
	Cattle slaughter				
	Slaughter of other livestock				
	Vegetable oil manufacture				
24	Fertilizers				

5.3 Income generation in the economy

Concerning the income generation capacity (wages), Table 4 shows that the soybean, beef cattle, poultry, plant extractivism, slaughter of beef cattle and other livestock, vegetable oil manufacture and fertilizers in Mato Grosso directly generate a low level of income in the actual activity when meeting its final demands of one million reais. However, they have a strong income multiplying effect on the economy, generating high income levels in industries that supply inputs to their productions, which consists of a major characteristic for the economy. The sugarcane and forestry sectors, on the other hand, are important in directly generating income, but have a smaller income multiplying effect when comparing them to their respective income multiplying capacities on the economy, which is also in fact an important characteristic.

Table 4. Direct, indirect and induced income generation (wages) for the final demand variation of one million reais – Mato Grosso.

No.	Sectors	Direct	Indirect	Induced
2	Soybean			
1	Sugarcane			
7	Beef cattle			
6	Poultry			
10	Forestry			
	Cattle slaughter			
	Slaughter of other livestock			
	Vegetable oil manufacture			
	Fertilizers			
24	Plant extractivism			

Table 5. Income multipliers for sectors in Mato Gross and the rest of Brazil.

		Mato Grosso		Rest of Brazil	
No.	Sectors	Order	Type 1	Order	Type 1
2	Soybean				
1	Sugarcane				
7	Beef cattle				
6	Poultry				
10	Plant extractivism				
	Forestry				
	Cattle slaughter				
	Slaughter of other livestock				
	Vegetable oil manufacture				
24	Fertilizers				

As in the case of the job multiplying capacity, the slaughter of cattle and other livestock, vegetable oil manufacture, and fertilizer sectors, both in Mato Grosso and the rest of Brazil, show a high income multiplying capacity, and are in the top ranking. The soybean sector in Mato

Grosso, in turn, is leader in terms of income generating capacity in the economy, while the same sector in the rest of Brazil ranks nineteenth for income generating capacity in the sectors in the rest of Brazil.

It is known that, according to the classic Johnston & Mellor (1961), one of the leading roles of agriculture in a country's economic growth process is to attract exchange gains with which the primary inputs for the development process could be procured abroad. Soybean is the main Brazilian export and Mato Grosso is the leading soybean producing and exporting state in Brazil.

Thus,, the impacts of the State's soybean exports were calculated over the total production and added value in the other sectors of both regions under study.

Table 6 shows that when addressing Mato Grosso soybean exports, a number of other sectors should increase their production, with emphasis on road and rail transport and alcohol in Mato Grosso, and the fertilizer and mining sectors in the rest of Brazil. It should be mentioned that most fertilizers used in Mato Grosso's agricultural production are imported from other Brazilian states, further evidence of the importance of the trade relations between the two regions.

Table 6. Production (R$'000) and value added (R$'000) generated in the economy when addressing Mato Grosso soybean exports.

		Mato Grosso		Rest of Brazil	
No.	Sectors	Production	V.A.	Production	V.A.
	Soybean	533,077	165,586	1,907	800
	Vegetable oil manufacture	177	34	1,865	411
	Road transport	10,121	3,940	4,807	1,775
	Rail transport	2,948	1,514	4,711	2,296
	Alcohol	2,386	860	4,077	1.683
	Fertilizers	16	3	140,197	27,867
	Beef cattle	43	17	1,844	926
	Other livestock	599	228	6,655	3,278
	Timber & furniture	69	29	762	316
	Animal fodder	3	1	1,220	371
	Mining	802	467	24,726	14,381

CONCLUSION

Our empirical findings suggest that at Mato Grosso State the primary sectors are the key ones. The state is highly integrated with the rest of Brazil, especially in what concerns agricultural products. Mato Grosso exports several commodities to the rest of Brazil and to foreign markets. Imports are concentrated in inputs to agriculture (fertilizer, machines, chemicals, etc) and industrialized products.

Soybean constitutes the most important agricultural product; its development at Mato Grosso has been extremely fast, characterized by a high capital to labour ratio. Employment multipliers have shown that direct employment generated by soybean expansion is small. Nevertheless, indirect and induced employments are quite high, suggesting that the pattern of economic growth at Mato Grosso induces urban as well as agricultural expansion. The model provides a useful tool for drafting public policies for Mato Grosso state, although it would be interesting to incorporate environmental coefficients in our input-output model, so as to be able to evaluate the environmental impacts of agricultural and urban expansion.

BIBLIOGRAPHY

ANTLE, J.M. The new economics of agriculture. **American Journal of Agricultural Economics**, 81(5): 993-1010, 1999.

CENTRO DE ESTUDOS AVANÇADOS EM ECONOMIA APLICADA (CEPEA). **PIB do agronegócio**. http://cepea.esalq.usp.br (20 April 2003)

CONFEDERAÇÃO NACIONAL DA AGRICULTURA E PECUÁRIA. **Renda agropecuária**. http://www.cna.org.br (20 abr. 2003)

FAO. **Statistical databases**: Faostat: agriculture. http://www.fao.org. (1 March. 2003)

FIGUEIREDO, M. G. Agricultura e estrutura produtiva do estado do Mato Grosso: uma análise insumo-produto. Dissertation (MS) - Escola Superior de Agricultura "Luiz de Queiroz", Sao Paulo University. 2003, 205p.

GUILHOTO, J. J. M.; SONIS, M.; HEWINGS, G. J. D.; MARTINS, E. B. Índices de ligações e setores-chave na economia brasileira: 1959/80**. Pesquisa e Planejamento Econômico**, 24(2): 287-314, August 1994.

GUILHOTO, J.J.M.; SESSO FILHO, U.A.; LOPES, R.L.; HILGEMBERG, C.M.A.T.; HILGEMBERG, E.M. Nota metodológica: construção da matriz insumo-produto utilizando dados preliminares das contas nacionais (compact disc). In: ENCONTRO BRASILEIRO DE ESTUDOS REGIONAIS E URBANOS, 2., Sao Paulo, 2002. **Anais**. Belo Horizonte: Associação Brasileira de Estudos Regionais, 2002.

HIRSCHMANN, A. O. The strategy of economic development. New Haven: Yale University Press. 1958.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Contas nacionais**: Brasil: 1999-2001. http://www.ibge.gov.br (02 out. 2003)

ISARD, W.; KUENNE, R.E. The impact of steel upon the greater New York: Philadelphia Industrial Region. **Review of Economics and Statistics**, v.35, n.4, p.289-301, November 1953.

JOHNSTON, B.; MELLOR, J.W. The role of agriculture in economic development. **American Economic Review**, 51: 566-593, September 1961.

LOBO E SILVA, C. A. Como as economias de Sao Paulo e de Minas Gerais se comparam à do resto do Brasil: uma análise das suas estruturas produtivas. Dissertation (MS) - Escola Superior de Agricultura "Luiz de Queiroz", Sao Paulo University. 2001, 108p.

McGILVRAY, J. Linkages, key sectors and development strategy. In: LEONTIEF, W. (ed.) **Structure, system and economic policy**. Cambridge: University Press, 1977, pp.49-56.

MILLER, R.E. The impact of the aluminum industry on the Pacific Northwest: a regional input-output analysis. **Review of Economics and Statistics**, v.39, n.2, p.200-209, May 1957.

MILLER, R. E.; BLAIR, P. D. **Input-output analysis**: foundations and extensions. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1985.

MINISTRY FOR DEVELOPMENT, INDUSTRY AND FOREIGN TRADE. http://www.mdic.gov.br (1 December 2003).

MONTOYA, M. A. A matriz insumo-produto internacional do Mercosul em 1990: a desigualdade regional e o impacto intersetorial do comércio inter-regional. Ph.D. thesis - Escola Superior de Agricultura "Luiz de Queiroz", Sao Paulo University. 1998, 217p.