AGRICULTURAL COOPERATIVES AND ECONOMIC DEVELOPMENT IN THE PARANA STATE (1985 AND 1995): AN INPUT-OUTPUT ANALYSIS [1]

ROSSANA LOTT RODRIGUES[2]
JOAQUIM J.M. GUILHOTO[3]
ANTONIO CARLOS MORETTO[4]

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***ABSTRACT**: The role that agricultural cooperatives played in the economic development of the Parana State, Brazil, in the 1985-1995 period is evaluated through the use of input-output analysis in this study. National input-output tables were used to derive a set of regional input-output tables for the years of 1985 and 1995 for the State of Parana and the agricultural sector and food processing sectors in the matrix were break down into two – cooperative and non-cooperative related sectors. From the above date it was possible to: a) identify and evaluate the relative participation of the agricultural cooperatives in the agricultural and food processing sectors; b) evaluate the relative importance of the agricultural cooperatives in terms of interindustry and economic relationships; and c) implement and evaluate the final demand impacts on the output and income generated through the cooperative and non-cooperative sectors. The results show that: a) the Cooperative Agriculture sector lost importance in terms of share in the total value of production in the 1985/1995 period; b) despite the fact that the food processing sectors showed a decrease in their importance for the State, those linked to the cooperatives were the sectors that most impacted the others sectors demand; c) considering the food related sectors, the cooperatives are the ones that have a greater impact on production and income; d) the productive structure of the State economy has become more integrated and complex in the 1985/1995 period, with a decrease in the importance of the agricultural related sectors and an increase in the service related sectors.*

***KEY WORDS:** Agricultural cooperatives; input-output; intersectorial relation.*

1 INTRODUCTION

The first cooperative, as a social economic institution, was created in 1844 in Rochdale, England. Since them there have been a lot of studies trying to better understand how the relations taken place within the cooperatives and with them and the "outside" world. Despite that the cooperatives can be seen in a variety of activities, one could say that it is in the agricultural sector that the cooperatives have played a major role all over the world.

It can be seen that the demand for food will grow steadily in the world given that the world population should get to around 5.7 billion of people in the turn of the century, and in the next 20 years should grow in more 1.4 billion (Côté *et al.*, 1995).

At the same time in a lot of countries the food distribution is concentrated only in a few big enterprises were there is a lot of vertical and horizontal integration. In this particular aspect some of agricultural cooperatives, mainly the ones working in the agroindustry, have the capability of coordinate the productive system in their field of production. They can coordinate the food production from the raw material to the agricultural products, and through the industrialized food.

The food market has become all over an international market and the new trend of economic openness that is taking over the world economy is certainly taken an important role in this process. This has required a more dynamic role of the cooperatives in the world, and as a result of that the cooperatives are merging, expanding, doing research and creating new ways to finance their activities. In the Brazilian case, in April 1998, BATAVO, a dairy products cooperative in the state of Parana, has

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[2] State University of Londrina, Parana, Brazil. E-mail: rlott@uel.br.
[3] State University of São Paulo (USP), Brazil, and University of Illinois. E-mail: guilhoto@usp.br.
[4] State University of Londrina, Parana, Brazil. E-mail: acmoretto@uel.br.

constitute a new company in which the multinational Parmalat had 51% of the new company (Arrastão..., 1998).

The agricultural cooperatives in Brazil in 1997 represented 30% of all the cooperatives in the economy. In this year there was 1410 agricultural cooperatives, with 923625 members and with 112835 people employed (OCB, 1997).

In the south region of Brazil there are 313 agricultural cooperatives with 468277 members and 65219 people employed (OCB, 1997). And by far in the south Region the Parana State is the one that shows the most organized cooperatives. In 1996 there was in the State 66 agricultural cooperatives with 119756 members (OCEPAR, 1997). The Organization of the Cooperatives in the State of Parana, OCEPAR, is the best organized in the Brazilian economy, being a reference for the cooperatives in the other Brazilian states.

Despite the amount of work that have been done with the cooperatives in the Parana State there was none that was concerned with the relation between the agricultural cooperatives and the other sectors in the economy. As so the objective of this study is to see how the agricultural cooperatives have grow in the state in the 1985-95 period. In order to do so it was constructed input-output tables for the state for the years of 1985 and 1995 and specific sectors for the agricultural cooperatives (Rodrigues, 2000). Then a series of different methodologies were applied such that it was possible to study the role and the importance of the agricultural cooperatives to the economy and to the other sectors.

In the next section it is presented an overview of the importance of the agricultural cooperatives in the Parana State. The third section will present the methodology used in this paper. The results are presented in the forth section while some final remarks are made in the last section.

2 THE AGRICULTURAL COOPERATIVES IN THE PARANA STATE[1]

The Parana state is located in the South region of Brazil and occupies an area of 199,555 Km² which corresponds to 2.34% of the national territory (IBGE, 1997a). The state population, in 1996, was estimated to be around 9 million people, which corresponds to 5.73% of the total Brazilian population. In 1995 the state share in the economy is around 6.5% and the per capita state GRP is US$ 4.915 against US$ 4.554 for the Brazilian economy (Table 1).

The colonization process of the Parana State in the beginning of the XIX century was conducted mainly from immigrants from Europe and in special from Germany, Holland, Poland, and Russia. In this process the first cooperatives were created in the State.

In 1997 the agricultural cooperatives were responsible for 55% of the agricultural gross regional product in the Parana State and around 35% of the rural population were linked with their activities (OCEPAR, 1997). Table 2 shows the evolution of the number of agricultural cooperatives, partners and workers in the Parana State.

Table 1 – Main Economical and Geographical Indicators of Brazil and Parana.

	Brazil	Parana	Parana/Brazil (%)
Size (Km²)	8,511,996	199,555	2.34
Population (1996)	157,079,573	9,003,804	5.73
Urban	123,082,167	7,011,990	5.70
Rural	33,997,406	1,991,814	5.86
Urbanization (%)	78.36	77.88	-
GDP (1995) (US$ Millions)	707,389	43,787	6.5
GDP per capita (US$ Thousand)	4,554	4,915	-

Source: IBGE (1997a and 1997b), Considera & Medina (1998) and Lourenço (1999).

Table 2 – Agricultural Cooperatives, partners and workers, Parana, 1980-95.

Year	Cooperatives	Partners	Workers
1980	64	106.748	14.576
1985	72	188.901	29.085
1990	69	193.340	34.489
1995	51	129.455	24.168

Source: OCEPAR, 1987, 1991 e 1996.

[1] This section is based on Bortoli (1984).

3 THEORETICAL BACKGROUND

3.1 The Rasmussen/Hirschman Approach

The work of Rasmussen (1956) and Hirschman (1958) led to the development of indexes of linkage 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 indexes may be developed as follows:

Backward linkage index (power of dispersion):

$$U_j = \left[B_{\bullet j} / n\right] / B^* \qquad (1)$$

Forward linkage index (sensitivity of dispersion):

$$U_i = \left[B_{i\bullet} / n\right] / B^* \qquad (2)$$

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

3.2 The Pure Linkage Approach

As presented by Guilhoto *et al.* (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:

$$A = \left(\begin{array}{c|c} A_{jj} & A_{ir} \\ \hline A_{rj} & A_{rr} \end{array}\right) \qquad (3)$$

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 purchased by the second region and vice versa. From (3), one can generate the following expression:

(4)

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

where:

$$\Delta_j = \left(I - A_{jj}\right)^{-1} \qquad (5)$$

$$\Delta_r = \left(I - A_{rr}\right)^{-1} \qquad (6)$$

$$\Delta_{ii} = \left(I - \Delta_i A_{ir} \Delta_r A_{ri}\right)^{-1} \qquad (7)$$

$$\Delta_{rr} = \left(I - \Delta_r A_{rj} \Delta_j A_{jr}\right)^{-1} \qquad (8)$$

By utilizing this decomposition (equation 4), it is possible to reveal the process of production in an economy as well as derive a set of multipliers/ linkages.

From the Leontief formulation:

$$X = (I-A)^{-1} Y \qquad (9)$$

and using the information contained in equations (4) through (8), one can derive a set of indexes that can be used: a) to rank the regions in terms of its importance in the economy; b) to see how the production process occurs in the economy. From equations (4) and (9) one obtains:

(13)

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

which leads to the definitions for the Pure Backward Linkage (PBL) and for the Pure Forward Linkage (PFL), i.e.,

$$\begin{aligned} PBL &= \Delta_r A_{rj} \Delta_j Y_j \\ PFL &= \Delta_j A_{jr} \Delta_r Y_r \end{aligned} \qquad (14)$$

where the PBL will give the pure impact on the rest of the economy of the value of the total production in region j, $\left(\Delta_j Y_j\right)$ i.e., 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 $\left(\Delta_r Y_r\right)$.

3.3 The Structure of Production: Economic Landscapes

The view that has been proposed by Sonis, *et al.* (1997) and by Sonis & Hewings (1999) for the interactions among the sectors to be arranged in a normalized hierarchical fashion and presented in a three-dimensional matrix that has been termed an *economic landscape*. This approach provides a consistent and complementary exploration of structure

to the more traditional approach associated with Rasmussen and Hirschman. However, in this case, attention is directed to a matrix derived from the product of row and column multipliers extracted from the Leontief inverse matrix. This matrix, the input-output multiplier product matrix (MPM), reveals the *hierarchy* of backward and forward linkages and their associated *economic landscapes*, reflecting the cross-structure of the multiplier product matrix. The developments will be elaborated below.

Consider the column and row multipliers of the Leontief inverse defined in section 3.1 above and define $b_{\bullet\bullet}$ as been the sum over all elements of the Leontief inverse matrix. Then, the intensity matrix, or the input-output multiplier product matrix (MPM) is defined as:

$$M = \frac{1}{b_{\bullet\bullet}} \left\| B_{i\bullet} B_{\bullet j} \right\| = \frac{1}{b_{\bullet\bullet}} \begin{pmatrix} B_{1\bullet} \\ B_{2\bullet} \\ \cdots \\ B_{n\bullet} \end{pmatrix} \begin{pmatrix} B_{\bullet 1} & B_{\bullet 2} & \cdots & B_{\bullet n} \end{pmatrix} = \left\| m_{ij} \right\| \tag{15}$$

One can reorganize the locations of rows and columns of *M* in such a way that the centers of the corresponding crosses appear on the main diagonal. In this fashion, the matrix will be reorganized in such a way that a descending *economic landscape* will be apparent, based on the rank-size sequence of the column and row multipliers. Furthermore, by adopting the rank-size ordering from one economy as the *numeraire*, the economic landscapes can be compared visually; deviations from the smoothly descending landscape of the numeraire economy will reflect differences in economic structure. These differences will reflect variations in the industry mix of regions, variations in the degrees of intraregional intermediation as well as variations in technology.

One of the attractive features of the economic landscape analysis is that the patterns revealed are consistent with the key sector identification procedures associated with Hirschman-Rasmussen. As Sonis *et al.* (1997) and Sonis and Hewings (1999) have pointed out, the rank-size hierarchies of the Rasmussen/Hirschman indexes coincide with the rank-size hierarchies of column and row multipliers of the MPM. This rearrangement also reveals the descending rank-size hierarchies of the Rasmussen/ Hirschman forward and backward linkage indexes.

Thus, the economic landscape provides a complementary tool in the preliminary elaboration of differences and similarities across economies. It will not replace other techniques but will serve as a first-stage filter that may help in focusing attention on potentially important similarities and differences across economies.

3.4 The Field of Influence

The concept of field of influence was introduced and elaborated by Sonis & Hewings (1989, 1994). It is mainly concerned with the problem of coefficient is mainly concerned with the problem of coefficient change, namely the influence of a change in one or more direct coefficients on the associated Leontief inverse matrix.[6] Since, given an economic system, some coefficients are more "influential" than others, the sectors responsible for the greater changes in the economy can be determined. Together with the Rasmussen/Hirschman linkage indexes and the pure linkage indexes, it completes our analytical framework for the determination of key sectors in an economic system.

Considering a small enough variation, e, in the input coefficient, a_{ij}, the presentation of the *basic* solution of the coefficient change problem proposed by Sonis and Hewings may be presented as follows. let $A = (a_{ij})$ be an $n \times n$ matrix of direct input coefficients; let $E(e_{ij})$ be a matrix of incremental changes in the direct input coefficients; let $B = (I - A)^{-1} = \left\| b_{ij} \right\|$, $B(E) = (I - A - E)^{-1} = b(e)_{ij} \|$ be the Leontief inverses before and after changes.

Using the notion of inverse-important input coefficients that is based on the conception of the field of influence associated with the change *in only one* input coefficient, assume that this change occurs in location (i_1, j_1), that is,

$$e_{ij} = \begin{cases} e & i = i_1, j = j_1 \\ 0 & i \neq i_1 \text{ or } j \neq j_1 \end{cases} \tag{16}$$

then, the field of influence can be constructed as the matrix $F(e_{ij})$ generated by multiplication of the j^{th} column of the Leontief matrix, B, with the i^{th} row:

$$F(e_{ij}) = \begin{pmatrix} b_{1j} \\ b_{2j} \\ \vdots \\ b_{nj} \end{pmatrix} \begin{pmatrix} b_{i1} & b_{i2} & \cdots & b_{in} \end{pmatrix} \tag{17}$$

where $F(e_{ij})$ is a $n \times n$ matrix, interpreted as the field of influence of the change on the input coefficient, a_{ij}. For every coefficient, a_{ij}, there will be an associated $n \times n$ field of influence matrix.

In order to determine which coefficients have the greater field of influence, reference is made to the rank-size ordering of the elements, S_{ij} from the largest to the smallest ones. Therefore, for every matrix $F(e_{ij})$, there will be an associated value given by:

[6] We considered here only the simplest case, i.e., the case in which the change occurs in only one input parameter. However, the analysis can be extended to the cases of changes in whole rows or columns.

$$S_{ij} = \sum_{k}^{n} \sum_{l}^{n} [f_{kl}(e_{ij})] \qquad (18)$$

It is possible to see that $S_{ij} = b_{\bullet j} b_{i\bullet}$ and thus provides a direct relationship with the intensity matrix defined in (15). Thus, from the values of S_{ij} a hierarchy can be developed of the direct coefficients, based on their fields of influence, i.e., ranking sectoral relations in terms of their sensitivity to changes, in a sense that they will be responsible for more significant impacts on the economy. It is important to stress that each field of influence and the MPM matrix as well have a cross structure; the largest elements define the largest column and row. After exclusion of these entries, the next largest element defines the second largest cross and so on. This is an important property in the empirical analysis.

RESULTS FOR THE STATE OF PARANA

In order to conduct the research it was construct input-output tables for the Parana State which were based in the national input-output tables of the Brazilian economy constructed for the years of 1985 and 1995. The input-output tables were first estimated for 32 sectors, then 8 of these sectors which are related to the agricultural cooperatives were open into Rest of Economy (ROE) and Cooperatives giving as a result a total of 40 sectors into the input-output system (see Table 3 for a complete list of the sectors).

4.1 Sectoral Share of the Production Value

The sectoral share of the production value is showed into Table 3. From the analysis of the results one can see the importance of the sectors ROE Agriculture (1) and Cooperative Agriculture (2) for the two year. All of the food sectors show a decline in their shares of the State total production. The Cooperative Sugar Products (26) only exists into the 995 input-output table.

Table 3 also shows that from 1985 to 1995 the sectors of Public Utilities (32), Construction (33), Trade (34), Public Administration (39), and Other Services (40), had an increase in their share of the total production showing an above average growth for these sectors. The same growth in importance can be observed in the industrial sectors of Electrical/ Electronic Equipment (7), Transport Equipment (8), Pulp, Paper and Printing (10), and Clothing, Footwear, Leather and Skins (16).

4.2 The Hirschman-Rasmussen Approach

Table 4 and Figures 1 and 2 show the results for the Hirschman-Rasmussen backward and forward linkages for the years of 1985 and 1995.

From there one has that for 1985, for the backward linkages, the higher values are found in the sectors ROE Coffee Products (17), Cooperative Coffee Products (18), ROE Vegetal Oil (27), Cooperative Vegetal Oil (28), ROE Meat Products (21) and Cooperative Meat Products (22). It is important to call attention to the fact that all of the industrial food sectors linked with the cooperatives showed backward indexes greater than the ones not linked with the cooperatives, which is an indication of importance of the cooperatives for the economy of the State.

For the forward linkages, the sectors of ROE Agriculture (1), Cooperative Agriculture (2) and Chemicals (12), Trade (34), and Transport (35) are the ones that do present the higher values in 1985. The results for the cooperatives show that they have a low value for the forward linkages which is an indication that the cooperatives do supply for few industries or that their production is more directed to the final demand.

For the years of 1985 and 1995 only the Pulp, Paper and Printing (10) and the Textile (15) sectors can be considered key-sectors for the Parana economy when one adopts the strict definition of key sector as the one that presents, both, the value of the backward and forward linkages greater than one (McGilvray, 1977).

Like in 1985, for 1995 the sectors in the food industry, ROE Meat Products (21), Cooperative Meat Products (22), ROE Vegetal Oil (27) and Cooperative Vegetal Oil (28), show the bigger values for the backward linkages. The position of the food sectors linked with the cooperatives is maintained in 1995 despite the loss in the sectors ROE Coffee Products (17) and Cooperative Coffee Products (18).

The loss in the coffee sectors can be explained on the fact that during the period of analysis due to weather and price problems there was a substitution of agricultural cultures in the Parana economy and soy beans has become the most important agricultural product in the state (Padis, 1981).

As for the forward linkage, in 1995 the same sectors as the ones in 1985 has showed to be the most important ones, i.e.: ROE Agriculture (1), Cooperative Agriculture (2), Chemicals (12), Trade (34), and Transport (35), with the addition of the Public Utilities (32) sector.

In 1985 and 1995, the sectors that have show to be the most important are: ROE Agriculture (1); Cooperative Agriculture (2); Chemicals (12); Public Utilities (32); Trade (34); Transport (35); and Other Services (40).

Table 3 – Sectoral Share in Parana Production Value, 1895 and 1995.

Sectors	1985	1995
1 ROE Agriculture	9.47	9.50
2 Cooperative Agriculture	6.53	4.47
3 Mining	0.24	0.27
4 Non-Metallic Minerals	1.42	1.18
5 Metal Products	0.92	0.98
6 Machinery and Equipment	1.17	1.51
7 Electrical/Electronic Equipment	1.24	2.41
8 Transport Equipment	1.24	3.34
9 Wood and Wood Products	2.90	2.82
10 Pulp, Paper and Printing	2.29	3.26
11 Rubber	0.14	0.04
12 Chemicals	8.39	3.81
13 Pharmaceutical and Veterinary	0.17	0.36
14 Plastics	0.46	0.49
15 Textile	2.04	0.91
16 Clothing, Footwear, Leather and Skins	0.73	1.06
17 ROE Coffee Products	1.98	0.13
18 Cooperative Coffee Products	0.60	0.11
19 ROE Vegetal Products	2.31	1.01
20 Cooperative Vegetal Products	0.58	0.08
21 ROE Meat Products	1.46	0.82
22 Cooperative Meat Products	0.27	0.22
23 ROE Dairy Products	0.07	0.03
24 Cooperative Dairy Products	0.27	0.17
25 ROE Sugar Products	0.86	0.17
26 Cooperative Sugar Products	-	0.01
27 ROE Vegetal Oil	2.79	0.64
28 Cooperative Vegetal Oil	0.56	0.17
29 ROE Other Food Products	2.70	1.76
30 Cooperative Other Food Products	0.29	0.16
31 Other Industrial Products	0.32	0.83
32 Public Utilities	3.67	6.27
33 Construction	6.17	7.61
34 Trade	8.96	10.15
35 Transport	5.66	4.80
36 Communication	0.60	0.95
37 Financial Institution	7.65	7.01
38 Realty Services	1.39	3.14
39 Public Administration	4.79	9.27
40 Other Services	6.69	8.04

Source: Estimated by the authors.

Table 4 – Hirschman-Rasmussen linkages for Parana, 1985 and 1995.

Sectors	1985		1995	
	Forward	Backward	Forward	Backward
1 ROE Agriculture	3.6060	0.8807	3.5525	0.8690
2 Cooperative Agriculture	2.1213	0.9158	2.3267	0.8979
3 Mining	0.6651	0.7426	0.7173	0.9044
4 Non-Metallic Minerals	0.9357	1.0173	0.9720	1.0175
5 Metal Products	0.7231	0.7770	0.8459	0.8549
6 Machinery and Equipment	0.7961	0.7545	0.9559	0.7942
7 Electrical/Electronic Equipment	0.6891	0.8023	0.8131	0.9116
8 Transport Equipment	0.7010	0.8034	0.9449	0.9883
9 Wood and Wood Products	0.7787	1.0236	0.8087	1.0597
10 Pulp, Paper and Printing	1.2538	1.0664	1.3158	1.1605
11 Rubber	0.6202	0.8742	0.6231	0.8446
12 Chemicals	3.7212	0.8992	2.2388	0.9053
13 Pharmaceutical and Veterinary	0.5768	0.9764	0.6185	0.9534
14 Plastics	0.7217	1.0473	0.8081	0.9341
15 Textile	1.1866	1.1068	1.0183	1.0136
16 Clothing, Footwear, Leather and Skins	0.5891	0.9918	0.6605	0.9950
17 ROE Coffee Products	0.8017	1.4011	0.7031	0.9416
18 Cooperative Coffee Products	0.6353	1.4132	0.6832	1.0512
19 ROE Vegetal Products	0.8040	1.0709	0.7861	1.1479
20 Cooperative Vegetal Products	0.6226	1.0855	0.6183	1.1645
21 ROE Meat Products	0.7003	1.3209	0.7170	1.2822
22 Cooperative Meat Products	0.5875	1.3256	0.6331	1.2870
23 ROE Dairy Products	0.5812	1.1351	0.6166	1.1560
24 Cooperative Dairy Products	0.6386	1.1387	0.6690	1.1612
25 ROE Sugar Products	0.8190	1.1512	0.6787	1.1588
26 Cooperative Sugar Products			0.6084	1.1990
27 ROE Vegetal Oil	0.9875	1.3237	0.9903	1.3599
28 Cooperative Vegetal Oil	0.6484	1.3465	0.7082	1.3924
29 ROE Other Food Products	0.8242	1.2266	0.8853	1.1597
30 Cooperative Other Food Products	0.5900	1.2479	0.6289	1.1849
31 Other Industrial Products	0.6385	0.852	0.7415	0.9678
32 Public Utilities	1.2423	0.9851	1.4088	0.9155
33 Construction	0.7314	0.9011	0.7307	0.8427
34 Trade	1.8331	0.8089	1.8410	0.8405
35 Transport	1.5159	0.8859	1.4966	0.8704
36 Communication	0.6714	0.7015	0.7709	0.7132
37 Financial Institutions	0.8281	0.6738	1.0150	0.7842
38 Realty Services	0.6362	0.6815	0.7221	0.6453
39 Public Administration	0.6386	0.8008	0.7989	0.8330
40 Other Services	1.3387	0.8432	1.3279	0.8372

Source: Estimated by the authors.

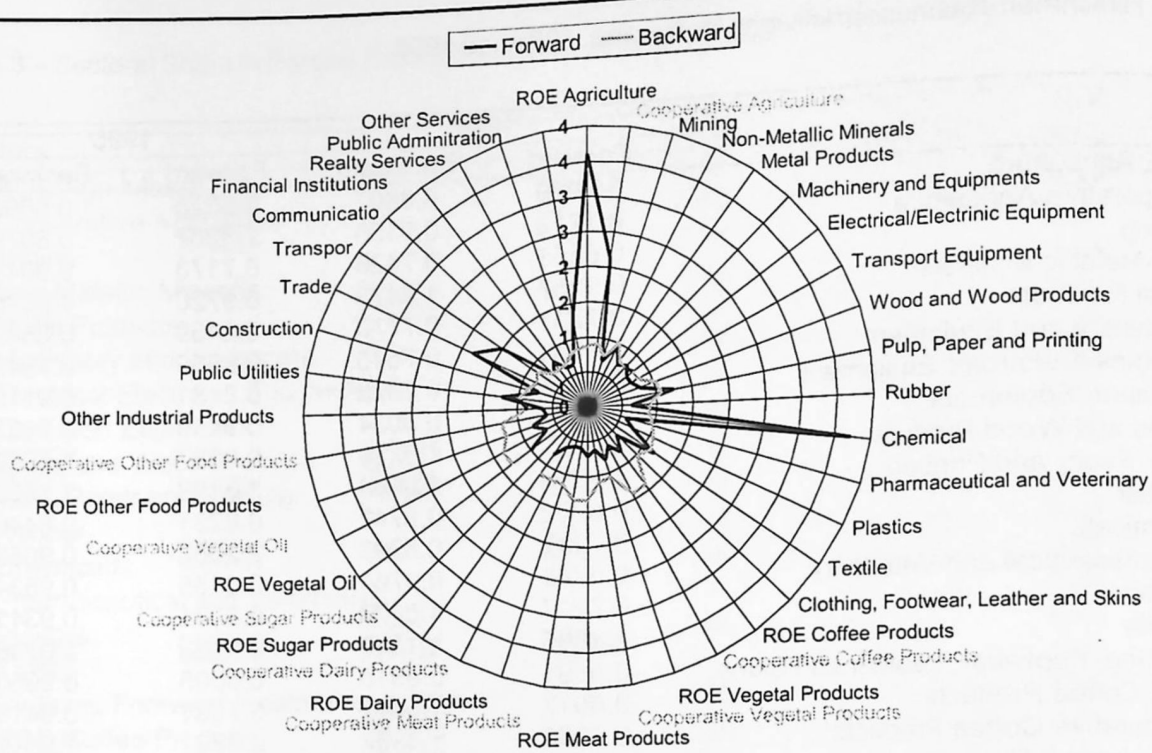


Figure 1 – Hirschman-Rasmussen Linkages, Parana, 1985.

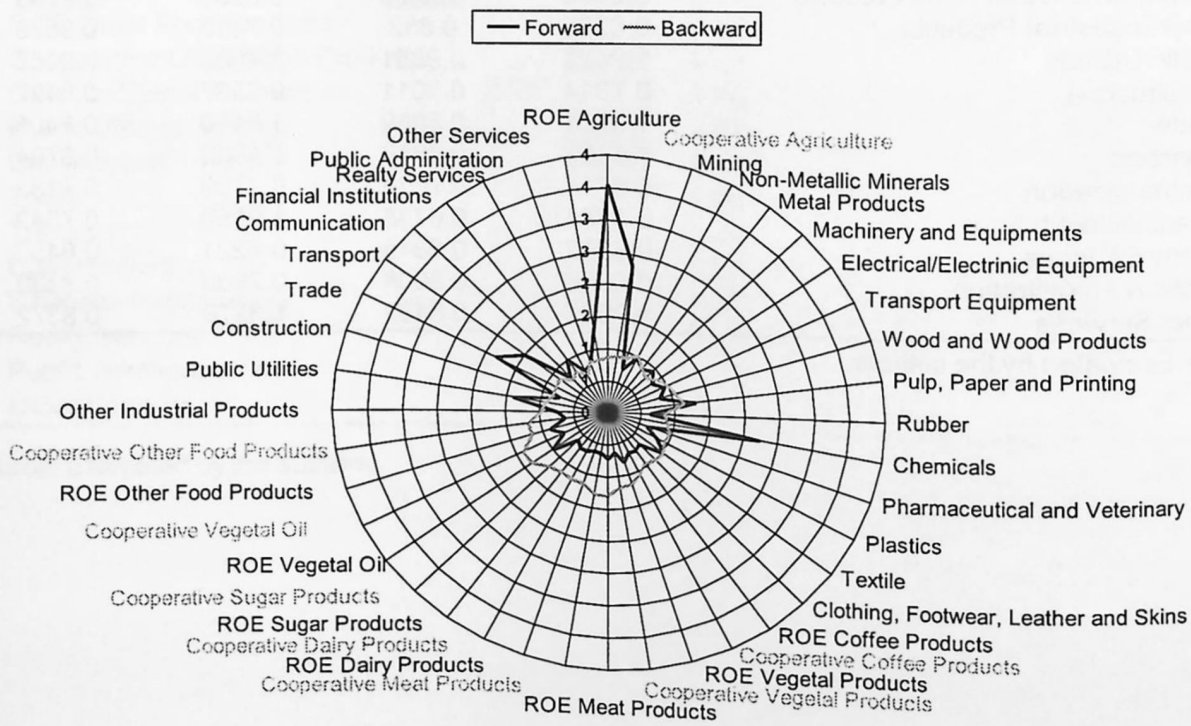


Figure 2 – Hirschman-Rasmussen Linkages, Parana, 1995

4.3 The Field of Influence Approach

The field of influence approach is used to see the importance of the links among the sectors in the economy in such a way the results for the economy are present into Figures 3 and 4, which present the 50 bigger values for the years of 1985 and 1995.

In 1985 the main links in the system are given by the ROE Agriculture (1), Chemicals (12), Textile (15) and Public Utilities (32) sectors. In 1995 there was some changes, with the increase in importance of the Cooperative Agriculture (2), Transport Equipment (8), and Pulp, Paper and Printing (10) that joined the sectors presented in 1985, i.e., ROE Agriculture (1), Chemicals (12), Textile (15) and Public Utilities (32) sectors. The increase in the number of sectors is and indication of an increase in the integration and complexity of interindustrial relations of the Parana's economy.

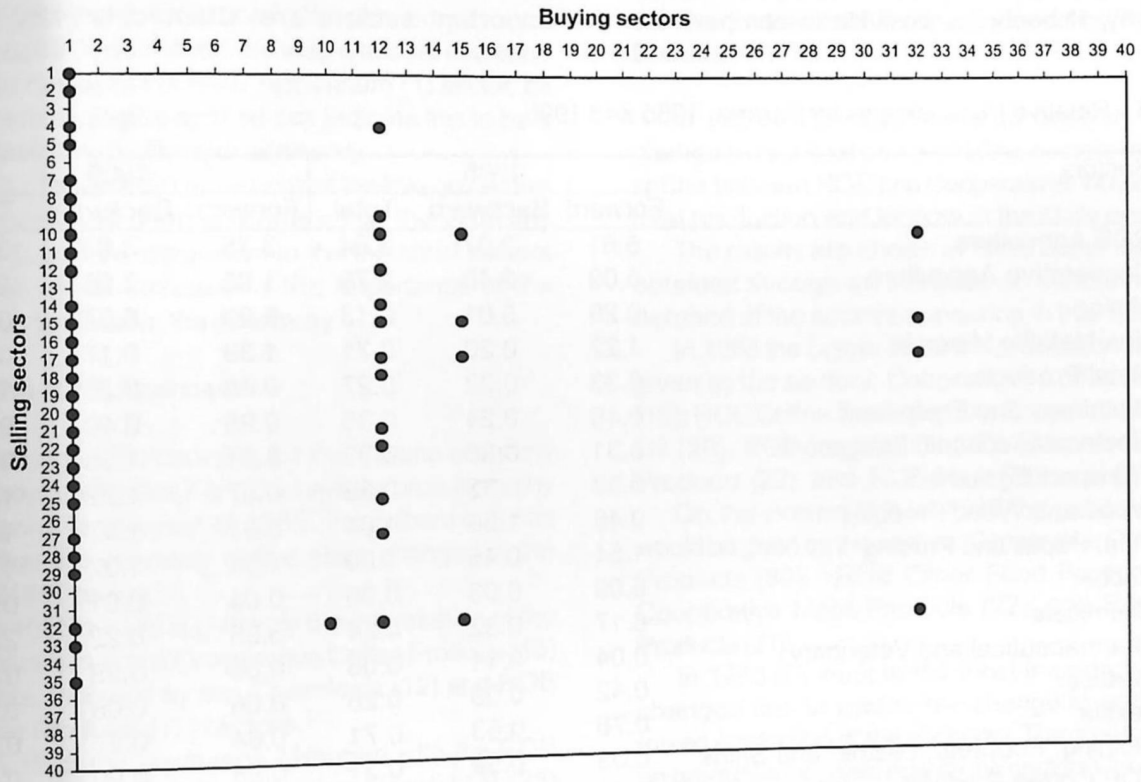


Figure 3 – Field of Influence, Parana, 1985.

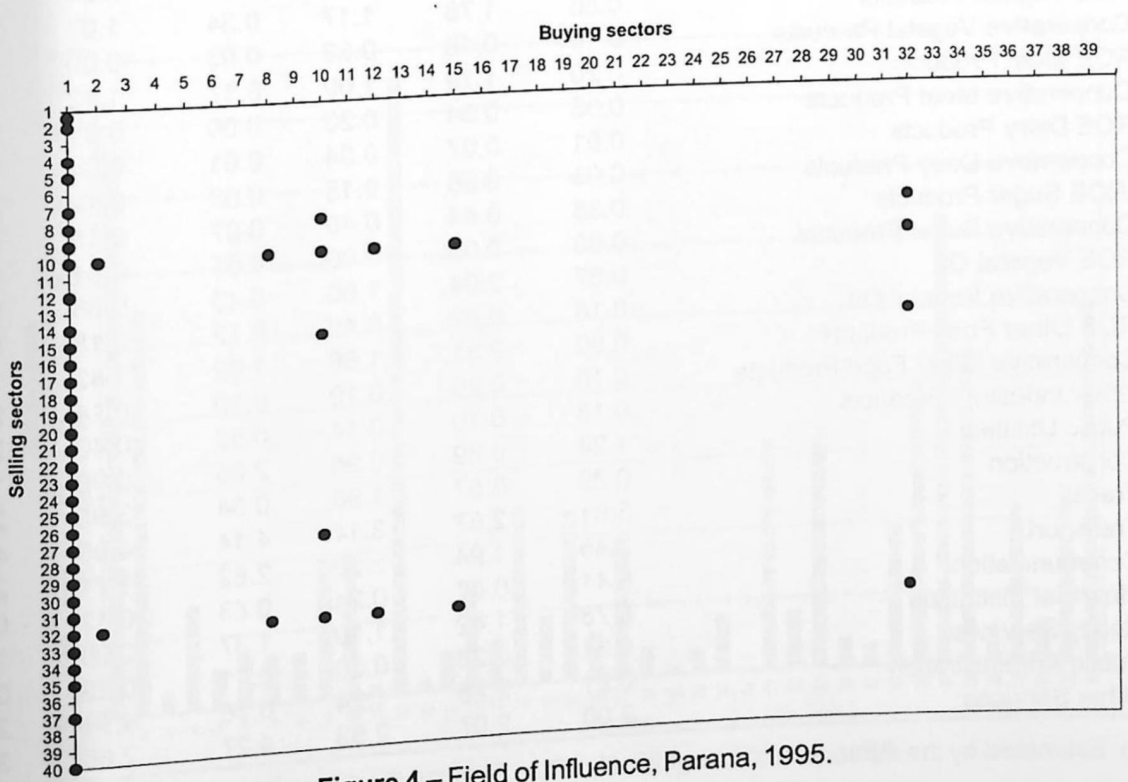


Figure 4 – Field of Influence, Parana, 1995.

4.4 The Pure Linkages Approach

The results for the pure linkage approach are presented into Table 5 and Figures 5 and 6. As the results for pure linkages are giving in monetary terms and given the high inflation problem faced by the Brazilian economy in the 1985/1995 period the results for the Pure linkages are presented normalized such that it is possible to estimate the relative importance of the sector in a given year, in such way it becomes possible to compare the results for the pure linkages for different time periods, different currencies, and different sizes of economies.

For 1985, in terms of forward linkages the most important sectors are: Chemicals (12), ROE Agriculture (1), Trade (34), Cooperative Agriculture (2) and Other Services (40). For the backward linkages, the most important sectors are: Construction (33), Trade (34), ROE Vegetal Oil (27), Cooperative Agriculture (2) and ROE Coffee Products (17).

For 1995, in terms of forward linkages the most important sectors are: Chemicals (12), Other

Table 5 – Relative Pure linkages for Parana, 1985 and 1995.

	Sectors	1985			1995		
		Forward	Backward	Total	Forward	Backward	Total
1	ROE Agriculture	5.61	2.07	3.84	3.75	3.03	3.39
2	Cooperative Agriculture	3.09	2.40	2.75	1.98	2.05	2.01
3	Mining	0.26	0.01	0.13	0.29	0.07	0.18
4	Non-Metallic Minerals	1.22	0.20	0.71	1.39	0.17	0.78
5	Metal Products	0.33	0.22	0.27	0.68	0.26	0.47
6	Machinery and Equipment	0.46	0.24	0.35	0.95	0.40	0.67
7	Electrical/Electronic Equipment	0.31	0.36	0.33	0.74	1.05	0.89
8	Transport Equipment	0.33	0.32	0.32	0.97	1.22	1.10
9	Wood and Wood Products	0.46	1.56	1.01	0.61	1.97	1.29
10	Pulp, Paper and Printing	1.54	0.46	1.00	1.91	1.32	1.61
11	Rubber	0.09	0.03	0.06	0.04	0.01	0.03
12	Chemicals	8.17	0.32	4.24	5.06	0.22	2.64
13	Pharmaceutical and Veterinary	0.04	0.11	0.08	0.06	0.29	0.18
14	Plastics	0.42	0.09	0.26	0.66	0.06	0.36
15	Textile	0.78	0.63	0.71	0.64	0.27	0.45
16	Clothing, Footwear, Leather and Skins	0.03	0.59	0.31	0.05	0.90	0.48
17	ROE Coffee Products	0.16	2.28	1.22	0.03	0.08	0.05
18	Cooperative Coffee Products	0.13	0.78	0.46	0.02	0.09	0.06
19	ROE Vegetal Products	0.56	1.78	1.17	0.34	1.07	0.70
20	Cooperative Vegetal Products	0.16	0.48	0.32	0.03	0.09	0.06
21	ROE Meat Products	0.20	1.79	1.00	0.17	1.12	0.65
22	Cooperative Meat Products	0.05	0.34	0.20	0.06	0.31	0.18
23	ROE Dairy Products	0.01	0.07	0.04	0.01	0.04	0.02
24	Cooperative Dairy Products	0.03	0.26	0.15	0.03	0.19	0.11
25	ROE Sugar Products	0.35	0.44	0.40	0.07	0.15	0.11
26	Cooperative Sugar Products	0.00	0.00	0.00	0.01	0.01	0.01
27	ROE Vegetal Oil	0.57	2.64	1.60	0.40	0.56	0.48
28	Cooperative Vegetal Oil	0.18	0.62	0.40	0.12	0.18	0.15
29	ROE Other Food Products	0.80	2.51	1.66	1.02	1.42	1.22
30	Cooperative Other Food Products	0.10	0.29	0.19	0.10	0.14	0.12
31	Other Industrial Products	0.18	0.10	0.14	0.52	0.40	0.46
32	Public Utilities	1.24	0.69	0.96	2.05	0.98	1.51
33	Construction	0.39	3.57	1.98	0.54	3.95	2.24
34	Trade	3.61	2.67	3.14	4.14	4.05	4.10
35	Transport	2.46	1.94	2.20	2.62	1.71	2.16
36	Communication	0.41	0.07	0.24	0.83	0.12	0.48
37	Financial Institution	0.78	1.42	1.10	1.37	2.00	1.68
38	Realty Services	0.31	0.28	0.30	0.71	0.29	0.50
39	Public Administration	0.21	2.25	1.24	0.76	4.91	2.84
40	Other Services	3.00	2.07	2.53	4.27	2.86	3.57

Source: Estimated by the authors.

Services (40), Trade (34), ROE Agriculture (1), and Transport (35). For the backward linkages, the most important sectors are: Public Administration (39), Trade (34), Construction (33), ROE Agriculture (1) and Other Services (40).

For the sectors divided into ROE and Cooperatives (1, 2, 17 to 30), what one observes is that from 1985 to 1995 they are loosing relative position in the economy. In general the other industrial sectors and in special the sectors linked with the services are gaining relative importance in the economy.

Despite the fact that there was a relative decrease in importance of the ROE Agriculture (1) sector, all the methodologies applied still indicate this to be a key sector in the Parana economy.

Also, the different measures of the linkages shows that there has been a tendency in the economy towards a more integration in the industrial sectors as well as an increase in the importance of the service sectors for the economy.

4.5 The MPM Approach

The economic landscapes for the Parana economy are shown in Figures 7 and 8 where the base hierarchy is the one for the year of 1985. From there one can see that the economy of the state changed in the 1985/1995 period.

In 1985 the top is given by the intersection of the Chemicals (12) and Cooperative Coffee Products (18) sectors, followed by the Chemicals (12) and ROE Coffee Products (17) sectors.

In 1995 the landscape changed with the ROE Agriculture (1) and Cooperative Vegetal Oil (28) sectors presenting the greater values, followed by the ROE Agriculture (1) and ROE Vegetal Oil (27) sectors. This once more stress the decline of the importance of the coffee sector for the state economy, as mentioned above.

A comparison of the landscapes show that in 1995 the differences among the sizes of the columns decrease what is and indication of a greater integration among sectors and of an increase in the economic complexity, as mentioned early.

4.6 Production and Income Induced by the Final Demand

In this section it is made an analysis of how changes in the final demand of the sectors that were splitter between ROE and Cooperatives would impact total production and income in the state economy.

The results are shown in Table 6 and they were obtained through an increase of 1,000 in the final demand of the sectors appearing in this table.

In 1985 the bigger impact in production would be given by the sectors: Cooperative Coffee Products (18); ROE Coffee Products (17); Cooperative Vegetal Oil (28); ROE Vegetal Oil (27); Cooperative Meat Products (22); and ROE Meat Products (21).

On the income side, in 1985 the greater impacts would be given by the sectors: Cooperative Other Food Products (30); ROE Other Food Products (29); Cooperative Meat Products (22); and ROE Meat Products (21).

In 1995 the rank of the most important sectors changed due in part to the change in agricultural mixed production of the economy. The greater impact on production is given now by the sectors Cooperative Vegetal Oil (28) and ROE Vegetal Oil (27).

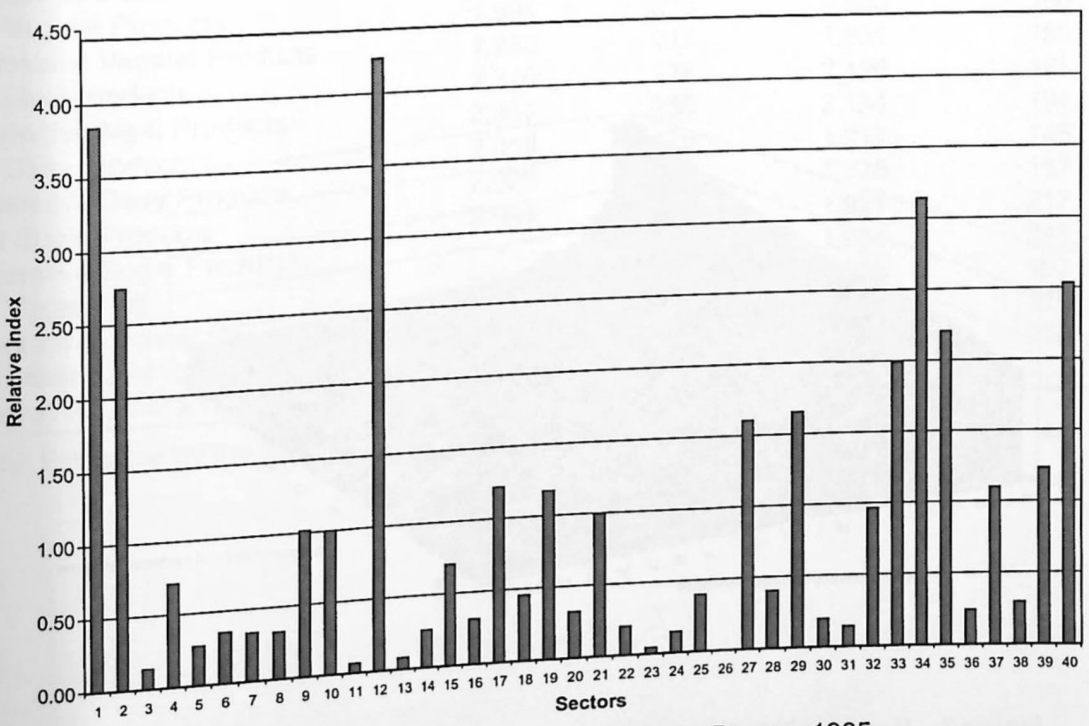


Figure 5 – Relative Pure Total Linkages, Parana, 1985.

On the income side, for 1995, the most important sectors would be: Cooperative Sugar Products (24); Cooperative Other Food Products (30); and ROE Other Food Products.

From Table 6 it is possible to observe that with the exception of the Meat Products (21 e 22) sector the results show that the cooperative sectors would have a greater impact on production and income than the non-cooperative sectors.

Other point to call attention is that in general, the impacts of the considered sectors on production and income are smaller in 1995 than in 1985, what shows in a certain sense the decrease of importance of these sectors for the state economy, confirming the results presented into Tables 3 and 5 above.

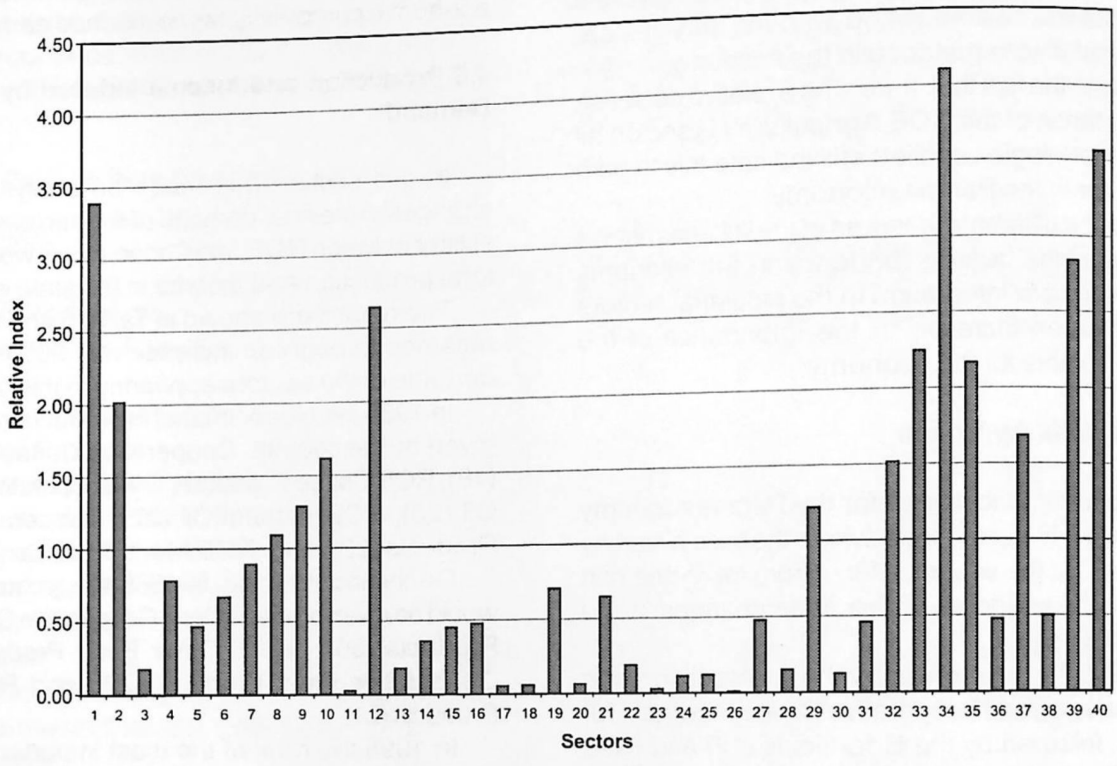


Figure 6 – Relative Pure Total Linkages, Parana, 1995.

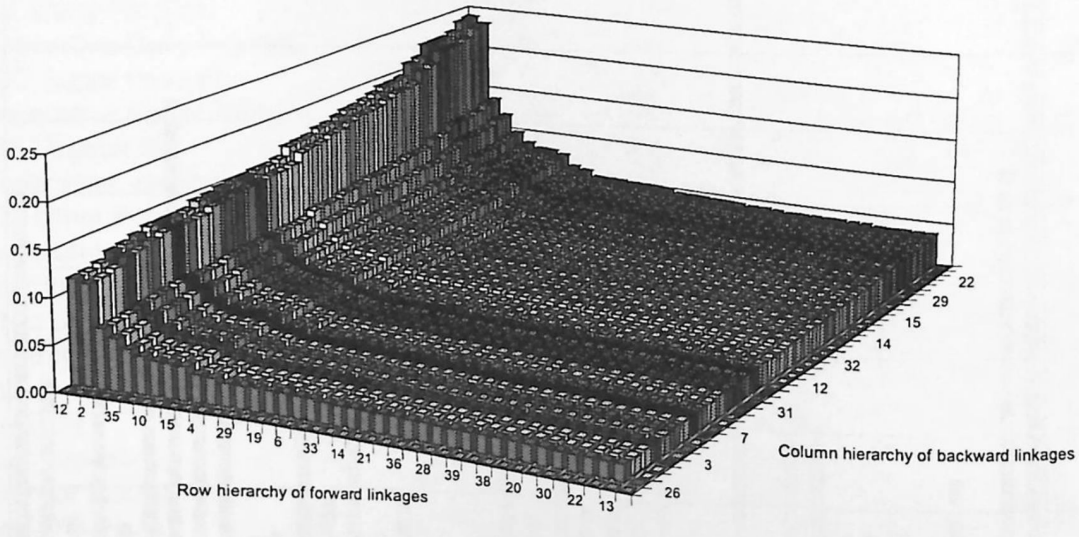


Figure 7 – Parana 1985: Cross-structure "landscape" for first order intensity field.

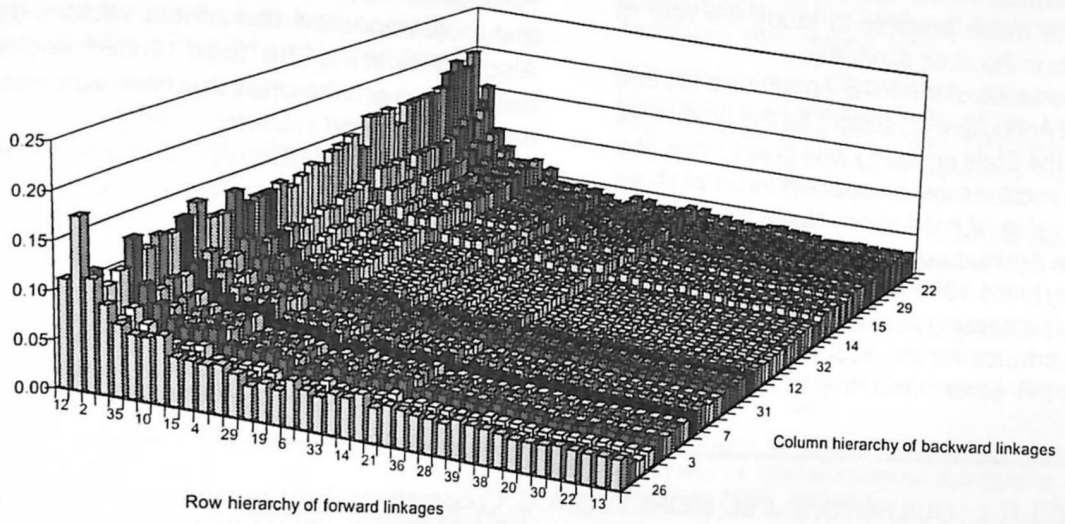


Figure 8 – Parana 1995: Cross-structure "landscape" using Parana 1985 imposed hierarchy

Table 6 – Production and Income Induced by 1,000 Change in the Final Demand Parana, 1985 and 1995.

Sectors	1985		1995	
	Production	Income	Production	Income
ROE Agriculture	1,566	198	1,441	141
Cooperative Agriculture	1,628	209	1,489	151
ROE Coffee Products	2,491	205	1,561	113
Cooperative Coffee Products	2,513	207	1,743	131
ROE Vegetal Products	1,904	216	1,903	186
Cooperative Vegetal Products	1,930	217	1,931	186
ROE Meat Products	2,349	237	2,126	195
Cooperative Meat Products	2,357	236	2,134	194
ROE Dairy Products	2,018	199	1,917	148
Cooperative Dairy Products	2,025	201	1,925	152
ROE Sugar Products	2,047	221	1,921	217
Cooperative Sugar Products	-	-	1,988	248
ROE Vegetal Oil	2,354	207	2,255	162
Cooperative Vegetal Oil	2,394	218	2,309	175
ROE Other Food Products	2,181	282	1,923	225
Cooperative Other Food Products	2,219	291	1,964	233

Source: Estimated by the authors

5 CONCLUSIONS

The construction of the input-output tables for the Parana State made possible to study the role of cooperatives in the state economy.

The importance of the ROE Agriculture (1) and Cooperative Agriculture (2) sectors for the productive structure of the State economy was great, once that they were one of the most important in terms of share in the total value of production. Nevertheless, the Cooperative Agriculture sector lost importance for the economy in the 1985/1995 period.

The food processing sectors showed a decrease in their importance for the economy in the same period. On the other hand, the food processing sectors linked to the cooperatives has showed to have the economy greater values for the backward linkages when measured by the Hirschman-Rasmussen approach, i.e., they were the sectors that most impacted the others sectors demand. Also, considering the food related sectors, the cooperatives are the ones that have a greater impact on production and income.

Finally, the productive structure of the state economy has become more integrated and complex in the 1985/1995 period, with a decrease in the importance of the agricultural related sectors and an increase in the other economic sectors, mainly the service related sectors.

RODRIGUES, R. L.; GUILHOTO, J. J. M.; MORETTO, A. C. Cooperativas Agropecuárias e Desenvolvimento Econômico no Estado do Paraná (1985 e 1995). *Semina*: Ci. Soc. Hum., Londrina, v. 21, n. 3, p. 113-127, set. 2000.

RESUMO: *O estudo avalia o papel que as cooperativas agropecuárias desempenharam no desenvolvimento econômico do Estado do Paraná nos anos de 1985 e 1995, utilizando-se da análise insumo-produto. As tabelas de insumo-produto do Brasil foram usadas para derivar as tabelas de insumo-produto do Paraná para os anos de 1985 e 1995 e os setores agropecuária e processadores de alimentos das matrizes do Paraná divididos em dois - cooperativa e não cooperativa. A partir dos dados gerados foi possível: a) identificar e avaliar a participação relativa das cooperativas agropecuárias nos setores agropecuária e processadores de alimentos; b) avaliar a importância relativa das cooperativas agropecuárias em termos de relações interindustriais; e c) implementar e avaliar impactos na demanda final no que se refere à geração de produto e renda por parte dos setores cooperativa e não-cooperativa. Os resultados mostraram que: a) o setor cooperativas agropecuárias perdeu importância em termos de participação no valor total da produção no período 1985/95; b) apesar dos setores processadores de alimentos mostrarem um decréscimo na sua importância para a dinâmica do Estado, aqueles ligados às cooperativas foram os maiores dinamizadores da demanda dos outros setores da economia; c) os setores processadores de alimentos cooperativos foram os que apresentaram os maiores impactos na produção e na renda d) a estrutura produtiva da economia do Estado se tornou mais integrada e complexa no período 1985/1995, com decréscimo da importância dos setores relacionados à agricultura e incremento nos setores relacionados ao ramo serviços.*

PALAVRAS-CHAVE: *Cooperativa agropecuária; insumo-produto; relação intersetorial.*

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