

Sector specialization matter: the identification of the Key-Sectors in the Brazilian economy in the period of 1985-2004

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1. Introduction

The recent trend of international trade, specially the increasing price of basic commodities, has led some authors to argue that some countries have moved too far in the process of internal productive diversification. The idea is that the diversification diverts resources that could be used to improve the sectors in which the countries already have comparative advantages and that this is hindering their growth. More specifically, these arguments¹ have been put forward in order to criticize, in Brazil, the arguments in favor of a more vertical industrial policy, directed promote key-sectors in the economy. In other words, recently, it has been proposed that the country should focus in the sectors which it has already attained comparative advantage, throwing away all the theoretical and empirical work of the main development economists.

The present work diverges enormously from these ideas and tries to improve the basic argument for a vertical industrial policy; that is, sectors diverge in their capacities to affect others, and it is possible to identify the sectors with the greatest potential to play an important role in the process of economic change. The relative importance of sectors, however, is not enduring and changes in the sectors ranking indicate structural changes in the economy. During the last two decades the Brazilian economy went through deep transformations in the macroeconomic environment and in its international insertion. These changes have a great transformation potential of the productive structure, which can be evaluated, initially, based on comparing the relative position of the key-sectors. Therefore, the main objective of this paper is to identify the key-sectors that promote economic growth, generate employment and the sectors impact on the trade balance in different periods.

In the specialized literature, the first indicators of the industrial linkages, also known as the Rasmussen-Hirschman indexes, were proposed by Rasmussen (1956) and refined by Hirschman (1958). Although these indicators have contributed to strengthen the idea of the existence of key-sectors in the economy, they were much criticized. Among the critiques it is possible to point out an important argument that they did not take into account the different output levels of each sector. Pushed by the critiques, many different indicators were proposed, trying to solve some of the problems.

These indicators, in general, decompose the linkages effects into two types: (a) backward linkages – which indicate the effect of a specific sector on the demand of all the sectors, including itself (direct and indirect effects); and (b) forward linkages – which indicate the effect of all the sectors in the demand of a specific sector. This division allows one to evaluate the multiplier potential of certain sectors with strong backward linkages, but also to highlight the key sectors to avoid bottle-necks in the process of economic growth and development, in the case of sectors with strong forward linkages.

The calculation of these indicators is strongly based on the input-output tables published by statistical offices all over the world, given the UN estimation methodology. The last official IO matrix published by the Brazilian statistical office (IBGE) was based on 1996 data. In March of this year, the 2004 national account data was released with a new base developed with data for the year 2000. Thus, in order to capture the most recent results it is possible

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¹ For two examples see Ferreira, P. C. G. (2005) and Canedo, et alli (2007).

to update² the IO matrix by the use of partial information coming from the 2004 Make and Use tables and an appropriate updating methodology³. Given the available data it is possible to compare the IO matrices of 1985, 1990, 1996 and the estimated for 2004, and to highlight the structural changes occurred in this period, identifying, as much as possible, the sectors that tend to be the drivers or the bottlenecks of the growth process.

This comparison, nevertheless, is limited to the current standard of the Brazilian economy. The linkages observed at the current standard depend on the technological level reached by the country, which is represented, up to some extent, by the technical and employment coefficients of the different sectors. Therefore, another important exercise is to compare the current IO matrix of Brazil with a matrix from a developed country, in order to point out some of the possible directions of technological change, which could strength the internal linkages of the economy. Another interesting exercise is to compare, not so easy to implement, giving the usual difference in sector aggregation, is the comparison with another developing country. For instance, it would be interesting to compare with one which is experiencing a better economic performance, opening up the possibilities for many comparative works.

This exercise is completely related to the framework for technological diffusion impact studies based on the IO approach, which was proposed in the Leontief & Duchin (1986) seminal paper. This framework is specially suited to evaluate the systemic effects of technological change at a multi-sectoral level of analysis, which allows the investigation of the interaction between producers and users of technologies. In contrast with the methodologies inspired by neoclassical theory, in the IO approach used by Leontief & Duchin (1986), economic growth is viewed as a demand-led process. In fact, they consider the demand expansion as the proximate cause of economic growth. Of course, technical change and other supply factors can have an influence on economic growth, but only through its effects on the demand side.

This methodology contest the framework of the growth accounting methodologies that try to separate the contribution of capital input, labor input and total factor productivity (TFP) to economic growth, considered as immediate sources of growth. Growth accounting exercises have been performed at macroeconomic⁴ and sectoral levels of aggregation. From the viewpoint of this theory, economic growth is characterized as a supply constrained process – mainly a labor constrained one in fact. This is the case because the price system is supposed to convey information on the relative scarcity of resources that is transmitted to consumers and producers and governs their choices in the direction of the full utilization of the available resources. Hence more capital accumulation and more productivity growth are always directly conducive to GDP and *per capita* GDP growth. However, this vision of the growth process doesn't seem to be appropriate for economies whose expansion is not normally constrained by the availability of resources in general and labor in particular. This has been the case of the Brazilian economy in which a systematically high level of underutilization of the labor force is observed. Besides this, growth accounting methodologies share with core neoclassical theory other strong assumptions such as perfect competition, high price flexibility and technical efficiency.

Therefore, this work tries to highlight the relative importance of different sectors in the Brazilian economy in order to point out that the relative sectoral specialization of each country is not, as the neoclassical economists point out, pre-determined in accordance with the endowment and scarcity of the factors. It depends, in fact, on the productive development of the country, which is completely linked to past and current economic policy. As Amsden emphasized: "climbing the ladder of comparative advantage is a matter of

² This step can be substitute in a very short run, since the new official IO for 2004 data will be released next July.

³ UN (1999), Bulmer-Thomas (1982) e Miller & Blair (1985), Kurz, Dietzenbacher & Lager (1998) e Bacharach (1970) and Grijò and Berni (2005).

⁴ See, in this respect, Jorgenson & Stiroh, (2000), Oliner & Sichel (2000) and Jorgenson (2001).

creating competitiveness, usually with government assistance, rather than stepping into it" (Amsden 1989, p. 243).

2. Key-Sectors Indicators: backward and forward Linkages

2.1. Rasmussen-Hirschman Linkage Indicators

The *backward linkages* are calculated as the total sum of each column of the Leontief inverse matrix:

$$B_{L} = \sum_{i=1}^m (\mathbf{I} - \mathbf{A})^{-1}$$

where BL is a (1 x m) vector of the *backward linkages* indicators by sector. This indicator measures in some sense what Hirschman called the input-provision or derived demand by that activity. The basic idea is that it measures the total output variation related to an increase in one unit of final demand of the sector, that is, the multiplier effect on the economy of the sector's final demand. Alternatively, the *forward linkages* measure the output utilization, that is, how much the output of the sector is affected by an increase in one unit of all sectors final demand. It is calculated as the sum of each row of the Leontief inverse matrix:

$$F_{iL} = (\mathbf{I} - \mathbf{A})^{-1} \mathbf{A}_{m,j}$$

where FL is a (m x 1) vector of *forward linkages* indicators.

These indicators, however, are sensible to the level of disaggregation of the matrix, more precisely, to the number of sectors encompassed. In order to allow for comparison among IO matrix of different dimensions, the indicators are normalized by calculating simple means:

$$\overline{B}_{L} = \frac{\sum_{i=1}^m [(\mathbf{I} - \mathbf{A})^{-1}]_{i,j}}{n}$$

$$\overline{F}_{iL} = \frac{\sum_{j=1}^m [(\mathbf{I} - \mathbf{A})^{-1}]_{i,j}}{n}$$

where n is the number of sectors.

There is an even more interesting pair of indicators derived from these averages that allow for a direct comparison among the sectors identifying those with above or below average performance. The first one is called *power of dispersion*, because it measures the impact of the sector in its suppliers, that is, how much its demand spreads in the economy. It is calculated dividing the normalized backward linkage indicator by the average of all coefficients in the inverse matrix:

$$P_{jD} = \frac{\overline{B}_{L}}{M_{T}}$$

Where MT is this total average:

$$M_{T} = \frac{1}{n^2} \sum_{i=1}^m \sum_{j=1}^m [(\mathbf{I} - \mathbf{A})^{-1}]_{i,j}$$

The other indicator is called sensibility of dispersion, since it represents the sensibility of the sector to the increase in the final demand of all sectors. It is calculated in an analogous form by dividing the normalized forward linkage indicators by the total average:

$$S D = \frac{\overline{F_i L}}{M_i}$$

For both index, a value above one implies an above average impact, and therefore can be used to identify key sectors as it will be explained in section.

2.2. Pure Indices of Industrial Linkages

The indicators described above are criticized by not taking into account the size of the sector; sectors diverge in terms of output levels and, therefore, the power of demand by each sector is different. A possible way to deal with this problem is by measuring the effect of an increase in one percent of final demand, instead of one unit and still use the indicator above. However, some authors⁵ have proposed another group of indicators called Pure Indices of Industrial Linkages, based on an improvement of the approach proposed by Cella e Clements.⁶

The basic idea of the Cella-Clements index is to measure the total linkage effect of each sector in the economy by calculating the difference between the total output of the economy and the possible output if the sector would not buy inputs from the economy and neither sell its output. Guilhoto et al (1994) propose some modifications in order to improve the measure, and start by a different decomposition of the technical coefficient matrix:

$$A = \begin{bmatrix} A_{jj} & A_{jr} \\ A_{rj} & A_{rr} \end{bmatrix} = \begin{bmatrix} A_{jj} & A_{jr} \\ A_{rj} & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & A_{rr} \end{bmatrix} = A_j + A_r$$

where matrix A_j represents the sector j isolated from the rest of the economy and matrix A_r the rest of the economy.

The *Pure Backward Linkages* measure the impact on the rest of the economy of the production of the sector:

$$PBL = i_r' (I - A_{rr})^{-1} A_{rj} q_j$$

where q_j is the total output of sector j ; $A_{rj} q_j$ measures the demand from sector j to the rest of the economy, which can be seen as a final demand vector to the rest of the economy; and $(I - A_{rr})^{-1}$ measures the direct and indirect impact of a variation of final demand over the total output of the rest of the economy

The *Pure Forward Linkages measure* the impact of the rest of the economy on the production of the sector:

$$PFL = A_{jr} (I - A_{rr})^{-1} q_r$$

where q_r is a vector of total output of each sector of the rest of the economy.

3. Data

3.1. Matrix Updating

The last official IO matrix for the Brazilian economy published by the Brazilian statistical office (IBGE) is based on 1996 data, but IBGE has published the make and use tables from

⁵ Guilhoto et al (1994)

⁶ Cella (1984) and Clements (1990).

the System of National Accounts with data up to 2003 with the same reference of 1996. We were therefore able to update the IO matrix using partial information from the 2003 make and use tables and an appropriate updating methodology.

The updating methodology applied in this work was proposed by Grijó and Bérni (2005). The main task involves the transformation of the use table measured in the System of National Accounts at consumers' prices into the domestic supply use table measured at basic prices. To transform consumer prices into basic prices, one must first exclude trade and transportation margins,⁷ then exclude indirect taxes collected and remitted by producers and finally isolate the domestic demand from imports. We therefore combined information from the last official IO database, which contains 1996 data for the margins, taxes and imports by using industries, with the known 2003 total value of production at basic prices, trade and transportation margins, indirect taxes and imports by commodities.

The basic methodology consists of four steps:

- (a) Define a mark-down matrix for the use of domestic supply at basic prices and mark-up matrices for indirect taxes, trade and transportation margins and imports, based on the official 1996 IO database;
- (b) Given those mark-down and mark-up matrices, obtain a first estimation of the use table at basic prices, as well as the commodity-by-industry tables of indirect taxes, trade and transportation margins and imports for 2003;
- (c) In the case of structural changes in production, trade and transportation margins, imports or taxes from 1996 to 2003, make adjustments to fill possible blanks in the 1996 structure; and
- (d) Use the RAS method⁸ to reconcile the two sources of information, aiming to balance all five tables given the known 2003 values of the make and use tables of the System of National Accounts.

3.2. Linking up the Matrices

In March 2007, IBGE published the new series of the System of National Accounts (SNA). The main objectives of the change were: (i) to incorporate, completely, the information from annual surveys, income tax, Household Budget Survey of 2003 and the primary sector census of 1996; (ii) to update concepts and definitions as defined by UN and other international agencies; and (iii) to adopt a classification compatible with the Brazilian classification. The new series include the make and use tables from the System of National Accounts from 2000 (the new reference year) up to 2004.

In principle, we could use the same methodology described above to update the Brazilian IO Matrix up to 2004, but, the changes implemented prevent a direct comparability with the old series. Therefore, we used a new updating method, inspired by the procedure used by IBGE to create a series of make and use tables, for the period previous to 2000, linked to the new series. We applied the method described in 3.1 to create use tables at basic prices for 2003 for old and new series and for 2004 and then we extrapolated the trend of the new series on the old one. In other words, we calculated the variation cell-by-cell from 2003 to 2004 of the make and use tables at basic prices and use this increment on the 2003 tables of the old series, subject to some national account identities.

3.3. Matrix at constant prices

In order to allow for comparison among the different years, all the values are considered at constant prices (R\$ 2003). The deflators for each sector used in each year, specific to output, final demand and value added, are shown in Table 22. Those related to the years of

⁷ These margins are treated separately as commodities that are produced by industries and purchased by intermediate and final users.

⁸ UN (1999); Bulmer-Thomas (1982); Miller and Blair (1985); Kurz, Dietzenbacher and Lager (1998); Bacharach (1970).

1985 to 2003 refers to the old series. For the year 2004, we used the original data at constant price published by IBGE, that is, at previous year prices.

4. Structural Change in Brazil before 1985

The analysis that follows is similar to many previous works that analyzed different periods of the Brazilian Economy. Most of these works cover the period between 1950 and 1980, a period of intense structural change in the Brazilian economy. During the 1950s, the industrialization process in Brazil was intensified characterized mainly as an intense import substitution industrialization (ISI), which resulted in major structural changes: “promoted the appearance of many different industrial sectors, with special emphasis on those with high income and population elasticities and with high forward and backward linkages” (Baer, Fonseca e Guilhoto, 1987, p. 275) In the period that followed, specially after 1968, there was an deepening on the industrialization process, even after the first oil shock in 1973-74, which extended up to the second oil shock in 1979 and came to a drastic end after the debt crisis in 1982. This second process was partially based on the intensifying the import substitution, by internalizing new sectors, especially the capital goods producers’, and partially on vast investments in infrastructure projects

Since the debt crisis, however, the Brazilian economy has never recovered a substantial development process as in the previous period. In fact, both decades that followed, 1980s and 1990s, were marked by low growth rates and the end of the industrialization spurt; the current decade seems to be following the same pattern. During this period, however, there was an increase in the degree of openness of the economy and a change from a hyperinflation period to a major price stabilization process. It is important, therefore, to highlight some of the previous results in order to evaluate up to what extent there was actually a change in the pattern of the structural change that took place before 1985 and the period that followed it, which is examined in this paper. We focus on two works which used different methods to analyze the same period: (i) Baer, Fonseca e. Guilhoto (1987) e Hewings, et al. (1989).

In the first work the authors used data from industrial censuses for the years 1970, 1975 and 1980, and of input-output tables for the years 1959, 1970 and 1975. Besides the general structural change represented by a major decline in agriculture and an increase in industry, the major findings can be divided into four sources of change. According to the authors (p.?) the *productive structure* was altered given the industrialization trends of the economy and to the increased concentration of income which accompanied it. Between 1959 and 1975, there was an increase in the share of capital goods, consumer durables and intermediary goods (except paper and rubber products); while non-durables (except for clothing and shoes) and agriculture declined.

The *final demand structure* was also modified on the one hand, durable consumer goods sectors increased their share, going in the opposite direction of non-durable goods, except clothing/shoes and processed foods. In fact, the authors point out the decline of raw agricultural products and the rise of processed foods. On the other hand the proportion of production destined for personal consumption declined indicating a rising trend in the interdependence of sectors which occurred in the years 1959-75⁹. This trend did not increase the country’s economic autarky, in many sectors the share of exports in total output increased, especially for sectors like metal products, machinery, transport equipment, paper products and chemicals.

In terms of technological change, the authors point out that by the 1970s most sectors incorporated the latest technology into their expansion plans, which are captured by the

⁹ “According to Hirschman (1958). this type of structural change is usually associated with the intensification of the industrialization process, i.e., the higher per capita income and the share of the population employed in the industrial sector, the greater will be intersectoral transactions”.

decline in the share of labor in value added and by the increase of the installed power per worker.

5. Results

To better understand the changes that took place in the economy, the results were aggregated¹⁰ into 10 sectors, as shown in Table 1, that encompass the whole economy, and into 7 industrial sectors, in order to analyze separately what happened with the Brazilian industry.

5.1. General Structural Change

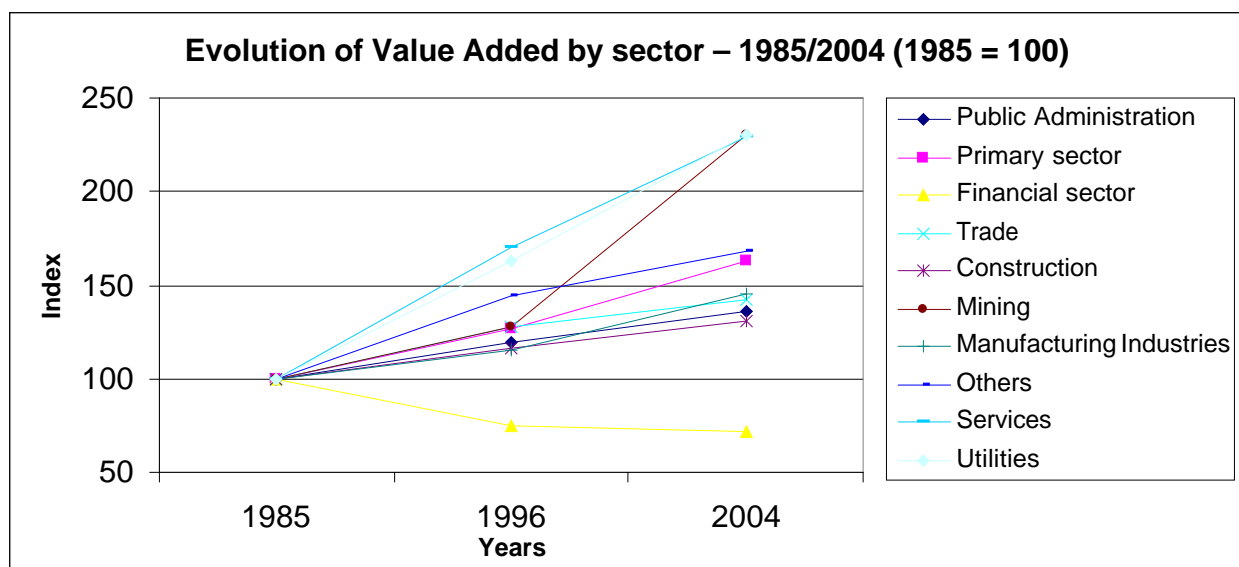
It is interesting to observe that, although the sectors performance was differentiated, there seems to be a low variation in the productive structure. In general, the services sectors (services to business sectors and to families, transports, communications and public utilities) has grown faster than manufacturing industries. The later, in fact, had a performance closer to the slowest sectors, such as construction and public administration (Figure 1). As can be seen in Table 2, there was practically no change in the hierarchy among the aggregated sectors in terms of its contribution to output, GDP and occupations. There was an increase in the share of service sectors, as expected, and a decrease in the financial sector, which is basically related to the reduction of inflation.

Table 1

	Total Output			Value Added			Employment		
	1985	1996	2004	1985	1996	2004	1985	1996	2004
Public Administration	237.120	287.585	340.286	166.459	198.307	226.849	5.382.832	5.366.700	6.609.748
Primary sector	154.000	196.272	268.939	83.972	106.623	137.138	17.114.951	13.905.800	13.584.399
Financial sector	154.449	121.262	142.965	117.412	88.257	84.790	1.075.195	749.500	805.980
Trade	155.926	203.761	227.468	83.600	107.158	118.679	5.889.394	8.744.300	11.494.331
Construction	170.419	198.479	203.009	88.925	103.178	116.298	3.530.366	3.523.000	3.913.879
Mining	39.309	48.476	75.748	27.001	34.600	62.092	356.399	232.900	338.705
Manufacturing Industries	855.558	1.030.449	1.241.914	266.167	307.019	387.505	8.153.945	7.994.200	9.211.490
Others	105.267	146.214	177.047	95.882	138.549	161.028	4.135.854	5.613.600	7.077.493
Services	194.446	317.377	415.332	95.809	162.877	219.940	7.797.949	13.402.500	17.395.101
Utilities	51.092	83.609	102.050	24.798	40.504	57.197	308.680	232.100	251.925

Font: For 1985 and 1986 input-output matrices by IBGE, for 2004, updated input-output matrix.

Figure 1



Elaborated with data from Table 1.

¹⁰ See Table 1

Table 2

	Total Output			Value Added			Employment		
	1985	1996	2004	1985	1996	2004	1985	1996	2004
Public Administration	11,2%	10,9%	10,7%	15,9%	15,4%	14,4%	10,0%	9,0%	9,4%
Primary sector	7,3%	7,5%	8,4%	8,0%	8,3%	8,7%	31,8%	23,3%	19,2%
Financial sector	7,3%	4,6%	4,5%	11,2%	6,9%	5,4%	2,0%	1,3%	1,1%
Trade	7,4%	7,7%	7,1%	8,0%	8,3%	7,6%	11,0%	14,6%	16,3%
Construction	8,0%	7,5%	6,4%	8,5%	8,0%	7,4%	6,6%	5,9%	5,5%
Mining	1,9%	1,8%	2,4%	2,6%	2,7%	4,0%	0,7%	0,4%	0,5%
Manufacturing Industries	40,4%	39,1%	38,9%	25,3%	23,9%	24,7%	15,2%	13,4%	13,0%
Others	5,0%	5,6%	5,5%	9,1%	10,8%	10,2%	7,7%	9,4%	10,0%
Services	9,2%	12,1%	13,0%	9,1%	12,7%	14,0%	14,5%	22,4%	24,6%
Utilities	2,4%	3,2%	3,2%	2,4%	3,1%	3,6%	0,6%	0,4%	0,4%

Font: For 1985 and 1986 input-output matrices by IBGE, for 2004, updated input-output matrix.

In the following tables and figures we took out some of the sectors that tend to distort the analysis: (i) public administration; (ii) financial sectors; and (iii) the rest – composed by rental and non-market private services. As pointed out above, the share of the bank system in the Brazilian economy was overestimated during the inflationary period, therefore, there was an expected fall in its participation. The other two were removed because they are basically imputed values. AS can be seen in the above table, these four sectors represent approximately 20% of output and GDP and one third of occupations.

Table 3

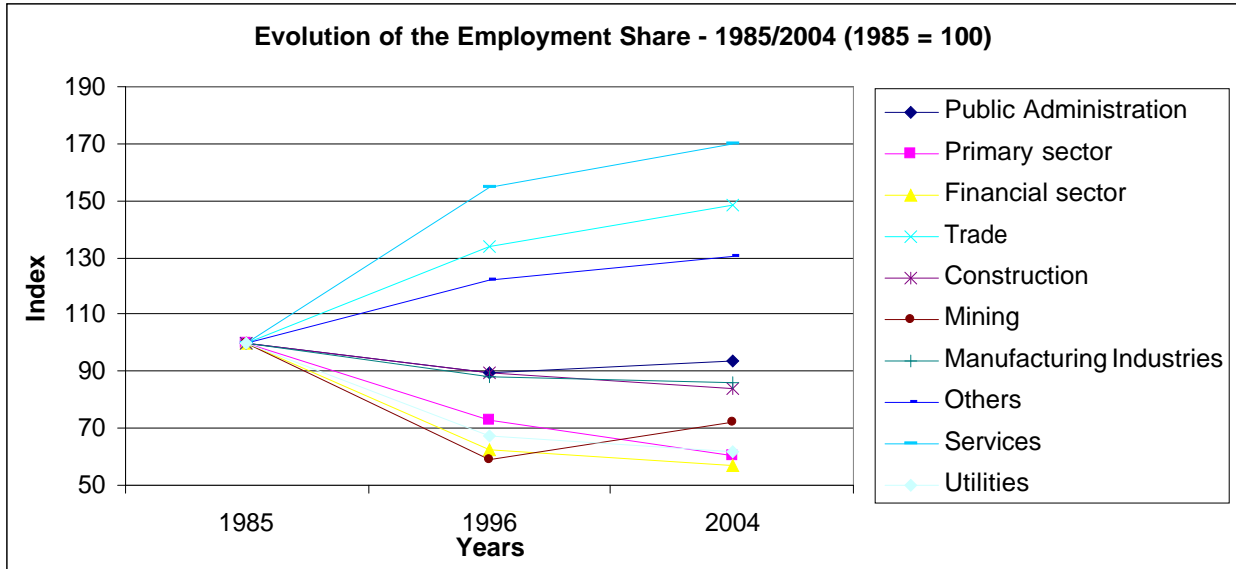
	Value Added			Employment			VA/Emp		
	1985	1996	2004	1985	1996	2004	1985	1996	2004
Primary sector	12,53%	12,37%	12,48%	39,66%	28,95%	24,18%	0,005	0,008	0,010
Trade	12,47%	12,43%	10,80%	13,65%	18,20%	20,46%	0,014	0,012	0,010
Construction	13,27%	11,97%	10,58%	8,18%	7,33%	6,97%	0,025	0,029	0,030
Mining	4,03%	4,01%	5,65%	0,83%	0,48%	0,60%	0,076	0,149	0,183
Manufacturing Industries	39,71%	35,62%	35,26%	18,90%	16,64%	16,39%	0,033	0,038	0,042
Services	14,29%	18,90%	20,02%	18,07%	27,90%	30,96%	0,012	0,012	0,013
Utilities	3,70%	4,70%	5,21%	0,72%	0,48%	0,45%	0,080	0,175	0,227

Font: For 1985 and 1986 input-output matrices by IBGE, for 2004, updated input-output matrix.

By removing those sectors, some of the tendencies already observed are emphasized. As can be seen in Table 3, the tendency of declining share of the primary sector was stopped and there is a relative stability of the share of “agriculture, hunting...” in terms of GDP, although there was a decline in terms of occupation, pointing to an automation process.. This is interesting since, in the study by Baer, Fonseca e. Guilhoto (1987), it was pointed out that the share of employment in this sector was still high in the previous period, in comparison to other countries with similar income per capita. Another important difference in relation to the previous period is the decline of the manufacturing industries, accompanied by construction and trade, compensated by an increase in the share of service sectors.

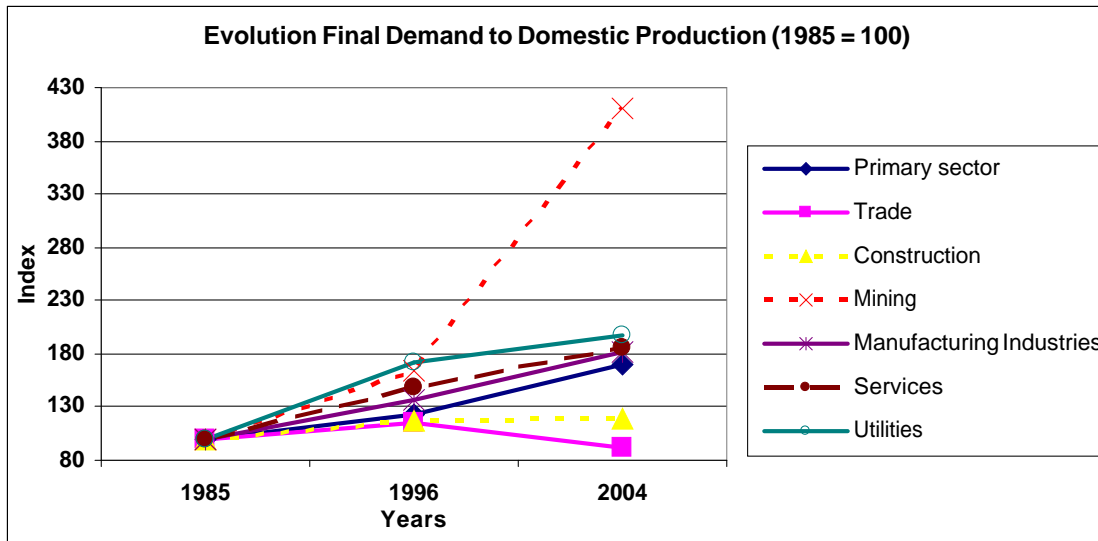
In terms of employment, as can be seen in Figure 2 there was a decrease in the share of most sectors, except trade and services. This could point out to some change in technology, or simply another measure of the contraction of most of the sectors. Indeed, there was an increase in the value added by employment in almost all sectors, especially utilities and the primary sector, except for trade. The combination of an increase in the share of employment in this last sector with a decline in its “productivity” is probably related to the fact that it is one of the sectors absorbing the labor force that is out of the market due to a low growth rate and decline in the share of employment by value added in all the other sectors.

Figure 2



Elaborated with data from Table 1.

Figure 3



5.2. Industrial Structure

There is a big debate about deindustrialization in Brazil. The results shown above seem to point out to a decrease in the share of manufacturing industries which seems to support this argument. The small tendency to decrease the share of the industrial sector is reinforced by its effect over investments. There is a feedback mechanism, since when the largest sector increases at a slow rate it will decrease the rate of capacity expansion and therefore the demand for capital goods, mainly industrial ones. In order to better evaluate what might have happened to the Brazilian industry during the last 20 years, it is important to analyze it at a more disaggregated level. The industrial sector was divided into 7 sub-sectors, as shown in Table 4. The objective of this section is not a complete examination of the Brazilian industry, but to highlight some features that can be captured by the data.

5.2.1. Productive Structure

As can be seen in Table 4, there was a great decrease in the share of traditional consumer goods in terms of value added, counterbalanced by the increase share in commodities and mechanical diffusers. The former sector, however, continues to be the main source of employment in the industrial sector, with almost 50% of the total. Therefore, there seems to be a concentration of employment in the less dynamic industrial sector.

Table 4

	Value Added			Employment			VA/Emp		
	1985	1996	2004	1985	1996	2004	1985	1996	2004
Primary Commodities	5.52%	5.83%	7.64%	4.34%	5.59%	5.24%	0.044	0.043	0.069
Industrial Commodities	19.95%	20.68%	22.93%	12.45%	10.93%	10.72%	0.055	0.079	0.101
Electric-Electronic Diffusers	3.29%	4.53%	3.13%	3.50%	3.09%	2.55%	0.032	0.061	0.058
Mechanical Diffusers	13.77%	14.02%	15.18%	10.45%	8.62%	11.01%	0.045	0.067	0.065
Oil (refined and extraction)	22.70%	22.75%	22.35%	1.53%	1.07%	1.45%	0.510	0.883	0.725
Traditional Consumer Goods	17.02%	14.07%	11.69%	46.48%	49.36%	47.13%	0.013	0.012	0.012
Traditional Input Goods	17.75%	18.12%	17.07%	21.24%	21.33%	21.89%	0.029	0.035	0.037

Another important remark in relation to the sectors value added is how it evolved along the years, as can be seen in Figure 4, the electric-electronic diffusers, the sector with one of the greatest increase in “productivity”, as can be seen in Figure 5, remained practically stagnated during 1996 – 2004, which seems at odds with international patterns.

Figure 4

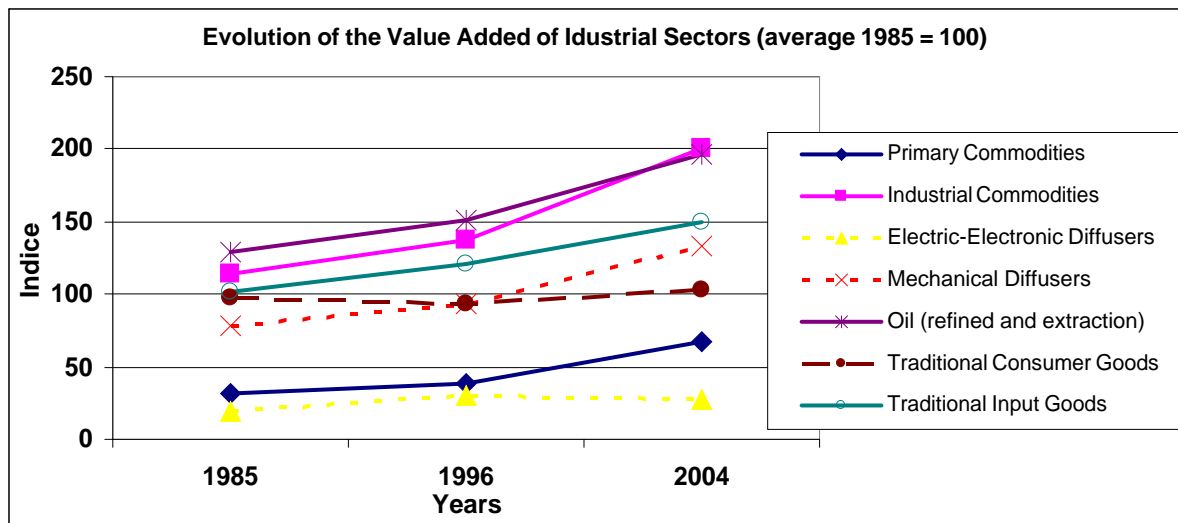
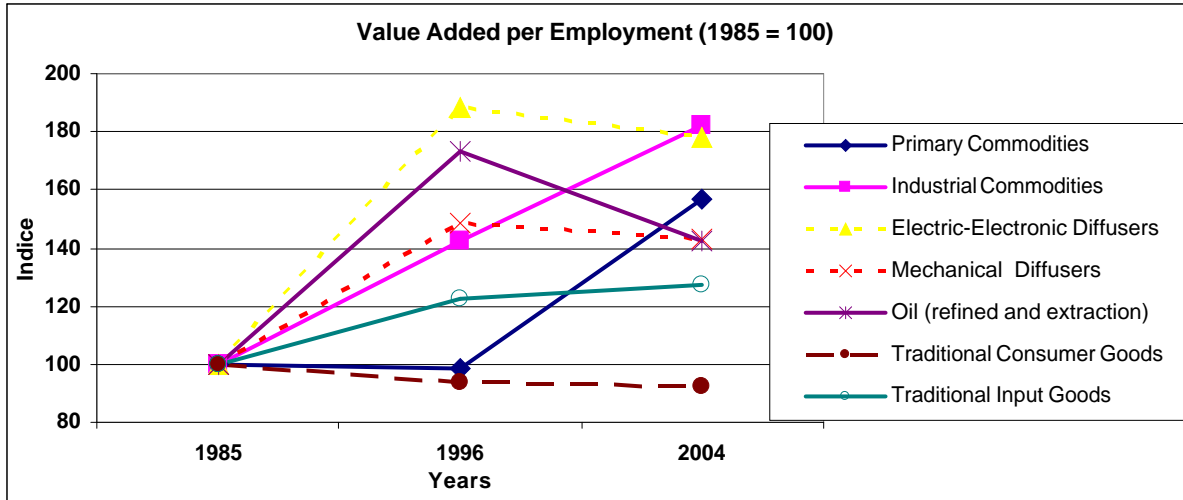


Figure 5



Elaborated with data from Table 1

5.2.2. Final Demand Structure

It is interesting to notice that there was actually a decline of final demand to the domestic production of the Electric-Electronic Diffusers (Figure 6), compensated by a large increase in imported final demand as can be seen in Figure 7. The low performance of Traditional Consumer Goods is probably also related to final demand, since it had the smallest accumulated rate of growth among all industrial sectors (Figure 6).

Figure 6

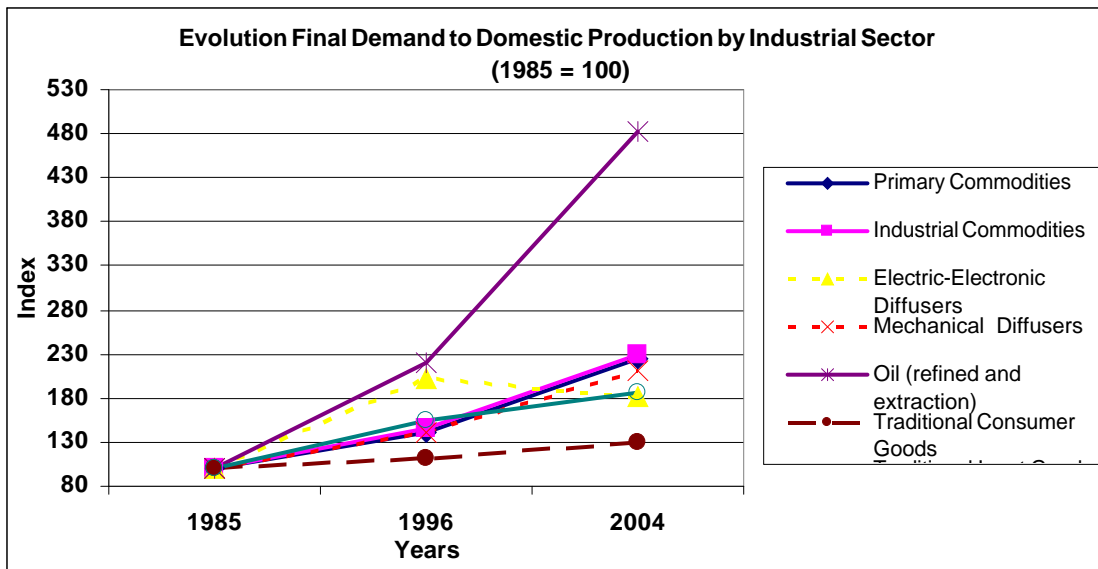


Figure 7

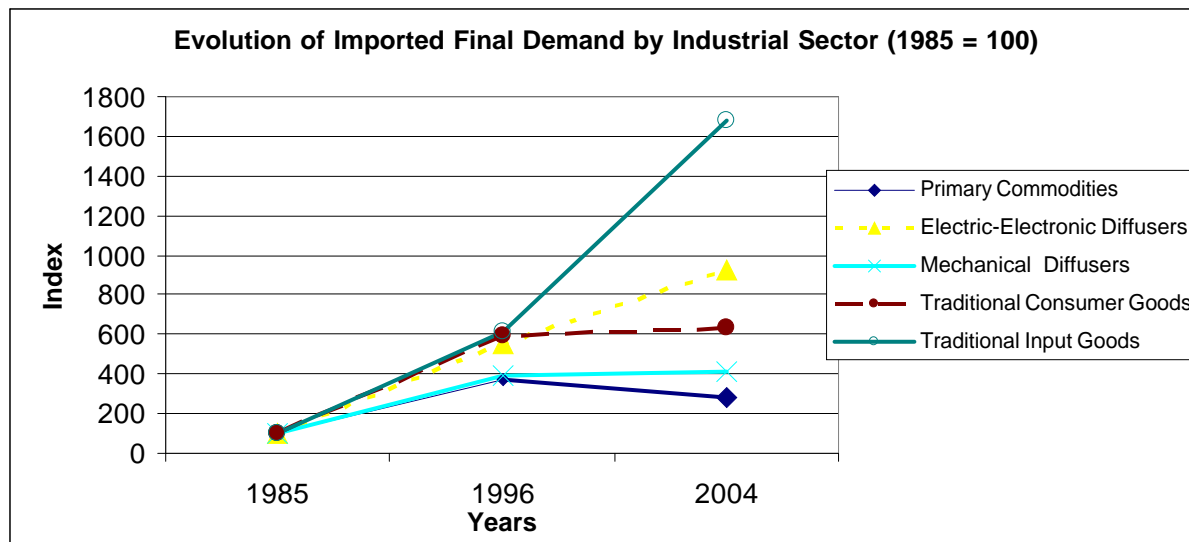


Table 5 – Personal Consumption Expenditures

	Share of Total			Share of Output		
	1985	1996	2004	1985	1996	2004
Primary Commodities	14,4%	15,6%	20,7%	34,1%	39,7%	36,0%
Industrial Commodities	6,5%	5,9%	4,3%	6,3%	7,1%	4,1%
Electric-Electronic Diffusers	5,9%	9,8%	6,8%	30,4%	47,8%	29,8%
Mechanical Diffusers	7,9%	11,6%	10,3%	12,6%	22,4%	13,1%
Oil (refined and extraction)	0,8%	2,6%	1,8%	1,0%	3,2%	1,6%
Traditional Consumer Goods	51,9%	41,5%	42,5%	48,4%	50,2%	43,8%
Traditional Input Goods	12,6%	13,0%	13,7%	13,7%	17,2%	15,3%

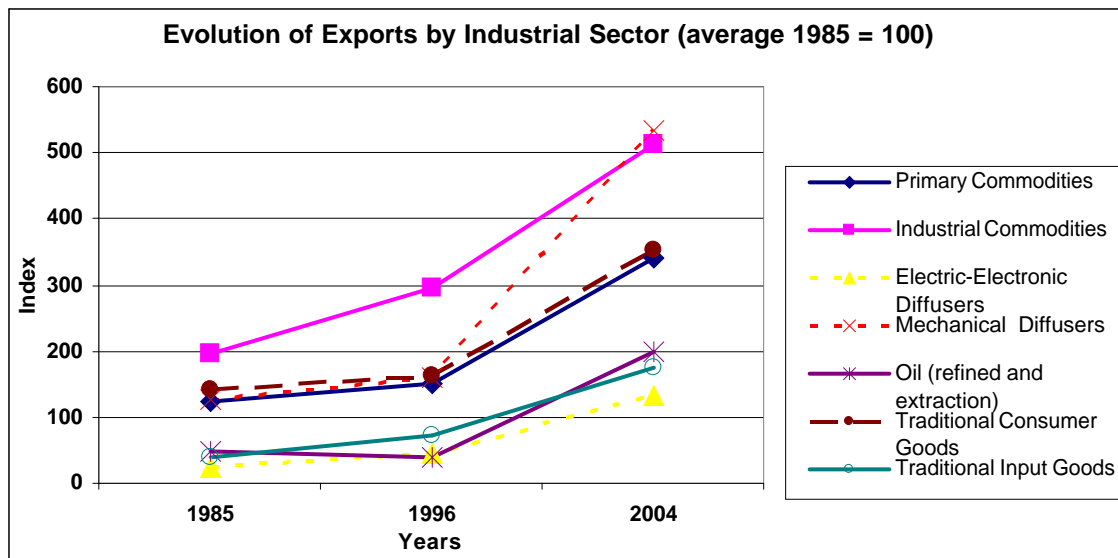
Table 6 – Exports

	Total Exports			Share of Total			Share of Output		
	1985	1996	2004	1985	1996	2004	1985	1996	2004
Primary Commodities	12.686	15.362	34.656	17,8%	16,3%	15,1%	17,3%	15,8%	25,5%
Industrial Commodities	20.147	30.194	52.473	28,2%	32,0%	22,9%	11,2%	14,5%	21,1%
Electric-Electronic Diffusers	2.451	4.540	13.591	3,4%	4,8%	5,9%	7,3%	8,9%	25,2%
Mechanical Diffusers	12.811	16.400	54.392	17,9%	17,4%	23,8%	11,8%	12,8%	29,4%
Oil (refined and extraction)	5.052	4.032	20.176	7,1%	4,3%	8,8%	3,3%	2,0%	8,0%
Traditional Consumer Goods	14.370	16.587	35.941	20,1%	17,6%	15,7%	7,7%	8,1%	15,7%
Traditional Input Goods	3.947	7.340	17.778	5,5%	7,8%	7,8%	2,5%	3,9%	8,4%

Table 7 – Imports

	Share over total final demand			imported technical coefficient		
	1985	1996	2004	1985	1996	2004
Primary Commodities	0,4%	1,1%	0,5%	1,5%	1,6%	1,1%
Industrial Commodities	0,9%	3,4%	-3,0%	4,2%	5,5%	7,1%
Electric-Electronic Diffusers	9,8%	22,9%	35,7%	6,2%	14,7%	15,1%
Mechanical Diffusers	7,0%	17,4%	12,9%	2,9%	7,0%	11,2%
Oil (refined and extraction)	-23,1%	11,0%	10,7%	23,8%	11,0%	10,6%
Traditional Consumer Goods	0,8%	4,0%	3,7%	1,9%	4,5%	4,9%
Traditional Input Goods	2,1%	7,7%	16,1%	4,2%	6,1%	9,3%

Figure 8



5.3. Key Sectors

There are many criteria to identify Key sectors and, as explained above, they usually are complementary. The analysis that follows, therefore, will be divided to cover some of these criteria. The first one is to identify sectors that have both, power of dispersion and sensibility of dispersion, above one. A similar idea is to identify sectors with the highest total pure industrial linkage indicators (sum of PBL and PFL described in section 2.2). Since this last indicator takes into account the level of production of the sector, their result usually differs. The idea of both indicators is to capture the sectors with the greatest impact, but frequently the sectors with high backward linkages are not the same with high forward linkages. For that reason, sectors that present either one of them high will also be considered in each of the methods applied. An important remark is that for this section we will deal with as many sectors as possible (the 42 presented in the Brazilian SNA).

5.3.1. Hirschman-Rasmussen

Table 8 - Sectors with both Indicators High at least in on of the periods

		PD		SD	
		1985	2004	1985	2004
05	Iron & steel	1,02	1,10	1,18	1,42
07	Fabricated metal products, except machinery & equipment	1,00	1,01	1,12	1,19
08	Machinery & equipment, nec	0,99	1,07	1,09	1,11
13	Other vehicles Railroad equipment & transport equip nec.	1,03	1,17	1,16	0,78
15	Pulp, paper, paper products, printing and publishing	0,96	1,01	1,07	1,18
18	refined petroleum petro-chemicals	0,82	1,10	1,34	3,35
22	Textiles	1,09	1,04	1,42	1,03
33	Industrial Services Utilities	1,05	0,82	1,06	1,63

Table 9 - Sectors with both Indicators low in both periods

		PD		SD	
		1985	2004	1985	2004
11	Electronic machinery & apparatus, nec	0,95	0,92	0,88	0,52
20	Pharmaceuticals	0,99	0,93	0,82	0,51
37	Post & telecommunications	0,84	0,82	0,86	0,95
43	Non-market private services	0,86	0,79	0,77	0,48

Backward Linkages

Table 10 - Sectors with high Power of Dispersion in both periods

		PD	
		1985	2004
30	Starch and Vegetable Fats and Oils Manufacturing	1,09	1,31
28	Dairy Product Manufacturing	1,22	1,28
12	Motor vehicles: cars, trucks and buses	1,19	1,27
24	Leather and footwear	1,07	1,22
25	Coffee	1,03	1,18
27	Animal Slaughtering and Processing	1,16	1,18
13	Other vehicles Railroad equipment & transport equip nec.	1,03	1,17
26	Vegetable Products (including tabaco)	1,06	1,17
31	Other Food and Beverage	1,12	1,16
05	Iron & steel	1,02	1,10
29	Sugar	1,01	1,09
32	Other Industries	1,02	1,06
22	Textiles	1,09	1,04
23	Textile products	1,17	1,02
14	Wood and products of wood and cork	1,06	1,01

Table 11 - Sectors with increasing Power of Dispersion

		PD	
		1985	2004
21	Plastic products	0,898	1,13
19	Chemicals excluding pharmaceuticals	0,869	1,12
18	refined petroleum petro-chemicals	0,824	1,10
08	Machinery & equipment, nec	0,990	1,07
10	Electrical machinery & apparatus, nec	0,990	1,07
17	chemical (non-oil)	0,947	1,04
04	Non-metallic mineral products	0,997	1,04
16	Rubber	0,950	1,02
15	Pulp, paper, paper products, printing and publishing	0,956	1,01
07	Fabricated metal products, except machinery & equipment	0,998	1,01
02	Mining and quarrying (non-energy)	0,873	1,01
03	Mining and quarrying (energy)	0,823	1,00

Table 12 - Sectors with decreasing Power of Dispersion

		PD	
		1985	2004
33	Industrial Services Utilities	1,05	0,82
34	Construction	1,12	0,86
39	Services to Families	1,14	0,84
41	Rental and leasing	1,04	0,53
42	Public administration	1,06	0,72

Forward Linkages

Table 13 - Sectors with high Sensibility of Dispersion in both periods

		SD	
		1985	2004
01	Agriculture, hunting, forestry and fishing	2,16	3,45
18	refined petroleum petro-chemicals	1,34	3,35
33	Industrial Services Utilities	1,06	1,63
35	Wholesale & retail trade	1,37	1,62
05	Iron & steel	1,18	1,42
40	Services to Business Sector	1,24	1,29
36	Transport	1,26	1,28
07	Fabricated metal products, except machinery & equipment	1,12	1,19
15	Pulp, paper, paper products, printing and publishing	1,07	1,18
08	Machinery & equipment, nec	1,09	1,11
22	Textiles	1,42	1,03

Table 14 - Sectors with increasing Sensibility of Dispersion

		SD	
		1985	2004
3	Mining and quarrying (energy)	0,82	1,26
19	Chemicals excluding pharmaceuticals	0,99	1,27
38	Finance & insurance	0,91	2,00

Table 15 – Sectors with decreasing Sensibility of Dispersion

		SD	
		1985	2004
13	Other vehicles Railroad equipment & transport equip nec.	1,16	0,78
6	Non-ferrous metals	1,04	0,87

5.3.2. Pure Indices of Industrial Linkages

Table 16 – PTL – sectors among the 10 highest in 1985 or 2004

		1985		2004	
		Index	Order	Index	Order
18	Refined petroleum petro-chemicals	202.041	3	359.023	1
02	Mining and quarrying (non-energy)	195.596	4	353.405	2
05	Iron & steel	188.615	5	320.257	3
04	Non-metallic mineral products	69.864	14	204.804	4
01	Agriculture, hunting, forestry and fishing	225.927	2	181.842	5
25	Coffee	133.476	7	180.852	6
30	Starch and Vegetable Fats and Oils Manufacturing	229.674	1	160.974	7
28	Dairy Product Manufacturing	134.191	6	159.306	8
27	Animal Slaughtering and Processing	123.659	8	152.514	9
12	Motor vehicles: cars, trucks and buses	84.774	11	149.706	10
36	Transport	105.835	9	140.827	11
19	Chemicals excluding pharmaceuticals	98.927	10	133.429	12

Table 17 – PTL – sectors among the 10 lowest in 1985 or 2004

		1985		2004	
		Index	Order	Index	Order
26	Vegetable Products (including tabaco)	24.009	35	84.414	22
08	Machinery & equipment, nec	25.875	33	41.410	31
34	Construction	33.761	31	38.119	33
38	Wholesale & retail trade	19.765	37	35.738	34
16	Finance & insurance	24.821	34	34.493	35
11	Electronic machinery & apparatus, nec	33.948	30	32.238	36
32	Textile products	13.273	39	23.800	37
21	Other Industries	11.905	40	20.176	38
42	Public administration	23.727	36	19.918	39
06	Machinery & equipment, nec	6.019	41	16.900	40
43	Non-ferrous metals	17.753	38	13.486	41
24	Leather and footwear	4.801	42	3.046	42

Backward Linkages

Table 18 – PBL – sectors among the 10 highest in 1985 or 2004

		1985		2004	
		Index	Order	Index	Order
05	Iron & steel	72.333	4	179.350	1
01	Agriculture, hunting, forestry and fishing	220.572	1	163.519	2
02	Mining and quarrying (non-energy)	61.767	6	149.142	3
30	Starch and Vegetable Fats and Oils Manufacturing	198.128	2	141.457	4
27	Animal Slaughtering and Processing	69.989	5	117.737	5
33	Industrial Services Utilities	56.626	8	99.415	6
25	Coffee	35.826	16	97.931	7
18	Refined petroleum petro-chemicals	80.774	3	93.739	8
07	Fabricated metal products, except machinery & equipment	37.918	14	88.759	9
31	Other Food and Beverage	41.332	11	75.329	10
36	Transport	43.437	10	70.127	11
03	Mining and quarrying (energy)	46.771	9	59.398	15
23	Textile products	57.186	7	14.756	39

Table 19 – PBL – sectors among the 10 lowest in 1985 or 2004

		1985		2004	
		Index	Order	Index	Order
28	Dairy Product Manufacturing	7.937	37	38.835	19
26	Vegetable Products (including tabaco)	2.764	42	27.647	26
14	Wood and products of wood and cork	10.955	33	22.270	29
32	Other Industries	10.488	34	21.362	30
40	Services to Business Sector	10.078	35	19.625	33
42	Public administration	20.653	24	19.281	34
11	Electronic machinery & apparatus, nec	9.166	36	17.878	35
21	Plastic products	6.248	39	16.397	36
06	Non-ferrous metals	3.287	41	16.309	37
12	Motor vehicles: cars, trucks and buses	11.817	32	15.439	38
23	Textile products	57.186	7	14.756	39
16	Rubber	7.455	38	14.415	40
43	Non-market private services	16.195	27	12.301	41
24	Leather and footwear	4.801	40	3.046	42

Forward Linkages

Table 20 - PFL – sectors among the 10 highest in 1985 or 2004

		1985		2004	
		Index	Order	Index	Order
18	Refined petroleum petro-chemicals	121.267	3	265.284	1
02	Mining and quarrying (non-energy)	133.829	1	204.263	2
04	Non-metallic mineral products	33.940	15	171.733	3
05	Iron & steel	116.283	4	140.906	4
12	Motor vehicles: cars, trucks and buses	72.957	6	134.267	5
28	Dairy Product Manufacturing	126.254	2	120.471	6
29	Sugar	33.170	16	96.718	7
25	Coffee	97.650	5	82.921	8
36	Transport	62.398	7	70.700	9
19	Chemicals excluding pharmaceuticals	57.972	8	69.470	10
13	Other vehicles Railroad equipment & transport equip nec.	48.373	10	67.914	11
27	Animal Slaughtering and Processing	53.669	9	34.778	16

Table 21 - PFL – sectors among the 10 lowest in 1985 or 2004

		1985		2004	
		Index	Order	Index	Order
23	Textile products	6.105	33	33.955	17
01	Agriculture, hunting, forestry and fishing	5.354	36	18.323	29
34	Construction	13.132	28	11.253	33
07	Fabricated metal products, except machinery & equipment	5.713	34	8.278	34
38	Finance & insurance	6.894	32	4.050	35
21	Plastic products	5.657	35	3.778	36
03	Mining and quarrying (energy)	3.025	38	3.532	37
32	Other Industries	2.785	39	2.438	38
43	Non-market private services	1.559	41	1.185	39
42	Public administration	3.074	37	637	40
06	Non-ferrous metals	2.732	40	592	41
24	Leather and footwear	0	42	0	42

6. Final Comments and Further Analysis

Comparing to the period previous to 1985 the structural changes captured by our work were of a different nature. While the previous period was marked by diversification of the industrial sector and an increase in the links in the economy, in the later period this process seems to have come to a stop. The major changes are related to the impact of the openness process on the productive structure of the Brazilian economy with sectors gaining and losing in this process. The industrial sector became more dependable on imported inputs for its production process, with a reduction in its level of employment. The developments in the agricultural sector continued the process started at the previous period, losing its share mainly in terms of its capacity of generate employment, which was pretty much reduced by a modernization process. The workers freed or not absorbed by the other sectors were absorbed by the service sector.

Input-output economics has virtually disappeared from the pages of leading mainstream economic journals since the late 1980s. Some of the reasons are related to the change in mainstream theory, the almost abandoning of the idea of planning development process, as when it was initially thought, but there are also some problems with its use of two major types: data problems and analytical issues.

Some of the major criticism to a dynamic Input-Output analysis is the level of aggregation of the data. In general, the levels are not sufficient to give a precise idea of what is comprised inside each one of them; therefore, there might be some changes related to either a process technological change or a different product. But if we think in terms of industrial policy, as it was the basic idea, the main task is to identify key sectors, independently if their composition has changed.

If in terms of industrial policy the composition of the sector is not a major drawback for a dynamic analysis, there is one important limitation to this comparative dynamics: input-output tables are not published every year; usually, they are published every-five years. Therefore, the data is very much influenced by the events that happened at the specific year and it is not simple to separate what is particular of the year or what is in fact a trend.

Besides that, the data available are also limited which restricts the structural change analysis. As was pointed out by Hewings et al. (1989), the structural changes are not concentrated in the production sectors alone, changes in the patterns of consumption and the distribution of income are of equal importance. The input-output framework has been extended to accommodate some of these concerns. For example, social accounting structure (SAM) which provides for a more complex set of interrelationships, involving production, institution and factor accounts

There are two basic lines in which we pretend to continue this work. The first one is to evaluate how is the newer structure of Brazil's industrial economy in comparison to international benchmarks based on cross-section studies. The other is to develop the social accounting matrix for Brazil.

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7. Appendix

Table 22 - Deflators

Code	Activities	R\$ 2003/Cr\$ 1985			R\$ 2003/ R\$ 1996			R\$ 2003/ R\$ 2004		
		Output	FD	VA	Output	FD	VA	Output	FD	VA
01	Agriculture, hunting, forestry and fishing	0.00074	0.00072	0.00065	2.04	2.02	1.84	0.93	0.90	0.96
02	Mining and quarrying (non-energy)	0.00071	0.00059	0.00047	2.58	2.72	2.86	0.88	0.94	0.80
03	Mining and quarrying (energy)	0.00080	0.00084	0.00101	4.89	4.89	6.76	0.83	0.84	0.84
04	Non-metallic mineral products	0.00085	0.00058	0.00077	2.25	1.80	1.93	1.01	0.95	1.01
05	Iron & steel	0.00078	0.00068	0.00103	2.79	2.62	3.44	0.76	0.74	0.57
06	Non-ferrous metals	0.00068	0.00074	0.00051	2.23	2.64	2.04	1.03	0.85	1.01
07	Fabricated metal products, except machinery & equipment	0.00073	0.00061	0.00055	2.15	2.08	1.60	0.90	0.86	0.95
08	Machinery & equipment, nec	0.00073	0.00078	0.00086	2.27	2.39	2.32	0.95	0.93	1.05
10	Electrical machinery & apparatus, nec	0.00053	0.00052	0.00026	1.70	1.97	0.98	0.93	0.93	0.93
11	Electronic machinery & apparatus, nec	0.00053	0.00054	0.00045	1.75	1.94	1.75	0.90	0.96	0.88
12	Motor vehicles: cars, trucks and buses	0.00078	0.00068	0.00077	1.79	1.80	1.20	0.97	0.95	0.66
13	Other vehicles Railroad equipment & transport equip nec.	0.00062	0.00076	0.00038	1.78	2.42	1.31	0.86	0.92	0.93
14	Wood and products of wood and cork	0.00080	0.00082	0.00062	1.93	2.00	1.58	0.89	0.90	0.96
15	Pulp, paper, paper products, printing and publishing	0.00075	0.00071	0.00065	2.34	2.64	2.68	0.93	0.97	0.92
16	Rubber	0.00070	0.00050	0.00069	2.28	2.02	2.28	0.87	0.90	0.88
17	chemical (non-oil)	0.00096	0.00045	0.00126	2.50	1.83	2.85	0.89	1.06	1.02
18	refined petroleum petro-chemicals	0.00092	0.00025	0.00176	3.55	2.45	3.27	0.90	0.94	1.10
19	Chemicals excluding pharmaceuticals	0.00094	0.00047	0.00081	2.59	2.58	2.62	0.81	0.92	0.68
20	Pharmaceuticals	0.00068	0.00071	0.00057	2.01	1.99	1.44	0.94	0.93	0.90
21	Plastic products	0.00086	0.00044	0.00076	2.27	1.99	1.77	0.89	0.89	0.89
22	Textiles	0.00057	0.00056	0.00032	1.78	1.76	1.15	0.96	0.95	0.93
23	Textile products	0.00054	0.00064	0.00069	1.47	1.55	1.98	0.88	0.90	0.88
24	Leather and footwear	0.00082	0.00089	0.00078	2.31	2.27	2.32	0.91	0.91	0.95
25	Coffee	0.00030	0.00026	0.00058	1.40	1.40	1.86	0.95	0.90	1.15
26	Vegetable Products (including tabaco)	0.00079	0.00060	0.00050	2.12	1.85	1.51	0.97	0.91	0.98
27	Animal Slaughtering and Processing	0.00079	0.00071	0.00097	2.14	1.95	1.68	0.92	0.90	0.88
28	Dairy Product Manufacturing	0.00068	0.00066	0.00063	1.68	1.68	1.17	0.89	0.91	1.04
29	Sugar	0.00072	0.00051	0.00132	2.66	2.16	4.77	0.99	1.01	0.88
30	Starch and Vegetable Fats and Oils Manufacturing	0.00089	0.00071	0.00081	2.31	2.27	2.59	0.81	0.86	0.27
31	Other Food and Beverage	0.00085	0.00073	0.00071	1.99	1.88	1.29	0.93	0.94	0.87
32	Other Industries	0.00070	0.00076	0.00063	2.00	1.79	1.83	0.94	0.95	0.89
33	Industrial Services Utilities	0.00100	0.00113	0.00101	2.47	2.29	2.12	0.89	0.86	0.84
34	Construction	0.00094	0.00096	0.00121	1.79	1.79	1.56	0.90	0.89	0.87
35	Wholesale & retail trade	0.00074	0.00117	0.00060	2.16	2.97	1.98	0.93	0.96	0.91
36	Transport	0.00060	0.00065	0.00044	2.14	2.07	1.52	0.94	0.94	0.93
37	Post & telecommunications	0.00057	0.00062	0.00047	2.28	2.38	1.82	0.88	0.89	0.88
38	Finance & insurance	0.00076	0.00125	0.00069	1.77	1.87	1.84	1.02	1.08	1.12
39	Services to Families	0.00069	0.00082	0.00080	1.36	1.43	1.19	0.94	0.93	0.94
40	Services to Business Sector	0.00055	0.00071	0.00048	1.72	2.59	1.59	0.93	0.95	0.93
41	Rental and leasing	0.00171	0.00187	0.00191	1.29	1.25	1.28	0.97	0.98	0.97
42	Public administration	0.00127	0.00129	0.00134	1.83	1.89	1.79	0.92	0.92	0.94
43	Non-market private services	0.00120	0.00120	0.00098	1.78	1.78	1.76	0.92	0.91	0.93

Table 23 - Classification

Code	Sectors SNA	Aggregated Sectors	Disaggregated Industry
01	Agriculture, hunting, forestry and fishing	Primary Sector	Primary Sector
02	Mining and quarrying (non-energy)	Mining	Industrial Commodities
03	Mining and quarrying (energy)		Oil (Refined and Extraction)
04	Non-metallic mineral products	Manufacturing Industries	Traditional Inputs
05	Iron & steel		Industrial Commodities
06	Non-ferrous metals		Traditional Inputs
07	Fabricated metal products, except machinery & equipment		Mechanical Diffusers
08	Machinery & equipment, nec		Electric-Electronic Diffusers
10	Electrical machinery & apparatus, nec		Mechanical Diffusers
11	Electronic machinery & apparatus, nec		
12	Motor vehicles: cars, trucks and buses		Traditional Consumer Goods
13	Other vehicles Railroad equipment & transport equip nec.		Industrial Commodities
14	Wood and products of wood and cork		Traditional Inputs
15	Pulp, paper, paper products, printing and publishing		
16	Rubber		Traditional Consumer Goods
17	chemical (non-oil)		
18	refined petroleum petro-chemicals		Primary Commodities
19	Chemicals excluding pharmaceuticals		
20	Pharmaceuticals		Traditional Consumer Goods
21	Plastic products		
22	Textiles		Traditional Consumer Goods
23	Textile products		
24	Leather and footwear		Traditional Consumer Goods
25	Coffee		
26	Vegetable Products (including tabaco)		Primary Commodities
27	Animal Slaughtering and Processing		
28	Dairy Product Manufacturing		Traditional Consumer Goods
29	Sugar		
30	Starch and Vegetable Fats and Oils Manufacturing	Traditional Consumer Goods	
31	Other Food and Beverage		
32	Other Industries	Traditional Inputs	
33	Industrial Services Utilities	Utilities	Industrial Services
34	Construction	Construction	
35	Wholesale & retail trade	Trade	Trade
36	Transport	Services	Services
37	Post & telecommunications		
38	Finance & insurance	Financial Sector	Financial Sector
39	Services to Families	Services	Services
40	Services to Business Sector		
41	Rental and leasing	Others	Others
42	Public administration	Public Administration	Public Administration
43	Non-market private services	Others	Others

Table 24 – Import Coefficients and Leakages

		Import Coefficient		Backward Leakage		Forward Leakage	
		1985	2004	1985	2004	1985	2004
01	Agriculture, hunting, forestry and fishing	0,002	0,020	0,04	0,08	0,15	0,21
02	Mining and quarrying (non-energy)	0,026	0,034	0,07	0,09	0,04	0,06
03	Mining and quarrying (energy)	0,031	0,012	0,05	0,03	0,39	0,28
04	Non-metallic mineral products	0,011	0,030	0,09	0,10	0,02	0,07
05	Iron & steel	0,051	0,078	0,15	0,16	0,10	0,23
06	Non-ferrous metals	0,059	0,158	0,12	0,26	0,09	0,24
07	Fabricated metal products, except machinery & equipment	0,012	0,032	0,08	0,13	0,06	0,19
08	Machinery & equipment, nec	0,022	0,042	0,07	0,09	0,12	0,16
10	Electrical machinery & apparatus, nec	0,034	0,082	0,08	0,17	0,06	0,11
11	Electronic machinery & apparatus, nec	0,080	0,251	0,12	0,30	0,10	0,26
12	Motor vehicles: cars, trucks and buses	0,041	0,260	0,13	0,35	0,00	0,01
13	Other vehicles Railroad equipment & transport equip nec.	0,036	0,086	0,09	0,19	0,10	0,37
14	Wood and products of wood and cork	0,011	0,025	0,07	0,09	0,01	0,02
15	Pulp, paper, paper products, printing and publishing	0,015	0,042	0,06	0,11	0,05	0,11
16	Rubber	0,045	0,097	0,14	0,20	0,04	0,11
17	chemical (non-oil)	0,050	0,040	0,11	0,09	0,10	0,19
18	refined petroleum petro-chemicals	0,317	0,132	0,43	0,19	0,22	0,68
19	Chemicals excluding pharmaceuticals	0,102	0,188	0,21	0,27	0,10	0,25
20	Pharmaceuticals	0,049	0,148	0,10	0,21	0,04	0,10
21	Plastic products	0,013	0,086	0,18	0,19	0,02	0,07
22	Textiles	0,009	0,091	0,06	0,19	0,03	0,18
23	Textile products	0,002	0,039	0,04	0,14	0,00	0,01
24	Leather and footwear	0,031	0,060	0,10	0,14	0,03	0,04
25	Coffee	0,000	0,006	0,02	0,06	0,00	0,00
26	Vegetable Products (including tabaco)	0,037	0,054	0,08	0,13	0,01	0,01
27	Animal Slaughtering and Processing	0,009	0,008	0,06	0,08	0,01	0,01
28	Dairy Product Manufacturing	0,004	0,013	0,05	0,09	0,00	0,00
29	Sugar	0,008	0,015	0,05	0,07	0,01	0,01
30	Starch and Vegetable Fats and Oils Manufacturing	0,032	0,015	0,10	0,09	0,02	0,04
31	Other Food and Beverage	0,026	0,043	0,09	0,12	0,02	0,03
32	Other Industries	0,037	0,062	0,08	0,12	0,03	0,05
33	Idustrial Services Utilities	0,010	0,039	0,05	0,07	0,03	0,18
34	Construction	0,011	0,025	0,07	0,07	0,01	0,01
35	Wholesale & retail trade	0,004	0,022	0,05	0,08	0,13	0,18
36	Transport	0,061	0,054	0,13	0,14	0,11	0,10
37	Post & telecommunications	0,013	0,036	0,02	0,06	0,01	0,07
38	Finance & insurance	0,005	0,024	0,01	0,04	0,02	0,22
39	Services to Families	0,009	0,026	0,04	0,07	0,02	0,03
40	Services to Business Sector	0,003	0,022	0,01	0,05	0,14	0,27
41	Rental and leasing	0,001	0,001	0,02	0,00	0,00	0,02
42	Public administration	0,016	0,038	0,04	0,06	0,01	0,04
43	Non-market private services	0,002	0,003	0,01	0,01	0,00	0,00
Simple Mean		0,03	0,06	0,08	0,12	0,06	0,13

Table 25 - Hirschman-Rasmussen

		Power of Dispersion				Sensibility of Dispersion			
		1985		2004		1985		2004	
01	Agriculture, hunting, forestry and fishing	0,93	32	0,91	31	2,16	1	3,45	1
02	Mining and quarrying (non-energy)	0,87	36	1,01	26	0,90	22	0,65	29
03	Mining and quarrying (energy)	0,82	42	1,00	27	0,82	37	1,26	10
04	Non-metallic mineral products	1,00	23	1,04	20	0,97	17	0,83	19
05	Iron & steel	1,02	19	1,10	13	1,18	7	1,42	6
06	Non-ferrous metals	1,00	22	0,98	28	1,04	13	0,87	18
07	Fabricated metal products, except machinery & equipment	1,00	21	1,01	24	1,12	9	1,19	11
08	Machinery & equipment, nec	0,99	24	1,07	15	1,09	10	1,11	13
10	Electrical machinery & apparatus, nec	0,99	25	1,07	16	0,94	19	0,65	27
11	Electronic machinery & apparatus, nec	0,95	30	0,92	30	0,88	27	0,52	39
12	Motor vehicles: cars, trucks and buses	1,19	2	1,27	3	0,79	40	0,51	40
13	Other vehicles Railroad equipment & transport equip nec.	1,03	17	1,17	7	1,16	8	0,78	21
14	Wood and products of wood and cork	1,06	11	1,01	25	0,89	24	0,62	33
15	Pulp, paper, paper products, printing and publishing	0,96	27	1,01	23	1,07	11	1,18	12
16	Rubber	0,95	28	1,02	21	0,97	18	0,88	17
17	chemical (non-oil)	0,95	29	1,04	19	0,87	29	0,91	16
18	refined petroleum petro-chemicals	0,82	41	1,10	12	1,34	4	3,35	2
19	Chemicals excluding pharmaceuticals	0,87	37	1,12	11	0,99	15	1,27	9
20	Pharmaceuticals	0,99	26	0,93	29	0,82	36	0,51	41
21	Plastic products	0,90	35	1,13	10	0,91	20	0,75	22
22	Textiles	1,09	8	1,04	18	1,42	2	1,03	14
23	Textile products	1,17	3	1,02	22	0,78	41	0,63	30
24	Leather and footwear	1,07	10	1,22	4	0,86	33	0,54	38
25	Coffee	1,03	16	1,18	5	0,89	25	0,59	37
26	Vegetable Products (including tabaco)	1,06	12	1,17	8	0,86	31	0,65	26
27	Animal Slaughtering and Processing	1,16	4	1,18	6	0,86	32	0,62	32
28	Dairy Product Manufacturing	1,22	1	1,28	2	0,90	23	0,62	34
29	Sugar	1,01	20	1,09	14	0,87	30	0,70	24
30	Starch and Vegetable Fats and Oils Manufacturi	1,09	9	1,31	1	0,88	26	0,79	20
31	Other Food and Beverage	1,12	7	1,16	9	0,86	35	0,72	23
32	Other Industries	1,02	18	1,06	17	0,87	28	0,65	28
33	Industrial Services Utilities	1,05	14	0,82	36	1,06	12	1,63	4
34	Construction	1,12	6	0,86	32	1,00	14	0,60	36
35	Wholesale & retail trade	0,91	33	0,71	41	1,37	3	1,62	5
36	Transport	0,94	31	0,86	33	1,26	5	1,28	8
37	Post & telecommunications	0,84	39	0,82	35	0,86	34	0,95	15
38	Finance & insurance	0,91	34	0,75	39	0,91	21	2,00	3
39	Services to Families	1,14	5	0,84	34	0,98	16	0,61	35
40	Services to Business Sector	0,84	40	0,78	38	1,24	6	1,29	7
41	Rental and leasing	1,04	15	0,53	42	0,80	39	0,69	25
42	Public administration	1,06	13	0,72	40	0,80	38	0,62	31
43	Non-market private services	0,86	38	0,79	37	0,77	42	0,48	42

Table 26 - Pure Indices of Industrial Linkages

	PBL				PFL				PTL				
	1985		2004		1985		2004		1985		2004		
01	Agriculture, hunting, forestry and fishing	220.572	1	163.519	2	5.354	36	18.323	29	225.927	2	181.842	5
02	Mining and quarrying (non-energy)	61.767	6	149.142	3	133.829	1	204.263	2	195.596	4	353.405	2
03	Mining and quarrying (energy)	46.771	9	59.398	15	3.025	38	3.532	37	49.796	23	62.930	24
04	Non-metallic mineral products	35.923	15	33.071	21	33.940	15	171.733	3	69.864	14	204.804	4
05	Iron & steel	72.333	4	179.350	1	116.283	4	140.906	4	188.615	5	320.257	3
06	Non-ferrous metals	3.287	41	16.309	37	2.732	40	592	41	6.019	41	16.900	40
07	Fabricated metal products, except machinery & equipment	37.918	14	88.759	9	5.713	34	8.278	34	43.631	25	97.037	18
08	Machinery & equipment, nec	12.133	30	21.044	31	13.742	27	20.366	24	25.875	33	41.410	31
10	Electrical machinery & apparatus, nec	34.640	18	52.929	16	8.910	31	17.641	30	43.549	26	70.570	23
11	Electronic machinery & apparatus, nec	9.166	36	17.878	35	24.782	22	14.360	32	33.948	30	32.238	36
12	Motor vehicles: cars, trucks and buses	11.817	32	15.439	38	72.957	6	134.267	5	84.774	11	149.706	10
13	Other vehicles Railroad equipment & transport equip nec.	30.857	19	61.134	14	48.373	10	67.914	11	79.231	12	129.048	13
14	Wood and products of wood and cork	10.955	33	22.270	29	25.713	21	22.185	22	36.668	29	44.455	30
15	Pulp, paper, paper products, printing and publishing	21.019	23	41.406	18	44.908	11	57.864	13	65.927	17	99.271	17
16	Rubber	7.455	38	14.415	40	17.366	26	20.079	25	24.821	34	34.493	35
17	chemical (non-oil)	41.009	12	32.698	22	28.637	20	52.348	15	69.645	15	85.047	21
18	refined petroleum petro-chemicals	80.774	3	93.739	8	121.267	3	265.284	1	202.041	3	359.023	1
19	Chemicals excluding pharmaceuticals	40.955	13	63.959	12	57.972	8	69.470	10	98.927	10	133.429	12
20	Pharmaceuticals	11.979	31	37.844	20	28.813	19	16.289	31	40.792	27	54.133	26
21	Plastic products	6.248	39	16.397	36	5.657	35	3.778	36	11.905	40	20.176	38
22	Textiles	23.155	22	61.406	13	41.088	12	23.973	21	64.243	18	85.379	20
23	Textile products	57.186	7	14.756	39	6.105	33	33.955	17	63.291	19	48.711	28
24	Leather and footwear	4.801	40	3.046	42	0	42	0	42	4.801	42	3.046	42
25	Coffee	35.826	16	97.931	7	97.650	5	82.921	8	133.476	7	180.852	6
26	Vegetable Products (including tabaco)	2.764	42	27.647	26	21.245	24	56.767	14	24.009	35	84.414	22
27	Animal Slaughtering and Processing	69.989	5	117.737	5	53.669	9	34.778	16	123.659	8	152.514	9
28	Dairy Product Manufacturing	7.937	37	38.835	19	126.254	2	120.471	6	134.191	6	159.306	8
29	Sugar	24.414	21	26.311	28	33.170	16	96.718	7	57.583	21	123.029	15
30	Starch and Vegetable Fats and Oils M	198.128	2	141.457	4	31.547	17	19.517	27	229.674	1	160.974	7
31	Other Food and Beverage	41.332	11	75.329	10	12.076	30	19.642	26	53.408	22	94.971	19
32	Other Industries	10.488	34	21.362	30	2.785	39	2.438	38	13.273	39	23.800	37
33	Industrial Services Utilities	56.626	8	99.415	6	12.947	29	25.510	19	69.572	16	124.925	14
34	Construction	20.628	25	26.867	27	13.132	28	11.253	33	33.761	31	38.119	33
35	Wholesale & retail trade	26.705	20	27.940	25	35.395	14	33.574	18	62.100	20	61.514	25
36	Transport	43.437	10	70.127	11	62.398	7	70.700	9	105.835	9	140.827	11
37	Post & telecommunications	35.487	17	47.335	17	37.033	13	67.557	12	72.520	13	114.892	16
38	Finance & insurance	12.871	29	31.688	23	6.894	32	4.050	35	19.765	37	35.738	34
39	Services to Families	18.921	26	19.960	32	20.719	25	25.195	20	39.640	28	45.155	29
40	Services to Business Sector	10.078	35	19.625	33	23.131	23	20.987	23	33.209	32	40.612	32
41	Rental and leasing	13.650	28	30.185	24	30.277	18	19.217	28	43.927	24	49.402	27
42	Public administration	20.653	24	19.281	34	3.074	37	637	40	23.727	36	19.918	39
43	Non-market private services	16.195	27	12.301	41	1.559	41	1.185	39	17.753	38	13.486	41