DEPARTAMENTO DE ECONOMIA
PUC/RJ

TEXTO PARA DISCUSSÃO
Nº 258

GROWTH AND PRODUCTIVITY IN BRAZILIAN INDUSTRIES: IMPACTS OF TRADE ORIENTATION

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JUNHO 1991

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Abstract: The text explores the relationship between total factor productivity (TFP) change, production expansion and variables related to trade orientation. The results indicate that TFP change is positively associated with output growth, the relationship being stronger for the slow-growth period 1980-85 than for the high-growth quinquennium 1975-80. In the former period TFP change accounts for nearly all of output change. A multisectoral demand-side decomposition model implemented using end-point data for 1975-85 highlights the role of trade-related variables in accounting for a sizeable proportion of output change. An additional preliminary result is the finding of positive impacts of trade orientation on the pattern of TFP change accros industries.

Resumo: O artigo examina as relações entre o crescimento da produtividade total dos fatores e da produção, expansão das exportações e substituição de importações nas indústrias brasileiras entre 1975 e 1985. Encontra-se associação positiva entre o crescimento da produção e da produtividade em ambos os quinquênios em que se dividiu a análise, sendo a associação mais forte no segundo do que no primeiro. Um modelo de decomposição multissetorial permitiu avaliar os impactos de variáveis relacionadas ao comércio exterior sobre o crescimento de diversos setores. Um interessante resultado preliminar adicional diz respeito aos impactos positivos das variáveis de comércio sobre a produtividade.

GROWTH AND PRODUCTIVITY IN BRAZILIAN INDUSTRIES : IMPACTS OF TRADE ORIENTATION.

Regis Bonelli[1]

1. INTRODUCTION

The relationship between productivity, output growth and export expansion has deserved a growing attention in contemporary trade and development policy literature. Since productivity is a potentially relevant determinant of comparative advantage in the medium and long terms, several hypotheses have been put forward to explain possible links between sectoral differences in factor productivity and trade performance, particularly in developing countries. Despite the wide variety of possible explanations that have been raised, no consensus as to which sources should deserve more attention has been arrived at so far. Nevertheless, a substantial body of information and analysis has been gathered and used as a departing point for additional research.

In this paper we investigate the links between output growth, total factor productivity (TFP) change and trade performance - in particular, the role of export expansion and

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[1]Department of Economics, Catholic University of Rio de Janeiro.
Paper presented at the IV Interamerican Seminar on Economics, sponsored by NBER and PUC/RJ, Santiago, Chile, March 15-16, 1991. Research assistantship by Leda Hahn is gratefully acknowledged, as well as research support from IDRC. Comments on an earlier version by E. Bacha, R. Werneck and A. Butelman were responsible for major improvements in the text.

import substitution - using sectoral data for the Brazilian manufacturing and extractive industries. Lack of appropriate empirical data for some variables constrains both the level of aggregation and the time span under analysis: in the first case, to the two-digit level of the industrial classification; in the second, to the period 1975-1985[2]. This period was divided into two quinquennia for the analysis of TFP changes due to differences both in performance and macroeconomic policies between 1975 and 1980 and from this last year to the mid-1980's that may have some effect on the results.

Section 2 presents stylized facts on the contribution of (and relationship between) productivity and factor input growth to trade orientation and output growth. Section 3 is essentially a methodological note on productivity measures and a presentation of results. Section 4 presents the methodology and results of a demand-side decomposition of output growth using end-point data for the decade 1975-85. Section 5 discusses how this decomposition can be related to the supply-side decomposition of section 3 and presents an empirical analysis with the objective of assessing the impacts of trade orientation on output and productivity growth. Section 6 closes the paper by summarizing the main findings. Supporting data and a brief technical note can be found in the Appendix.

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[2]The empirical work has been possible because of the recent release of two sources of information elaborated by IBGE, the official Brazilian statistical agency: the 1980 input-output matrix and the 1985 Industrial Census.

2. GROWTH, TRADE AND DEVELOPMENT POLICY AND PRODUCTIVITY

Nishimizu and Robinson (1986) summarize the links between trade policies and productivity performance according to three different hypotheses:

(i) the first is the existence of a positive association between the growth of output and the growth of productivity (Verdoorn's Law, when expressed in terms of labor productivity), an argument based on the existence of scale economies and observed especially in manufacturing industries. Expanding the market through trade should therefore increase productivity and lead to cost reduction. Although usually made in terms of export expansion, this argument applies to import substitution as well - in which case the final result should depend on the size and structure of the domestic market;

(ii) the second link implies a challenge-response mechanism and, despite not being formalized in the literature, refers to X-efficiency: enhancing international competition through trade liberalization (and export promotion) is likely to increase domestic efficiency and cost reduction. Protectionist policies, on the other hand, tend to reduce competitiveness and lead to inefficiency, the same occurring with excessive export subsidies. In essence, the causal mechanism states that export expansion and import substitution may increase productivity depending on the impact on cost reduction incentives and the structure of markets. Opponents of this view, however, argue that whenever possible profit-maximizing entrepreneurs will reduce costs - even if there is no increase in competition;

(iii) the third relation stems from the literature on foreign exchange constraints, and states that in developing countries imported capital and intermediate goods are not very substitutable with their domestically produced counterparts due to embodied technical progress. Protection/import repression will therefore lead to a less efficient performance than policies that increase the availability of imported capital and material inputs, such as export expansion policies. Note that according to this view exports are important only as a source of foreign exchange.

Clearly, the hypotheses above are not mutually exclusive and their effects may not be distinguishable or independent from each other. Perhaps more important, it has not been even possible in empirical work to assert the direction of causality - i.e., if faster total factor productivity (TFP) growth is a result of a more open trade policy or the other way around. It may be the case, for instance, that, given a limited domestic demand - due to a recession, for instance - exogenous TFP growth shifts the supply curve and creates incentives to exports. The nature of the development process and trade strategies at particular points of time may therefore help in sorting out the relative importance of different factors and policies in specific countries. However, the methods developed so far and the empirical studies which use them have not been capable of providing definite answers. Even so, recent cross country evidence - based mainly on the impressive growth rates achieved by the Asian outward-oriented NIC's - favors the hypothesis that differences in output growth rates are associated with the degree of export orientation, reinforcing the idea that export demand could act as an engine of growth for developing countries.

Pinheiro's (1989) careful survey of works on the relationship between export promotion and output growth, on the other hand, finds that the somewhat frustrating results of these studies have led to a shift of focus to productivity changes. Among his conclusions there is one particularly telling for our purposes: that "the cross-section production function model is not the best way to study the links between trade orientation and the supply sources of output growth"(p. 32). This comment points to the need for detailed sectoral national studies that take into account country-specific trade regimes and policies.

3.GROWTH AND PRODUCTIVITY IN BRAZILIAN INDUSTRIES, 1975-1985

The framework for total factor productivity (TFP) measurement, based on microeconomic production and cost theory, has recently witnessed the development of new, flexible and less constraining functional formulas for productivity measurement. One of these developments is the use of a translog production function that includes material inputs as a factor of production, besides labor and capital. The inclusion of intermediate input implies the use of a gross production function, instead of a value added function. This inclusion follows from the assumption that intermediate inputs are not separable from capital and labor in production. This is the most widely adopted procedure in recent studies of TFP measurement. As usual, the rate of TFP growth is defined as the part of real output growth that is not accounted for by changes in combined real factor inputs over time. The shortcomings of such an approach have been well summarized in R. Nelson's (1981) critical paper: the causes of 'residual' growth variation are not well understood, and are likely to include a great number of factors. Therefore, empirical results on TFP change should not be interpreted as a measure of technical change or that technical change is exogenous: "The measures really treat production units as a black box" [Nishimizu and Robinson (1986) p. 288]. Nevertheless, it is a generally accepted broad measure of productivity change - at least as seen by the increasing accumulation of empirical work on productivity measurement.

With these remarks in mind, Table 1 below presents yearly averages estimates of output growth and TFP change for the period 1975-1985 and the two selected sub-periods for 22 industries. In each sector TFP growth (tfp) was computed according to the usual growth-accounting equation:

$x = a.l + b.k + c.m + tfp$ where x is the annual average of gross output growth rates, the weights a, b, and c are average shares of labor compensation, capital and raw materials in each period[3], l is the average growth rate of total employment, k is the growth rate of the capital stock (adopted as a proxy for capital services) and m is the growth rate of raw materials used up in production[4].

Note that results for the decade average out data from quite different quinquennia. During the first one (1975-80) the total growth rate reached 7.9 % yearly (an average lower than the 11% long run trend since World War II) while the rate of TFP change was only 0.5% yearly. During the slow growth period 1980-85 the manufacturing rate was 1.1 %, nearly the same as the rate of TFP change. This comes as a surprising finding: to the slow growth associated with the recession of 1981-83 there corresponds a rate of productivity change that is even higher than the rate observed in periods of higher growth. In other words, combined factor use during the recession must have fallen as firms adjusted their employment, material input and capital use levels to the reduced aggregate demand.

TABLE 1: OUTPUT AND TFP CHANGE (% PER YEAR)

SECTOR	1975 - 1980 OUTPUT	1975 - 1980 TFP	1980 - 1985 OUTPUT	1980 - 1985 TFP	1975 - 1985 OUTPUT	1975 - 1985 TFP
MINERAL EXTRACTION	6.16	-0.66	11.88	6.96	9.01	3.31
NONMETALLIC MINERALS	7.52	0.84	-3.75	1.66	1.73	1.30
BASIC METALS	8.45	0.37	-1.04	0.91	3.60	0.67
MECHANICAL EQUIPMENT	10.82	4.12	-5.52	-1.81	2.32	0.95
ELECTRICAL EQUIPMENT	10.79	4.30	4.99	4.37	7.85	4.33
TRANSPORT EQUIPMENT	5.92	1.85	1.87	2.97	3.87	2.36
WOOD PRODUCTS	7.58	1.41	-5.95	0.07	0.60	0.72
FURNITURE	8.31	1.83	-7.43	-2.81	0.10	-0.67
PAPER AND PULP	11.64	1.91	2.92	2.09	7.19	2.00
RUBBER PRODUCTS	6.54	2.01	-0.01	3.00	3.22	2.63
LEATHER PRODUCTS	8.62	1.86	-3.78	-3.37	2.23	-0.90
CHEMICALS	8.87	1.29	3.53	3.12	6.20	2.32
PHARMACEUTICALS	2.54	-2.33	1.77	1.77	2.15	-0.24
SOAPS AND PARFUMS	9.26	4.50	4.05	1.21	6.62	1.83
PLASTICS	10.05	2.34	-2.06	0.78	3.68	1.39
TEXTILES	5.67	1.89	-2.33	1.40	1.59	1.46
CLOTHING AND FOOTWEAR	6.59	0.34	5.19	2.11	5.89	1.21
FOOD PRODUCTS	5.13	0.92	1.34	-0.22	3.22	0.30
BEVERAGES	7.89	0.19	-1.10	-0.13	3.30	0.06
TOBACCO	5.26	3.51	4.23	2.28	4.74	1.78
PRINTING AND PUBLISHING	2.49	-0.16	-1.90	0.89	0.27	0.41
MISCELLANEOUS	10.09	3.23	0.00	0.51	4.92	1.81
T O T A L	7.86	0.48	1.05	1.09	4.40	0.80

SOURCE: IBGE, INDUSTRIAL CENSUS (1975, 1980, 1985)

[3]Pinheiro (1989) shows that this procedure provides an approximation for Divisia indices.

[4]Basic data come from the Industrial Censuses of 1975, 1980 and 1985. See the Appendix for details.

One important qualification, however, is that for some industries the results may be misleading due to the fact that no correction was made regarding capital utilization when estimating capital services. Maturation of investment projects associated with the Second National Development Plan (1974-79) occurred in the second period considered here. Therefore, the measurement of capital services is probably overstated in the first span - and understated in the second one - in industries like Mineral Extraction, Nonmetallic Minerals, Basic Metals, Paper and Pulp and Chemicals. For the whole 1975-85 period output grew at 4.4 % yearly while the rate of TFP change reached 0.80 % per year.

The dispersion of output and TFP growth rates is high in both periods relative to the international experience[5]. In particular, the impact of reduced or even negative growth in the second span has not meant in many cases a diminished rate of TFP growth and, as far as the manufacturing total is concerned, it is related to a higher rate of TFP change than before. Despite the qualification already made, this is the most striking result from the table.

A standard supply-side sources of growth decomposition is shown in Table 2. Except for the cases in which the output growth

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[5]Nishimizu and Robinson (1986) report for Japan (1955-73) a standard deviation of output growth rates of 3.05% around an average of 12.41 %. For Korea (1960-77) the figures are 5.38 % and 22.01 %, respectively, while for Turkey (1963-76) they found 4.64 % and 13.66 %. The coefficient of variation is thus on the order of 0.25 to 0.3. The corresponding figures for Brazil are much higher: a standard deviation of 2.40 around a sample mean of 3.82, i.e., a coefficient of variation of .63

rate is small - which results in unusually high calculated shares - the figures in the table provide an estimate of the main factors accounting for the growth of production (or lack of it). Thus, the contribution of labor input is small in all cases and periods with the exception of a few "labor intensive" industries: Nonmetallic Minerals, Mechanical Equipment and, especially, Clothing and Footwear and Printing and Publishing. The share of output growth accounted for by increased material input use is, as expected, high in nearly all industries and periods. It "explains" most of output growth in intermediate producing industries such as Nonmetallic Minerals, Basic Metals, Paper and Pulp, Rubber Products and agriculture-oriented industries like Food Products. The contribution of capital input is highest in Mineral Extraction, Mechanical Equipment, Chemicals, Pharmaceuticals, Soaps and Related Products, Plastics, Clothing and Footwear and Miscellaneous. Note that in some of these the contribution may be biased upwards for reasons already explained (Mineral Extraction, Mechanical Equipment and Chemicals, for instance). The contribution of TFP varies considerably depending on the period chosen: for the decade 1975-85 the highest contributions to output growth are found in the Nonmetallic Minerals, Electrical Equipment, Transport Equipment, Rubber Products, Textiles and Printing and Publishing, all of them with a larger than 50 % share (the Wood industry was excluded from this group because her small output growth rate distorts the factor contributions to growth).

TABLE 2: SOURCES OF GROWTH BY INDUSTRY (%)

INDUSTRIES	1975 - 1980				1980 - 1985				1975 - 1985			
	1	2	3	4	1	2	3	4	1	2	3	4
MINERAL EXTRACTION	9,9	40,7	60,2	-10,7	0,0	4,0	37,5	58,6	2,9	15,0	45,3	36,7
NONMETALLIC MINERALS	9,4	52,1	27,3	11,2	12,0	66,6	65,8	-44,4	7,6	32,7	-15,4	75,1
BASIC METALS	3,3	64,0	28,4	4,4	19,0	170,8	-1,8	-88,0	0,9	47,0	33,4	18,7
MECHANICAL EQUIPMENT	10,1	20,5	31,4	38,1	6,0	40,3	21,1	32,7	17,4	-7,2	48,7	41,1
ELECTRICAL EQUIPMENT	5,5	31,7	23,0	39,8	2,5	8,0	1,9	87,6	4,8	22,9	17,1	55,1
TRANSPORT EQUIPMENT	6,1	35,0	6,3	52,6	-1,0	-18,9	-38,7	158,6	5,1	20,7	13,2	61,0
WOOD PRODUCTS	7,9	40,8	32,7	18,6	10,0	45,7	45,5	-1,2	2,3	4,6	-27,5	120,6
FURNITURE	7,5	25,5	45,0	22,0	0,5	30,2	31,4	37,9	286,1	-133,0	621,8	-674,8
PAPER AND PULP	2,9	41,7	38,9	16,4	1,1	23,5	3,9	71,4	2,7	37,5	32,1	27,8
RUBBER PRODUCTS	4,2	61,0	4,1	30,7	-1434,0	20173,1	6326,6	-24965,6	7,2	18,1	-7,1	81,8
LEATHER PRODUCTS	4,7	56,1	38,7	0,5	-8,4	-4,9	24,1	89,1	23,3	143,1	62,4	-128,7
CHEMICALS	1,4	52,0	32,2	14,5	4,9	-40,0	46,8	88,3	2,4	23,6	36,6	37,4
PHARMACEUTICALS	1,5	50,1	140,1	-91,7	-10,4	-16,0	26,1	100,3	-2,7	23,1	90,6	-11,0
SOAPS AND PARFUMS	1,6	39,3	32,0	27,0	0,4	-23,4	93,1	29,9	1,5	19,7	51,1	27,7
PLASTICS	7,0	31,7	38,1	23,3	-6,9	75,6	69,3	-38,0	11,7	19,4	31,2	37,7
TEXTILES	3,3	44,5	24,8	27,4	10,9	96,7	52,6	-60,2	-2,5	0,0	10,5	92,0
CLOTHING AND FOOTWEAR	14,4	27,5	52,9	5,2	13,2	11,0	35,3	40,6	13,9	19,7	45,8	20,5
FOOD PRODUCTS	3,6	46,4	32,0	17,9	0,7	186,7	-70,8	-16,5	3,2	75,9	11,7	9,2
BEVERAGES	1,7	46,3	49,7	2,4	-2,1	86,6	3,6	11,9	2,6	40,6	54,8	2,0
TOBACCO	-3,5	59,1	30,0	14,4	-2,1	11,3	37,0	53,8	-3,3	36,8	28,7	37,7
PRINTING AND PUBLISHING	14,0	23,9	68,4	-6,3	8,2	42,3	96,4	-46,8	41,3	-36,9	-57,7	153,4
MISCELLANEOUS	5,5	28,8	33,7	32,0	-275,8	-159,5	-4704,0	5239,3	5,5	27,4	30,2	36,8
TOTAL	5,0	55,7	34,2	5,1	-3,2	-22,0	20,5	104,7	4,2	44,7	33,7	17,4

1. Contribution of Labor Input, divided by Gross Output Growth
2. Contribution of Material Input, divided by Gross Output Growth
3. Contribution of Capital Input, divided by Gross Output Growth
4. Contribution of TFP Change, divided by Gross Output Growth

In some industries the estimated rate of TFP change has resulted very near zero or even negative. This suggests that either the corresponding output growth rates may be underestimated (Leather Products, Furniture, Pharmaceuticals, and Rubber Products industries) or input use, particularly capital, overestimated in these cases.

The dispersion of rates of change of output is similar to that of TFP, in both periods. In general, the lowest rates of TFP change correspond to the lowest output growth rates. Thus, for the years 1975-80 TFP change in the Printing and Publishing, Pharmaceuticals, Mineral Extractive, Leather and Beverages industries was negative (first three cases) or near zero (the remaining ones). In all these cases output growth was below the average. The opposite happens with fast growing industries: Mechanical Equipment, Electrical Equipment, Soaps and Parfums, Miscellaneous, Plastics, Paper and Pulp, and Chemicals all had rates of TFP change well above the manufacturing 0.5 % total[6].

The same kind of asssociation appears in 1980-85. Nearly all the industries hardest hit by the 1981-83 recession (Furniture, Wood, Mechanical Equipment, Leather Products, Nonmetallic Minerals, Textiles, Plastics) had negative or below

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[6]As already noted, the relatively low rate of TFP change for the manufacturing sector in 1975-80 probably reflects the large increase in the value of the capital stock - and thus of the contribution of capital- associated with the program of import substituion of capital goods and intermediate goods during Pres. Geisel's administration and the 1980 investment boom. A correction for the degree of capacity utilization would reduce the contribution of capital.

average rates of TFP change. In the other extreme of the growth spectrum are the Mineral Extraction, Clothing and Footwear, Electrical Material and Equipment, Tobacco, Soaps and Related Products, Chemicals and Paper industries, all of them displaying rates of TFP change well above the average. A comparison of productivity changes between the two periods shows no association: the Spearman's rank correlation coefficient between the respective series is virtually zero (+0.04).A similar comparison for output growth rates also yields no association (the rank correlation coefficient is -0.07).

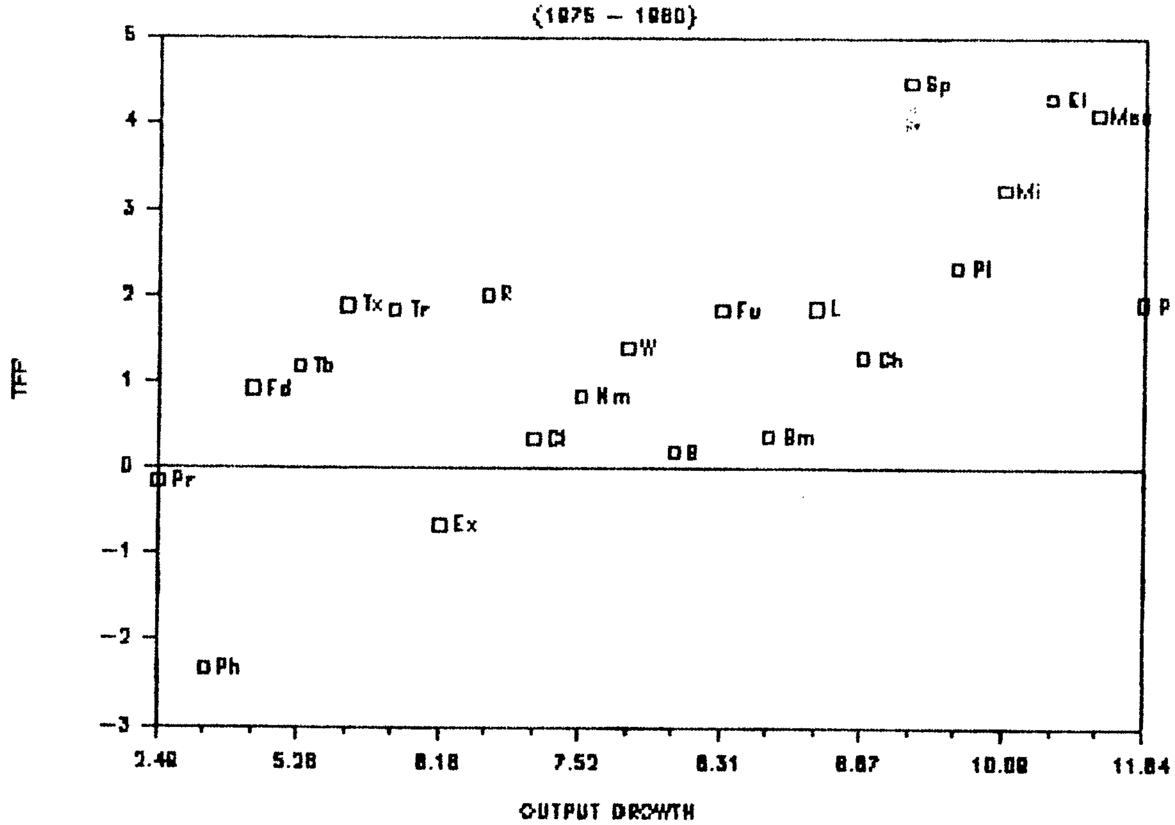
Despite the fact that the series are not associated, there is evidence that within sub-periods output growth is related to TFP change. Figures 1, 2 and 3 show the scatter of points for individual industries according to the time periods chosen. It is apparent from the visual inspection of the figures that a positive association exists, particularly in 1980-85. To explore the association statistically a cross-section regression equation of the form

% TFP change = constant + % output change

was fitted to the data shown in Table 1. Regression results for each time period are shown below the respective figures, confirming the existence of a positive association between the series: no less than 50 % of the variance in TFP change is "explained" by output growth rates, the estimated coefficient being on the order of 0.4 to 0.5 and statistically significant. As expected from the visual inspection, the fit is better for the second period than for the first one. In addition, despite the fact that the estimated slope coefficient is nearly the same in the two sub-periods, the intercept term increases substantially, as implied before, from the high-growth to the slow-growth period.

For the whole period large positive deviations from the fitted values, meaning higher than predicted rates of TFP change, occur in the Textiles, Electrical Equipment, Transport Equipment and, especially, Rubber industries. These are all concentrated industries - suggesting that market structure may be related to productivity increases, a hypothesis not explored here. Negative deviations appear particularly in the Leather and, to a lesser extent, Pharmaceuticals, Beverages, Clothing and Footwear, Soaps and Related Products, and Plastics industries. All these outliers belong to the light industry group, and many to the slow-growth team, implying that firms in the respective industries have lagged behind in terms of productivity advances observed elsewhere. Note also that some among them recorded negative rates of TFP change, on average, over a time span of a whole decade. However, the decline of import coefficients after 1980, both of capital equipment and material inputs, may have caused lower productivity gains - a hypothesis not tested here because of lack of adequate data. Ruling this out, one possible explanation is that estimated output growth may have been understated in these cases (particularly Leather, Furniture, Pharmaceuticals and Beverages industries).

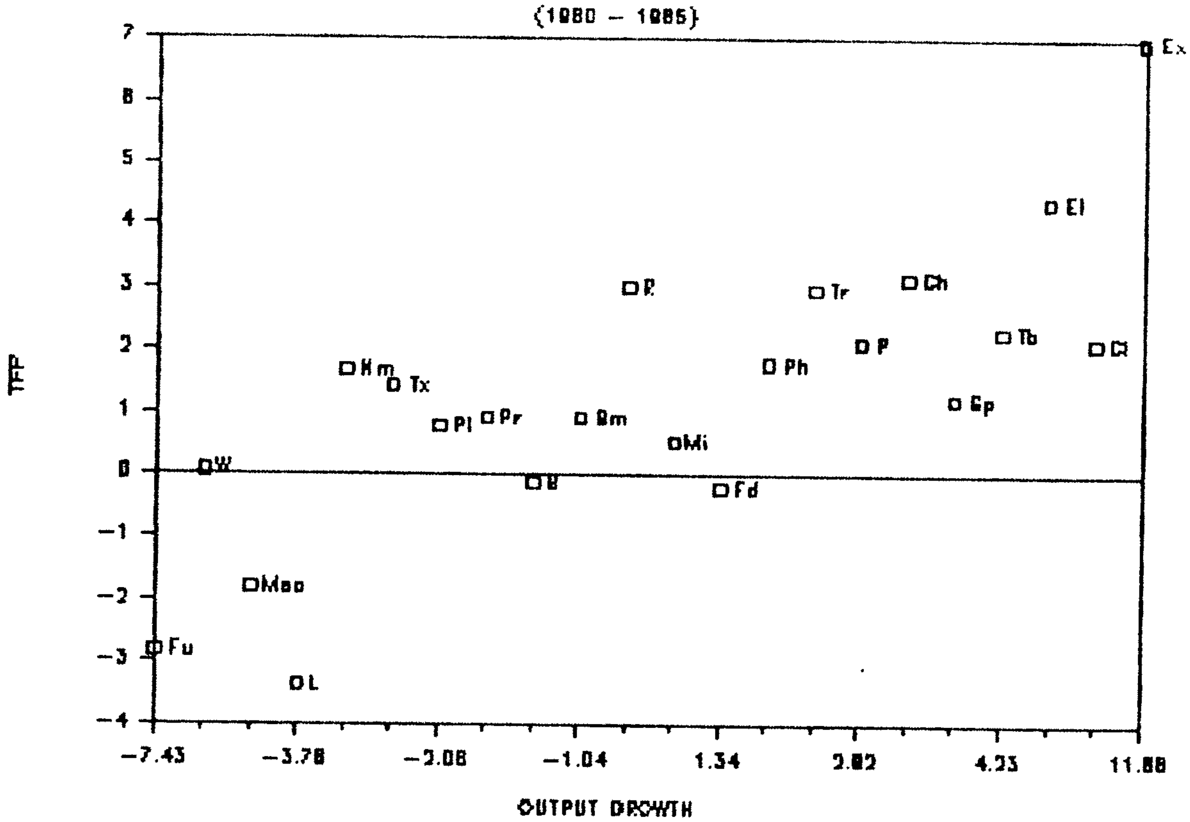
FIGURE 1: % TFP CHANGE x OUTPUT GROWTH



Regression Output:		
Constant		-2,08919
Std Err of Y Est		1,143693
R Squared		0,529730
No. of Observations		22
Degrees of Freedom		20
X Coefficient(s)	0,476466	
Std Err of Coef.	0,100383	

FIGURE 2: % TFP CHANGE x OUTPUT GROWTH

(1980 – 1985)



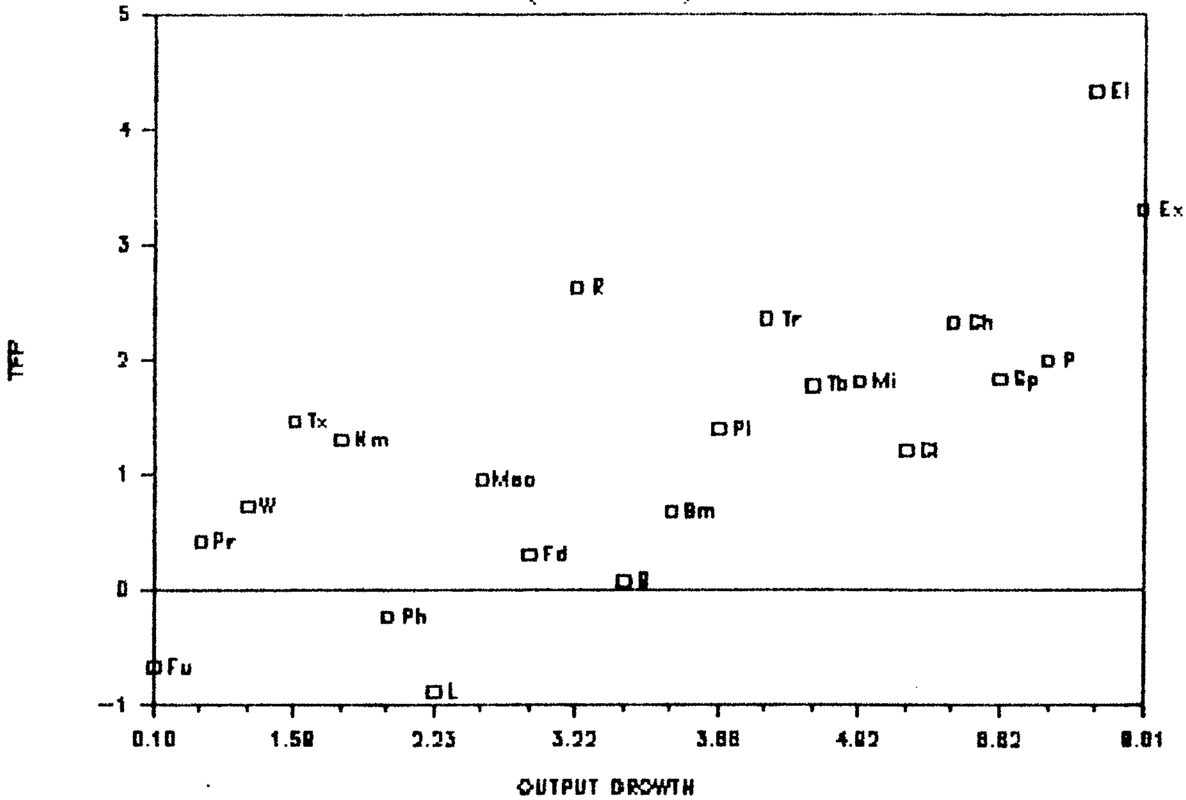
Regression Output:

Constant	1,130226
Std Err of Y Est	1,310802
R Squared	0,682958
No. of Observations	22
Degrees of Freedom	20

X Coefficient(s)	0,420064
Std Err of Coef.	0,063997

FIGURE 3: % TFP CHANGE x OUTPUT GROWTH

(1975 – 1985)



Regression Output:

Constant	-0,13137
Std Err of Y Est	0,871540
R Squared	0,549500
No. of Observations	22
Degrees of Freedom	20

X Coefficient(s)	0,378777
Std Err of Coef.	0,076688

An international comparison of TFP change in the manufacturing sector is presented in Table 3.

TABLE 3. SOURCES OF GROWTH FOR THE MANUFACTURING SECTOR

[% PER YEAR]

Measure	Japan (1955-73)	Korea (1960-77)	Turkey (1963-76)	Yugoslavia (1965-78)	Brazil (1975-85)
Gross output	11.59	17.94	10.71	9.78	4.40
Labor input	4.50	5.32	5.05	2.99	2.36
Capital input	10.84	12.98	11.24	7.72	4.24
Material input	10.41	16.29	9.29	11.50	3.39
Weighted l.input	0.70(.06)	0.46(.03)	0.55(.05)	0.67(.07)	0.18(.04)
Weighted c.input	1.51(.13)	3.50(.20)	3.23(.30)	0.78(.08)	1.45(.34)
Weighted m.input	7.34(.63)	10.28(.57)	5.60(.52)	7.85(.80)	1.97(.45)
TFP change	2.04(.18)	3.71(.21)	1.33(.12)	0.48(.05)	0.80(.17)

Notes: (i) Ratios of weighted labor,capital, material input and TFP growht to gross output growth are given in parentheses.
(ii) Figures for Brazil include Mineral Extractive industries.
Sorces: Nishimizu and Robinson (1986) and own estimates.

Even considering that the periods reported are not the same or strictly comparable, a few points stand out forcefully from the table. The first is the well-known impressive and sustained growth rates achieved by Korea and, to a lesser extent, Japan[7] over a long time span. Second, the relatively modest contributions of labor input in all countries shown. Third, the very large differences in

[7]Dollar and Sokoloff (1990) report even higher rates for real value added in Korea: 21.9 % yearly from 1963 to 1979.

the contribution of capital input: Brazil, in particular, has a contribution (34 %) nearly four times the Yugoslavian (8 %) and two and a half times the Japanese (13 %) - but this can be partly explained as a result of heavy investments in a few industries from 1975 to 1980 and the relatively short time period chosen. Fourth, as for material input, Yugoslavia stands as a especial case with a 80 % contribution compared to averages of 45 to 60 %. A consequence of this is the relatively minor role of TFP change in this particular country as compared to the others. Fifth, the output growth rate and TFP change estimate for Brazil are in contrast with the corresponding estimates for the other countries (with the exception of the rate of TFP change in Yugoslavia, very low for international comparisons): both the rate of TFP change and the overall output growth rate are smaller than the other countries'. As shown above, this is a direct consequence of slower growth, on average, during 1980-85 due to the 1981-83 recession, and in spite of the fact that TFP growth in this period was even a little higher than output growth.

Previous studies on TFP growht in Brazilian manufacturing industries have arrived at results not very different from the ones reported above. Thus, Bonelli (1976) found out that TFP growth accounted for 22 % of the value added growth rate of 8.4 % estimated for 1959-70. Pinheiro (1989), working with a gross output production function for the period 1970-80 estimated TFP growth at 2.6 % yearly, representing 20 % of the output growth rate. Corresponding value added figures were 1.5 % and 15.2 %. These estimates obtained for high-growth periods, when compared to those shown in Table 3 place Brazil nearer to Japan and Korea than to Turkey or Yugoslavia - at least as far as the contribution of TFP change to total output growth is concerned. See, however, Braga and Rossi (1988).

4.' SOURCES OF GROWTH: A DEMAND SIDE DECOMPOSITION

The interdependence between growth and structural change points to the use of multisector models as appropriate to demand-side growth accounting exercises. This procedure permits the evaluation of both direct and indirect effects of changes in final demand aggregates on output growth.

The usual point of departure is the well-known material balance equations that describe sectoral equilibrium between supply and demand[8]:

$$(1)\ X(i) = Sum_j U(ij) + CD(i) + ID(i) + E(i)$$

where the level of sectoral output is written as the sum of its uses as intermediate input plus final utilization (consumption and investment of /in domestic goods and exports). A similar identity holds for imports:

$$(2)\ M(i) = Sum_j M(ij) + CM(i) + IM(i)$$

where imports by origin are written as the sum of intermediate uses and final utilization (consumption and investment of/in imported goods). Adopting the usual hypotheses that domestic and imported intermediate use are proportional do gross output, i.e.,

$$(3)\ U(ij) = a(ij).X(j) \quad , \text{ and}$$

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[8]The exposition is adapted from Syrquin (1988), especially Section 4, and Robinson (1986).

$$(4)\ M(ij) = m(ij).X(j)$$

equations (1) and (2) can be written, in matrix notation, as

$$(5)\ X = Ad.X + Cd + Id + E \text{ and}$$

$$(6)\ M = Am.X + Cm + Im$$

Adding up systems (5) and (6) results in

$$(7)\ X + M = [Ad + Am].X + [Cd + Cm] + [Id + Im] + E$$

Define

$A = Ad + Am$ technical coefficient matrix of domestic and imported material input

$C = Cd + Cm$ consumption vector, domestic and imported goods

$I = Id + Im$ investment vector, domestic and imported goods

Equation (7) can then be re-written, adopting the hypothesis that imports are competitive, as

$$(8)\ X = A.X + C + I + E - M$$

Note that the technical coefficients in matrix A are likely to be more stable over time than if the matrix were constructed using domestic inputs only. The possibility of substituion between domestic and imported inputs is thus implicitly adopted, keeping unchanged the coefficient a(ij). Manipulation of (8) leads to

$$(9)\ X = A^*C + A^*I + A^*E - A^*M$$ where $A^* = [I-A]^{-1}$ is the Leontief inverse matrix.

Changes in (9) can be written as

$$(10)\ dX = A^*dC + A^*dI + A^*dE - A^*dM + dA[C + I + E - M] + $$
$$+ \text{(second order terms)}$$

Therefore, output change can be decomposed, from left to right, into five componentes (neglecting second order terms):

(i) expansion of consumption demand (domestic and imported);

(ii) expansion of investment demand (domestic and imported);

(iii) expansion of export demand;

(iv) import substitution;

(v) effect of input-output technical coefficients change.

The system (10) provides a consistent way of dealing with the effects of concepts such as import substitution and technical structure change on output growth. Unfortunately, the last term in equation (10) is usually obtained as a residual - which has the shortcoming of pooling together the measurement of structural change with all eventual observation and measurement errors.

As is well known, the identification of demand-side sources of growth does not imply any causal mechanism or that these sources be exogenous: they may well be the result of more fundamental subjacent causes. However, the approach provides first order approximations and orders of magnitude of various effects indicating areas for further research and the likely impact of growth and trade strategies. In particular, this kind of demand-side decomposition can be related to the supply-side exercise shown in the previous section. Note that departing from equation (10) a given sector's output growth rate can be found by dividing both terms by base period output. A little manipulation yields, neglecting second-order terms:

$$(11)\ x = A^{*}c.w_c + A^{*}i.w_i + A^{*}e.w_e - A^{*}m.w_m + dA[C+I+E-M]/X$$

where the lower case letters x, c, i, e, and m stand for rates of change of the corresponding variables and the weights w are base-year shares of consumption, investment, exports and imports in sectoral output. Alternatively, noting that the sum of the individual demand aggregates contributions add up to one [from equation (10)], equation (11) can be written for each sector as:

(12) x = [A*dC/dX].x + [A*dI/dX].x + [A*dE/dX].x - [A*dM/dX].x

+ growth contribution of technical coefficient change

This expression decomposes the output growth rate in individual contributions of output growth allocated to consumption, investment, export expansion, import substitution (or expansion) and input-output technical coefficients change. The relationship between trade orientation and TFP change can therefore be explored using this framework, as will be seen shortly.

Before entering this point, however, we present the demand-side growth accounting results for the 1975-85 period in Table 4 below[9]. The components were estimated according to equation (10) dividing each sector's contributions by the respective output change. The input-output matrix data refer to the year 1980, and the 27-sector matrix includes, besides the manufacturing and extractive

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[9]Growth rates for demand components by sector are found in the Appendix. The exercise refers to the whole period due to the fact that from 1980 to 1985 no less than 11 industries recorded negative average growth rates, which would unnecessarily complicate the analysis of the results

industries, the following sectors: Farm Products, Electric Energy and Public Utilities Industrial Services, Construction Industry, Services, and a "dummy" sector[10] (not shown in the table). Neglecting the growth effects of changes in I-O coefficients, the factors shown below were adjusted to add up to unity.

As expected, consumption accounts for most of output growth. This is particularly true for the Agriculture, Services and Electrical Energy sectors, but suits many final consumption-oriented industries as well: Pharmaceuticals, Parfums and Related Products, Plastics, Textiles, Clothing and Footwear, Food, Beverages, Tobacco, Printing and Publishing and Miscellaneous industries. On the average, for the economy as a whole, consumption, both private and government, accounts for 57 % of total output expansion from 1975 to 1985. This figure is below the 1980 GDP share of consumption (79 %) showing that aggregate consumption lagged behind overall growth due mainly to the recession of 1981-83.

Investment expenditures represented a modest 6 % contribution to growth, well below the 1980 investment share in GDP: 23 %. Except for the Construction and respective material input-producing industries (Nonmetallic Minerals and Wood), the contribution of investment to growth is almost negligible in nearly all the remaining sectors. This is somewhat surprising since one should expect in this case significant contributions in capital goods producing industries such as Mechanical, Electrical and

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[10]This is a fictitious sector constructed with accounting purposes only.

Transport Equipment. However, as in the case of machinery and equipment imports, the effects of the 1981-83 recession were hardly felt precisely on this group of industries. Note that aggregate gross investment growth was virtually zero between 1975 and 1985.

One of the main results of both trade policy and domestic recession appears when the growth contributions of exports are examined. Even supposing that the estimated export growth rates for individual sectors may be overstated due to the use of Laspeyres quantity indices, the results are still impressive: no less than 25 % of total output growth is directly and indirectly "explained" by the expansion of exports. A somewhat trivial implication is that, if it were not for exports, output expansion from 1975 to 1985 would have been one-fourth lower than actually observed (i.e.,3.1 % yearly, instead of 4.1 %, the actual GDP rate). Note that the share of exports in 1980 GDP was only 9 %, the increase in real terms from 1975 (8.5 %) to 1985 (14.1 %) being, therefore, very impressive. This was particularly true during the second time span here analysed (figures from the National Accounts at constant prices).

Results for particular industries, especially those in the intermediate goods producers group, are even more spectacular: Leather Products (with a 67 % contribution), Transportation Equipment (65 %), Furniture (63 %), Basic Metals (57 %), Paper and Pulp (48 %), Rubber (45 %), Tobacco (42%), Nonmetallic Minerals (41 %), Wood Products (40 %), Mineral Extraction (39 %), Chemicals (37 %), Plastics (36 %) and Textiles (36 %) were, all of them cases in which increased exports represented in good measure an outlet to compensate for a diminished domestic demand.

TABLE 4: DEMAND-SIDE DECOMPOSITION OF GROWTH, 1975-1985 [In %].

Sectors	Consumption Expansion	Investment Expansion	Export Expansion	Import Substitution
Farm Products	80	11	11	- 2
Min. Extraction	35	5	39	22
Nonmetallic Min.	20	28	41	12
Basic Metals	12	4	57	27
Mec. Equipment	14	...	25	62
Electr. Equipment	41	4	31	24
Transport Equip.	21	-1	65	15
Wood	27	26	40	6
Furniture	27	-2	63	12
Paper and Pulp	37	2	48	13
Rubber	44	2	45	10
Leather	36	...	67	- 4
Chemicals	51	4	37	8
Pharmaceuticals	111	2	17	-30
Soaps and Parfums	86	...	10	5
Plastics	47	9	36	7
Textiles	60	1	36	3
Clothing and Footwear	79	...	19	1
Food Products	110	3	- 6	- 6
Beverages	80	1	12	7
Tobacco	56	...	42	2
Printing and Publ.	64	2	24	11
Miscellaneous	55	1	32	13
Electrical Energy	69	2	20	9
Construction	19	74	5	2
Services	79	2	14	5
TOTAL	57	6	25	13

Sources: Own estimates based on IBGE Industrial Censuses of 1975, 1980 and 1985 and National Accounts.

In some periods the outward orientation was helped by a devalued exchange rate. In others exports were pulled by a fast growing external demand - as in 1984, particularly from the USA. In many instances, however, they represented an undesired outcome of a sluggish or even reduced domestic demand. Note that for the sectors in which Brazil had already by 1975 established herself as an exporter of some significance (Primary Products, Food, Clothing and Footwear, for instance) the contribution came to be much lower than in the remaining cases. In these "new" industries (Basic Metals, Mechanical, Electrical and Transport Equipment, Paper and Pulp, for instance) export values began the period from very low levels - which explains the very high growth rates and shares of exports. On Brazilian trade policy and trade patterns in the period, see Fritsch and Franco (1989).

The estimates related to "import substitution" are equally impressive. Far from representing a response to growth-oriented policy stimuli, however, they are the result of import repression associated with the foreign exchange crisis that followed the shock wave of 1979-80 as well as the maturation of investment projects associated with President Geisel's Second National Development Plan.

Brazilian authorities have long been aware of the efficacy of non-trade barriers to deal with foreign exchange shortages. Import repression has been used very often in the past, having become a sort of traditon in the trade policy (or absence of) field. Strict controls on imports were enforced throughout most of the 1980's. The results in terms of constraining imports were quickly arrived at, but the consequences in terms of long term growth and productivity (see below) may be disastrous - not to mention the actual difficulties in dismantling the system of controls.

In terms of the framework here adopted to decompose output changes, a reduction in competitive imports appears as being met by output expansion, being termed import substitution[11]. This factor can only have some relevance in industries in which imports (by origin) have some quantitative expression. Despite the fact that imports in the base year were high in all industries due to the speculative import demand associated with the aftermath of the first oil crisis, substantial contributions of import substitution to output growth are concentrated in a small group of industries. Above the average of 13 % one finds either industries associated with investment demand [Mechanical Equipment (62 %), Basic Metals (27 %), Electrical Equipment (24 %), and Transportation Equipment (15 %)] or the very particular case of Mineral Extractive industries (with a 22 % contribution of import substitution). It is difficult to ascertain, in the former cases, how much can be attributed to import substitution and how much to repressed imports and a diminished gross investment demand. In the second case, however, it seems clear that output increases have been associated with import substitution of crude oil as sea exploration increased substantially in the second half of the

[11] Actually, the ratio of imports to domestic output decreased in nearly all industries between 1975 and 1985.

1980's. In a previous study [Bonelli (1985)] we estimated the import substitution component in this industry at 7.0 % of output change between 1975 and 1980 using a methodology similar to the one used here. The corresponding estimate for the 1980-83 recession reached 141 %. Results for the industries in the metal-mechanic group were invariably high during 1975-83.

5.TFP CHANGE AND TRADE ORIENTATION

As we have seen, TFP change can be thought of as representing a supply response (or a stimulus) to changes in the components of demand. In particular, we wish to investigate the relationship between TFP change and two demand components directly associated with trade policies: export expansion and import substitution. As Nishimizu and Robinson (1986, pp.300) put it:

> "Taking these components as exogenous, or as determined by exogenous policy regimes, we can relate TFP growth to changes in the sources of demand growth."

The authors add to this the usual word of caution on the implications as to the direction of causality. Despite the fact that tests devised to verify the direction of causality have not been used, the hypothesis that favors the direction going from demand to TFP seems more in accord with the results, as will be seen.

Note that the average rate of TFP change is estimated as

(13) $tfp = x - a.l - b.k - c.m$

and, from (12), the contribution of export expansion and import substitution to output growth is estimated as

(14) $[A*dE/dX]x - [A*dM/dX]x = x - [A*dC/dX]x - [A*dI/dX]x -$ $-$ contribution of I-O coefficient change

Neglecting the last term in the right-hand side, it is apparent that a close correspondence between the rate of TFP change and trade orientation will tautologically occur if the total contribution of factor input from the supply side (a.l+b.k+c.m) approximates the growth contribution of domestic absorption expansion from the demand side. Since there is no reason to expect that combined factor use growth equals the growth contribution of domestic absorption - except in the very particular case where TFP change is zero accross sectors and export expansion and import growth exactly match each other in all sectors - running a regresion of the left hand-side of (14) on TFP rates of change accross industries will allows us to test for the existence of links between TFP change and trade orientation.

Therefore, the single equation model to be estimated is:

$tfp = a_0 + a_1.x_{EXP} + a_2.x_{SM}$ where tfp, x_{EXP} , and x_{SM} are annual rates of TFP change, output growth allocated to export expansion and output growth allocated to import substitution. The OLS regression equation fitted to average annual data (1975-85) for the 22 industries, with observations ranked in ascending order of TFP change, is the following (t values in parenthesis):

$$tfp = \underset{(1.01)}{0.30} + \underset{(2.13)}{0.55x_{EXP}} + \underset{(2.05)}{0.80x_{SM}}$$

$R^2 = 0.59$ F = 13.61 DW = 1.43 SER = 0.85

Despite the fact that the independent variables are correlated - the correlation coefficient being on the order of 0.45 - both regression coefficients are significantly different from zero. The standard t-test reveals that they are not statistically significantly different from each other, though. In spite of the fact that the intercept is not statistically different from zero, it positive value suggests that TFP rises even with zero export and import substitution growth.

Different functional forms were tried in an attempt to improve the estimation. None of them, however, yielded substantially better results than the simple equation above.

An examination of the plot between fitted and actual values reveals very high relative residuals for a group of industries located in the lower end of the TFP series when ranked in increasing orders of magnitude, particularly those with negative rates of TFP change: Leather, Furniture, Pharmaceuticals, Beverages and Basic Metals.[12]

The conclusion is that a non-negligible proportion of the variation in TFP growth rates is "explained" by output growth allocated to export expansion (EXP) and import substitution (SM) - especially when correction is made for the case of industries with a negative or very small rate of TFP change. Both factors EXP and

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[12] Adding a "dummy" variable (D=1 for these sectors and 0 for the remaining ones) to the above equation improves the fit considerably:

$$tfp = \underset{(3.55)}{0.77} + \underset{(3.22)}{0.55}x_{EXP} + \underset{(1.98)}{0.52}x_{SM} - \underset{(-5.1)}{1.52}D$$

$R^2 = 0.83$ $F = 29.66$ $SER = 0.56$

SM have a positive impact on productivity, as shown by the sign of the respective coefficients. As already argued, a positive constant term implies increases in TFP levels over and above the contribution of export expansion or import substitution.

With the objective of assessing the influence of these same variables on output growth rates (x) the following cross-section equation was fitted to the data:

$$x = \underset{(2.77)}{1.67} + \underset{(2.80)}{1.46x_{EXP}} + \underset{(1.11)}{0.87x_{SM}}$$

$R^2 = 0.52$

The results are not as good as before. Not only the fit is poorer, but also the import substitution coefficient is not statistically significantly different from zero. They do suggest, however, the relevance and importance of export expansion in contributing to growth.

The main conclusion of the exercise, therefore, is that the Brazilian experience from the mid-1970's to the mid-1980's points to the existence of a positive association between the degrees of export expansion and import substitution (or compression) and the rates of productivity change as estimated by TFP growth rates: on average, a 1 % increase in the rate of output growth allocated to export expansion (or import substitution) "generates" an additional 0.5 % rate of TFP change.

From the similar magnitudes of the estimated regression coefficients one can also suggest that the results confirm the simple version of Verdoorn's law, which implies that any expansion of the market, regardless of source, improves productivity performance[13]. In the second place, the results are consistent with the idea that both export expansion and import substitution generate TFP growth through economies of scale and/or through competitive incentives. An interesting but rather controversial corolary of this last proposition is that import liberalization may imply a diminished productivity performance (by reducing competitive cost-reduction incentives, perhaps)[14]. In terms of the hypotheses presented in Section 2, the results are suggestive of the applicability of the first two, but not of the last one: that imported inputs embody technologies that can only be attained through imports and that, therefore, constraining imports would lead to a poorer productivity performance than otherwise, in which case one would expect a negative coefficient for the import substitution variable. Although the argument be more conveniently applicable to imports classified by destination, it can be made when imports are classified by origin as well.

It goes without saying that these preliminary conclusions should be taken with extreme care. Not only the statistical base and the relatively short time-period analyzed may not be suitable for providing definite answers, but also it may be misleading to

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[13]This conclusion stands in contrast to Nishimizu and Robinson's (1986, pp.303), who found out export expansion coefficients positive and higher than the (negative) import substitution coefficient in most of the industries they studied in Japan, Korea, Yugoslavia and Turkey.

[14]It could be the case, for instance, that the focus of the liberalization process is on final goods. If intermediate goods remain protected from foreign competition liberalization may bring about this result. On liberalization in Brazil see Franco (1990)

interpret the severe import repression of the beginning of the 1980's - dictated, as it was, by macro conditions related to the shortage of foreign exchange - as being "import substitution".

6.FINAL COMMENTS

The growing literature on the possible effects of trade liberalization on growth has not been capable so far of providing general formal models to test the appropriate hypotheses of the relationships between productivity change and trade orientation. To the lack of theoretical rigor one should add the empirical defficiencies related to estimating the relevant magnitudes involved, particularly in developing countries.

In this work we tried to reduce the gap between the different hypotheses and empirical constructs by estimating data on total factor productivity in manufacturing and extractive industries in Brazil from the mid-1970's to the mid-1980's and testing them against variables related to trade orientation: export expansion and import substitution/import repression or compression.

The first interesting finding from the measurement of TFP changes over time, when compared to the respective output growth rates, is the existence of an association between the two series in both sub-periods into which the analysis was divided. The association is stronger during the slow-growth period 1980-85 than during the fast-growth period 1975-80.

One of the main results from the supply-side output growth decomposition, performed at the two-digit level of aggregation and using end-point data, was that, on average, total factor productivity during the slow growth 1980-1985 years increased faster than during the high growth 1975-1980 period. As noted, the TFP change estimates for the period 1975-1980 may be biased downwards because, due to the lack of adequate data, no correction for capacity utilization was attempted. Even so, it seems unlikely that correcting the capital figures could turn the share of output growth accounted for by TFP change in 1975-1980 larger than in 1980-1985. This is a topic for further research.

Results for particular industries allow us to separate one group in which the performance in terms of productivity change was substantially better than in the remaining industries for the period analysed as a whole. It includes, within the manufacturing sector, technology-intensive industries such as Electrical Equipment, Transport Equipment, Paper and Pulp, Rubber Products, Chemicals and Miscallaneous. At the other extreme one finds industries such as Leather Products, Furniture, and Pharmaceuticals, all of which characterized by negative rates of TFP change over 1975-85.

A demand-side growth decomposition exercise performed for the decade 1975-1985 as a whole highlighted the role of export expansion in contributing to growth in nearly all industries, with the non-negligible exception of Food Products. The estimates related to import substitution are also high, particularly in the capital goods producing sectors: Basic Metals, Mechanical

Equipment, Electrical Equipment and Transport Equipment. It is interesting to note that, despite its high share in final aggregate demand, the contribution of consumption expansion to growth was small in many important industries as compared to either export expansion and import substitution. As for investment, if it were not the Construction industry the share of output accounted for these expenditures would have been even smaller than the 6 % estimated for 1975-85.

Finally, we explored the existence of association between sectoral TFP change - obtained from the supply-side decomposition of output - and trade orientation as estimated by output growth allocated to export expansion and/or import substitution. The conclusion was that a good part of the interindustry variation in TFP growth rates is explained by variables related to export expansion and import substitution. A word of caution was repeatedly voiced throughout this work: that it would be misleading to interpret the severe import repression of the 1980's, dictated as it was by macroeconomic conditions associated with the shortage of foreign exchange that followed the shock wave of the beginning of the decade, as being import substitution. Except for this caveat, however, the results seem sufficiently robust to justify the assertion that export growth and TFP change are strongly and positively associated. The link between them is probably the growth of output, as it should be expected. Nothing can be said as to the direction of causality, but it seems more likely that scale economies and related variables influence the pattern of productivity change, and not the other way around.

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APPENDIX

Methodological Note:

Gross output growth rates are estimated monthly by IBGE for most sectors. For the remaining ones growth was estimated deflating the Census value of gross output by appropriate sectoral price indices computed from "Conjuntura Econômica" (various issues). Two exceptions to this procedure were Wood and Leather Products, where specific indices were computed directly from Census data for 1975-80. Labor input is simply a Census head-count because no reliable estimate of man-hours worked could be found. Independent capital stock estimates for the total were distributed by sector according to Census historic values. The exceptions here were: Nonmetallic Minerals, Leather Products and Printing and Publishing, where the growth of electrical energy consumption from 1975 to 1980 was used as a proxy for capital services; and Metal Products, Paper and Pulp, Pharmaceuticals, Soaps and Parfums, Clothing and Footwear, and Beverages where the growth of electrical energy consumption was used as a proxy for capital services between 1980 and 1985. Deflators for raw materials were constructed using sectoral implicit deflators and coefficients from the 1980 Input-Output table. In a few cases own sector deflators were used instead: Extractive Minerals, Metal Products, Transportation Equipment, Wood, Rubber, Leather, Textiles, Clothing and Footwear and Total Manufacturing from 1975 to 1980; and Nonmetallic Minerals, Electrical Equipment and Wood from 1980 to 1985.

APPENDIX TABLES.

TABLE A1: LABOR, RAW MATERIAL AND CAPITAL INPUT GROWTH

INDUSTRIES	1975 - 1980 Labor (%)	Raw Mat (%)	Capital (%)	1980 - 1985 Labor (%)	Raw Mat (%)	Capital (%)	1975 - 1985 Labor (%)	Raw Mat (%)	Capital (%)
MINERAL EXTRACTION	6,00	7,44	6,60	-0,06	1,94	6,60	2,92	4,65	6,60
NONMETALLIC MINERALS	6,43	9,50	4,30	-3,84	-6,13	-5,19	1,16	1,38	-0,56
BASIC METALS	3,73	8,42	8,45	-2,71	-2,80	0,07	0,46	2,65	4,17
MECHANICAL EQUIPMENT	6,57	4,70	9,37	-1,79	-5,20	-2,99	2,30	-0,37	3,01
ELECTRICAL EQUIPMENT	6,65	6,52	6,42	1,20	0,87	0,22	3,89	3,66	3,27
TRANSPORT EQUIPMENT	4,89	3,12	1,42	-0,20	-0,58	-2,46	2,31	1,26	1,84
WOOD PRODUCTS	5,23	6,62	5,93	-4,75	-6,09	-6,33	0,12	0,06	-0,39
FURNITURE	4,75	4,26	10,06	-0,30	-4,60	-6,11	2,19	-0,27	1,65
PAPER AND PULP	4,60	8,69	12,33	0,41	1,28	0,30	2,48	4,92	6,14
RUBBER PRODUCTS	4,12	6,40	0,87	2,10	-4,18	-2,24	3,11	0,97	-0,70
LEATHER PRODUCTS	3,13	6,44	8,58	3,43	0,31	-2,83	3,28	3,33	2,72
CHEMICALS	5,23	6,68	9,96	5,36	-2,14	5,36	5,30	2,17	7,64
PHARMACEUTICALS	0,58	3,50	6,22	-2,06	-0,76	0,86	-0,75	1,35	3,51
SOAPS AND PARFUMS	3,24	6,71	7,24	0,21	-1,74	9,74	1,71	2,40	8,48
PLASTICS	8,34	6,21	9,49	1,53	-3,15	-3,46	4,88	1,42	2,81
TEXTILES	2,50	4,09	4,56	-3,46	-3,98	-3,40	-0,53	0,00	0,50
CLOTHING AND FOOTWEAR	8,76	3,43	9,59	5,98	1,18	4,54	7,36	2,30	7,04
FOOD PRODUCTS	4,47	3,33	6,75	0,19	3,65	-3,54	2,31	3,49	1,48
BEVERAGES	1,74	7,50	8,99	0,24	-1,88	-0,10	0,99	2,70	4,34
TOBACCO	-3,48	6,47	3,38	-1,05	1,04	3,43	-2,27	3,72	2,95
PRINTING AND PUBLISHING	2,21	1,76	3,38	-0,86	-2,30	-3,89	0,66	-0,29	-0,32
MISCELLANEOUS	5,17	7,25	6,90	-0,24	-0,04	-0,90	2,43	3,54	2,93
TOTAL	5,22	7,33	8,21	-0,42	-0,41	0,61	2,36	3,39	4,34

Source: IBGE, Industrial Census (1975,1980, 1985)

TABLE A2: AVERAGE SHARE OF LABOR, RAW MATERIALS AND CAPITAL INPUT

INDUSTRIES	1975 - 1980			1980 - 1985		
	Labor	Raw Mat	Capital	Labor	Raw Mat	Capital
MINERAL EXTRACTION	0,101	0,337	0,562	0,080	0,246	0,674
NONMETALLIC MINERALS	0,110	0,412	0,478	0,117	0,407	0,476
BASIC METALS	0,074	0,642	0,284	0,073	0,634	0,293
MECHANICAL EQUIPMENT	0,166	0,472	0,362	0,184	0,427	0,389
ELECTRICAL EQUIPMENT	0,089	0,524	0,387	0,105	0,459	0,436
TRANSPORT EQUIPMENT	0,074	0,664	0,262	0,097	0,609	0,294
WOOD PRODUCTS	0,115	0,468	0,418	0,126	0,447	0,428
FURNITURE	0,130	0,498	0,371	0,130	0,487	0,382
PAPER AND PULP	0,074	0,559	0,368	0,080	0,537	0,383
RUBBER PRODUCTS	0,067	0,623	0,311	0,082	0,579	0,339
LEATHER PRODUCTS	0,102	0,592	0,306	0,092	0,586	0,322
CHEMICALS	0,023	0,690	0,286	0,032	0,660	0,308
PHARMACEUTICALS	0,064	0,364	0,572	0,089	0,373	0,538
SOAPS AND PARFUMS	0,047	0,543	0,410	0,068	0,545	0,387
PLASTICS	0,084	0,512	0,403	0,093	0,494	0,413
TEXTILES	0,075	0,617	0,308	0,074	0,566	0,360
CLOTHING AND FOOTWEAR	0,108	0,528	0,364	0,114	0,482	0,404
FOOD PRODUCTS	0,042	0,715	0,243	0,047	0,685	0,268
BEVERAGES	0,077	0,487	0,436	0,096	0,506	0,398
TOBACCO	0,053	0,481	0,467	0,085	0,458	0,457
PRINTING AND PUBLISHING	0,158	0,339	0,504	0,180	0,349	0,471
MISCELLANEOUS	0,107	0,400	0,493	0,115	0,362	0,523
T O T A L	0,075	0,597	0,328	0,080	0,563	0,356

Source: IBGE, Industrial Census (1975, 1980, 1985)

TABLE A3: AVERAGE GROWTH RATES: CONSUMPTIÓN, INVESTMENT, EXPORTS AND IMPORTS EXPANSION (1975-1985, % PER YEAR)

SECTOR	CONSUMP	INVEST.	EXPORTS	IMPORTS
FARM PRODUCTS	5,3	4,1	2,8	4,1
MINERAL EXTRACTION	0,0	-0,8	3,7	-1,6
NONMETALLIC MINERALS	0,0	-0,8	30,7	-9,9
BASIC METALS	1,5	-0,8	30,1	-15,0
MECHANICAL EQUIPMENT	3,8	-0,8	10,6	-15,7
ELECTRICAL EQUIPMENT	3,8	-0,8	14,6	-5,0
TRANSPORT EQUIPMENT	0,6	-0,8	19,1	-3,3
WOOD PRODUCTS	0,0	-0,8	6,2	-15,6
FURNITURE	0,0	-0,8	14,8	-3,7
PAPER AND PULP	3,7	-0,8	22,6	-9,4
RUBBER PRODUCTS	0,0	-0,8	23,4	1,1
LEATHER PRODUCTS	0,0	-0,8	11,3	4,8
CHEMICALS	3,8	-0,8	15,9	-0,3
PHARMACEUTICALS	2,6	-0,8	8,3	13,3
SOAPS AND PARFUMS	3,8	-0,8	28,1	-9,3
PLASTICS	1,2	-0,8	34,1	5,0
TEXTILES	2,0	-0,8	6,3	-1,1
CLOTHING AND FOOTWEAR	3,8	-0,8	7,4	-2,8
FOOD PRODUCTS	2,2	-0,8	-0,8	11,0
BEVERAGES	1,9	-0,8	29,5	-2,5
TOBACCO	3,8	-0,8	6,6	-21,0
PRINTING AND PUBLISHING	0,0	-0,8	8,3	-5,1
MISCELLANEOUS	3,4	-0,8	12,7	-3,4
ELECTRICAL ENERGY	6,2	-0,8	0,0	0,0
CONSTRUCTION SERVICE	0,0	1,5	0,0	0,0
SERVICES	4,8	-0,8	7,4	-4,2
T O T A L	4,2	1,0	7,4	-4,2

TABLE A2: AVERAGE SHARE OF LABOR, RAW MATERIALS AND CAPITAL INPUT

INDUSTRIES	1975 - 1980			1980 - 1985		
	Labor	Raw Mat	Capital	Labor	Raw Mat	Capital
MINERAL EXTRACTION	0,101	0,337	0,562	0,080	0,246	0,674
NONMETALLIC MINERALS	0,110	0,412	0,478	0,117	0,407	0,476
BASIC METALS	0,074	0,642	0,284	0,073	0,634	0,293
MECHANICAL EQUIPMENT	0,166	0,472	0,362	0,184	0,427	0,389
ELECTRICAL EQUIPMENT	0,089	0,524	0,387	0,105	0,459	0,436
TRANSPORT EQUIPMENT	0,074	0,664	0,262	0,097	0,609	0,294
WOOD PRODUCTS	0,115	0,468	0,418	0,126	0,447	0,428
FURNITURE	0,130	0,498	0,371	0,130	0,487	0,382
PAPER AND PULP	0,074	0,559	0,368	0,080	0,537	0,383
RUBBER PRODUCTS	0,067	0,623	0,311	0,082	0,579	0,339
LEATHER PRODUCTS	0,102	0,592	0,306	0,092	0,586	0,322
CHEMICALS	0,023	0,690	0,286	0,032	0,660	0,308
PHARMACEUTICALS	0,064	0,364	0,572	0,089	0,373	0,538
SOAPS AND PARFUMS	0,047	0,543	0,410	0,068	0,545	0,387
PLASTICS	0,084	0,512	0,403	0,093	0,494	0,413
TEXTILES	0,075	0,617	0,308	0,074	0,566	0,360
CLOTHING AND FOOTWEAR	0,108	0,528	0,364	0,114	0,482	0,404
FOOD PRODUCTS	0,042	0,715	0,243	0,047	0,685	0,268
BEVERAGES	0,077	0,487	0,436	0,096	0,506	0,398
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MISCELLANEOUS	0,107	0,400	0,493	0,115	0,362	0,523
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Source: IBGE, Industrial Census (1975, 1980, 1985)

TABLE A3: AVERAGE GROWTH RATES: CONSUMPTIÓN, INVESTMENT, EXPORTS AND IMPORTS EXPANSION (1975-1985, % PER YEAR)

SECTOR	CONSUMP	INVEST	EXPORTS	IMPORTS
FARM PRODUCTS	5,3	4,1	2,8	4,1
MINERAL EXTRACTION	0,0	-0,8	3,7	-1,6
NONMETALLIC MINERALS	0,0	-0,8	30,7	-9,9
BASIC METALS	1,5	-0,8	30,1	-15,0
MECHANICAL EQUIPMENT	3,8	-0,8	10,6	-15,7
ELECTRICAL EQUIPMENT	3,8	-0,8	14,6	-5,0
TRANSPORT EQUIPMENT	0,6	-0,8	19,1	-3,3
WOOD PRODUCTS	0,0	-0,8	6,2	-15,6
FURNITURE	0,0	-0,8	14,8	-3,7
PAPER AND PULP	3,7	-0,8	22,6	-9,4
RUBBER PRODUCTS	0,0	-0,8	23,4	1,1
LEATHER PRODUCTS	0,0	-0,8	11,3	4,8
CHEMICALS	3,8	-0,8	15,9	-0,3
PHARMACEUTICALS	2,6	-0,8	8,3	13,3
SOAPS AND PARFUMS	3,8	-0,8	28,1	-9,3
PLASTICS	1,2	-0,8	34,1	5,0
TEXTILES	2,0	-0,8	6,3	-1,1
CLOTHING AND FOOTWEAR	3,8	-0,8	7,4	-2,8
FOOD PRODUCTS	2,2	-0,8	-0,8	11,0
BEVERAGES	1,9	-0,8	29,5	-2,5
TOBACCO	3,8	-0,8	6,6	-21,0
PRINTING AND PUBLISHING	0,0	-0,8	8,3	-5,1
MISCELLANEOUS	3,4	-0,8	12,7	-3,4
ELECTRICAL ENERGY	6,2	-0,8	0,0	0,0
CONSTRUCTION SERVICE	0,0	1,5	0,0	0,0
SERVICES	4,8	-0,8	7,4	-4,2
T O T A L	4,2	1,0	7,4	-4,2

TEXTOS PARA DISCUSSÃO

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231. Amadeo, E.J., "Desemprego: Teorias e Evidências sobre a Experiência Recente na OECD".

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238. Carneiro, D.D. e R.L.F. Werneck, "Brazil: Medium-Term Development and Growth Resumption in Brazil".

239. Franco, G.H.B., "Liberalização: Cuidados a Tomar".

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248. Amadeo, E.J., "Keynes, Kalecki e abordagem neoclássica sobre a 'causalidade' entre emprego e distribuição".

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251. Bonelli, R. e E. Landau, "Do Ajuste à Abertura: a Economia Brasileira em Transição para os Anos 90".

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253. Cunha, L.R.A., "Congelamento e Preços Relativos: a Experiência Brasileira".

254. Amadeo, E.J. e E.K. Bastos, "Malthus e Ricardo sobre a Determinação da Taxa de Lucro".

255. Fritsch, W. e G.H.B. Franco, "Trade Policy, Trade Performance and Structural Change in Four Latin American Countries, 1970-1985".

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