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Productivity, growth *and industrial exports* in Brazil

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Because productivity is a determinant of comparative advantages over the medium and long terms, the relationship between productivity, industrial growth and exports of manufactures is coming under increasing scrutiny in studies on development and trade policy. This article analyses that relationship in Brazil, where the rise in industrial productivity has been slowing since the mid-1970s. The author examines this slowdown together with its causes, which include macroeconomic conditions, trade strategies, growth policies and technological trends. The theoretical aspects of the relationship between growth, productivity and export orientation are also explored, and the performance and structure of Brazil's exports of manufactures are examined, as are changes in their competitive position according to different estimates. Data from the 1985 industrial census are used to delve further into this subject, and finally some salient conclusions are presented.

I

Introduction

In addition to being the only way to raise the living standards of our societies, productivity growth is also one of the few ways of improving a country's competitive position in the international marketplace over the long term. From the standpoint of price competitiveness, if a country's productivity is consistently lower than that of its trading partners, then the only way it can compete at the international level is to pay lower wages. The sole alternative is to raise its productivity.

The fact that Brazilian industry's productivity growth appears to have been slowing down since around the mid-1970s is therefore a cause for concern (see table 1). This article will demonstrate in some detail how this productivity dynamic is closely related to long-term variations in industrial growth rates.[1] Thus, the average annual growth rate of industrial output for the period 1920-1992 was 6.24%, while the corresponding rate for employment during the same period was 3.46%. This means that labour productivity climbed at an average annual rate of 2.68% during that 72-year period. By comparison, the lackluster performance seen in the 1980s provides an alarming contrast, despite the seeming improvement registered between 1985 and 1992.

Actually, the results for this latter period are almost entirely due to the fact that employment fell far more steeply than output during the last two of those years.[2] The question as to how much of this change is accounted for by the need to adjust to the trade liberalization measures now being implemented and how much is due to a decline in production that has not been balanced by a matching change in the pace of technical progress is a subject that warrants further study.[3]

The logical questions to be asked when analysing this slowdown in productivity growth are whether it is due to macroeconomic factors, whether it is a reflection of pre-existing trade or development strategies, whether it stems from technological trends, or whether it is merely the result of the types of development processes being experienced in Brazil. A closely related question, in view of Brazil's increasing integration into the international economy (a process which has gathered speed since 1990 thanks to the country's ambitious experiment with trade liberalization), is what kind of relationship (if any) exists between this process and the slowing of productivity growth. One way of looking into this question is by analysing the country's export performance.

Brazil's exports of manufactures have undergone a notable expansion and diversification in terms of both products and geographical markets as part of a process that began in the mid-1960s and continued until quite recently.[4] Until the mid-1980s, these increases had to do with the difference between the returns to be obtained from producing for export versus producing for the domestic market. During the second half of the 1980s, however, something quite baffling occurred: exports continued to expand, or at least held steady at their existing levels, despite a steep decline in all indicators of competitiveness. This suggests that some other sorts of factors are at work which competitiveness indexes have failed to pick up.

□ This article is a revised version of a paper prepared for ECLAC in August 1992, considerably improved thanks to the comments made by Armando Castelar Pinheiro.

[1] The figures for the 1950s merit a more careful examination because they do not appear to fit in with this long-term trend. This anomaly may be due to the type of industrialization that took place in the 1950s, which involved the introduction of new, highly capital-intensive, labour-saving technologies on a scale never before seen in the country.

[2] Manufacturing output dropped by about 0.6% in 1991 and by another 5% in 1992. The decreases in employment for those years were 10.2% and 8.9%, respectively (the variation in the number of paid hours of labour in production activities has been used in place of the number of man/hours worked). Consequently, the increase in labour productivity for 1991-1992 amounted to 15.4%.

[3] This result might also be a reflection of a "tertiarization" of industrial activities, since the data on production refer to gross output rather than to value added. However, given the magnitudes involved, this hypothesis would appear to be insufficient to account for all of the productivity growth registered in those two years.

[4] Exports of manufactures rose from about US$1 billion in the late 1960s to about US$30 billion by the start of the 1990s.

TABLE 1

Brazil: Annual average growth rates of manufacturing output and labour productivity in selected periods
(Percentages)

	1920-1939	1939-1949	1949-1959	1959-1970	1970-1975	1975-1980	1980-1985	1985-1992
Output	6.3	7.9	9.3	7.2	10.7	7.3	-0.6	-0
Productivity	1.4	2.7	6.8	3.0	3.3	1.5	0.4	1.7

Source: Estimates prepared by the author on the basis of census data; up to 1985, see Brazilian Geographical and Statistical Institute (IBGE, 1989); after 1985, see IBGE, *Pesquisa industrial mensal. Produção física* and *Pesquisa industrial mensal. Datos gerais* (various issues).

At least three possible explanations for this phenomenon –none of which are mutually exclusive– may be advanced: (i) a shift in the product mix towards more competitive products; (ii) hysteresis in terms of export volumes due, for example, to the previously-incurred costs involved in penetrating external markets; [5] and (iii) cross-sectoral differentials in productivity growth, which would generate comparative advantages for some of those sectors. The object of this article is to evaluate these possibilities on the basis of an empirical analysis of the relevant variables.

II

Competitiveness of exports of manufactures

Since the mid-1960s, Brazilian exports have undergone rapid growth and diversification in terms of both their product mix and geographical markets, with the share of total exports represented by manufactures jumping from 41% in 1970 to 87% in 1989-1991 (see table 2).[6] Both the growth rate and the structural changes seen in the country's export pattern were more marked in the 1970s than in the following decade. During the 1970s, traditional exports steadily lost ground, whereas during the 1980s only a small group of industries (metal products, transport equipment and, to a lesser extent, paper and paperboard and communications and electrical equipment) exhibited significant growth. Until the mid-1980s, these increases were associated with profit differentials between external and domestic sales. However, some of the policies adopted to boost exports had to be abandoned towards the close of the 1970s, with their place being taken by real devaluations of the cruzeiro during certain periods, such as 1983-1985. This, coupled with the existence of idle industrial capacity and the growth of the world economy up to 1989, helped to bring the value of exports up to present levels. Despite this apparent success, Brazil's export performance since the mid-1980s has been quite odd in that exports have increased, or at least held steady, despite a decline in various indicators of competitiveness.[7] This question will be investigated further in the remainder of this section.

[5] In this context, the hysteresis would take the form of a delay in reacting to sharp changes in the exchange rate; this phenomenon may be heightened if domestic demand is weak.

[6] The Brazilian Geographical and Statistical Institute (IBGE) classifies processed agricultural raw materials as industrial products. Using the classification of the former Bureau of Foreign Trade (CACEX) –now the Department of Foreign Trade (DECEX)– the share of manufactures and semi-manufactures in total exports is around 70%.

[7] Although the data for 1992 are not yet available, the classification used in table 2 serves to show that the country's export performance for that year fits in with the above-mentioned trend. Total exports climbed from US$31.3 billion in 1991 to US$36.2 billion in 1992: an increase of some 16%.

TABLE 2

Brazil: Exports of manufactures by industrial sectors in selected years (1970-1991)
(Billions of dollars FOB and percentages)

Sectors	1970	%	1975	%	1980	%	1985	%	1989	%	1991	%
Metal products	112	10.0	263	4.3	1 165	6.8	2 627	11.9	6 343	21.3	6 112	22.4
Machinery	65	5.8	408	6.7	1 494	8.7	1 492	6.7	1 966	6.6	1 735	6.4
Electrical equipment	24	2.1	178	2.9	488	2.8	593	2.7	1 178	4.0	1 110	4.1
Transport equipment	23	2.1	317	5.2	1 434	8.4	1 804	8.2	3 812	12.8	3 049	11.2
Wood	109	9.7	140	2.3	383	2.2	299	1.4	408	1.4	443	1.6
Paper and paperboard	6	0.5	58	1.0	513	3.0	534	2.4	1 286	4.3	1 230	4.5
Leather	42	3.7	71	1.2	126	0.7	166	0.8	256	0.9	314	1.2
Chemicals	107	9.5	1 013	16.7	3 014	18.1	4 868	22.0	5 495	18.4	4 094	15.0
Textiles	75	6.7	422	7.0	738	4.3	786	3.6	1 083	3.6	1 095	4.0
Wearing apparel and footwear	14	1.2	138	3.9	477	2.8	1 017	4.6	1 473	4.9	1 364	5.0
Foodstuffs	464	41.3	2 607	43.0	6 008	35.1	6 053	27.4	4 670	15.7	4 504	16.5
Tobacco	33	2.9	149	2.5	295	1.7	459	2.1	539	1.8	799	2.9
Miscellaneous	9	0.8	61	1.0	225	1.5	272	1.2	474	1.6	521	1.9
Other [a]	41	3.6	143	2.3	689	4.0	1 143	5.2	830	2.8	935	3.4
Total	**1 125**	**100**	**6 066**	**100**	**17 136**	**100**	**22 114**	**100**	**29 812**	**100**	**27 303**	**100**
Manufactures / Total (%)	141.1		70.0		85.1		86.3		86.7		87.3	

Source: Bureau of Foreign Trade (CACEX)/Foreign Trade Research Centre Foundation (FUNCEX)/IBGE.
[a] Includes non-metallic minerals; furniture; rubber; pharmaceuticals; perfumery, soap and candles; plastics; beverages; printing and publishing.

One indicator (not often used in Brazil) for estimating trends in a country's price competitiveness is the unit cost of labour as compared to that of its trading partners.[8] From a longer-term perspective, a series on unit costs of labour for the Brazilian manufacturing sector shows a nearly continuous growth trend, with definite interruptions only in 1982-1984 and possibly 1991.[9] Furthermore, annual movements are, in large part, accounted for by variations in the ratio between wages and the exchange rate (see table 3), which are strongly influenced by movements in the latter variable (Thompson-Flores, 1992; BNDES, 1992). Of course, the unit-cost index can be expressed as the relationship between average wages in real terms (or denominated in a foreign currency) and labour productivity. The table clearly shows that, on average, productivity rose very slowly after 1980. After 1987, the increases can be accounted for by the decline in employment levels, as noted earlier. This means that dollar-denominated wages were the main cause of the variation in the unit cost of labour,[10] especially in the 1980s.

The table also shows the average unit cost of labour (UCL) for a group of countries that purchase around 70% of Brazil's exports and, in the last column, the ratio between the unit cost of labour in these trading partners and in Brazil, i.e., the relative unit cost of labour (RUCL). According to this indicator, in the years between the mid-1980s and 1989, Brazil witnessed an unprecedented deterioration in the competitive position of its exports. The upturn seen in 1990 and, especially, in 1991 brought the relative unit cost of labour back up to the levels of the late 1970s. This analysis therefore points to the

[8] The unit cost of labour is measured as the wage cost per unit of production; for comparisons between different countries, this indicator should be expressed in a common monetary unit. See, for example, BNDES (1992).

[9] See Fagerberg (1988) for a critical review of the use of unit costs of labour as long-term competitiveness indicators.

[10] Average wages in dollars rose by 12.5% per year between 1970 and 1972 and 1980 and 1982, chiefly because of the devaluation of the dollar in the 1970s. The data also indicate that real wages in cruzeiros followed a pro-cyclical trend during that period. Between 1984-1985 and 1989, the cruzeiro devaluation rate was below domestic inflation and wage policies were being relaxed (BNDES, 1992).

TABLE 3

Brazil: Unit costs of labour, productivity and relative unit costs of labour (RUCL), 1970-1991
(1987 = 100)

Year	UCL in Brazil	Productivity of labour	Wage/exchange rate ratio	Average UCL in countries purchasing Brazilian exports	RUCL [a]
1970	44.0	79.9	35.2	33.0	75.1
1971	36.0	83.8	30.2	35.5	98.5
1972	34.7	89.4	31.0	38.6	111.3
1973	44.3	94.1	41.7	43.6	98.4
1974	53.0	92.2	48.9	49.7	93.7
1975	63.0	93.8	59.1	58.1	92.2
1976	68.9	97.8	67.3	57.9	84.1
1977	78.0	95.8	74.7	63.1	80.9
1978	89.9	97.1	87.2	72.1	80.3
1979	95.1	98.4	93.7	80.3	84.4
1980	89.4	100.9	90.3	88.0	98.5
1981	109.1	95.4	104.1	85.2	78.1
1982	119.1	99.3	118.3	83.7	70.3
1983	78.6	98.7	77.6	79.7	101.4
1984	68.6	103.4	71.0	74.5	108.6
1985	76.9	102.8	79.0	74.3	96.7
1986	90.9	100.9	91.7	90.3	99.3
1987	100.0	100.0	100.0	100.0	100.0
1988	115.5	100.5	116.1	102.0	88.4
1989	166.3	106.2	176.7	100.4	60.4
1990	165.2	103.2	170.4	110.6	66.9
1991	135.1	114.2	154.3	115.8	85.7

Source: Organization for Economic Cooperation and Development (OECD), IBGE and International Foundation for Science (IFS)/ International Monetary Fund (IMF). For 1970-1985, Thompson-Flores (1992); after 1985, estimates prepared by the author.
[a] Ratio between the weighted average of the UCLs for Brazil's 11 main trading partners and Brazil's UCL, expressed in dollars.

conclusion that during the 1980s the competitiveness of the country's exports was greatly impaired by macroeconomic conditions –especially fluctuations in the exchange rate– rather than by changes in productivity.

The question that arises here is whether or not this conclusion holds true for this indicator only. In order to find the answer to that question, we may examine a number of other indicators (see table 4). Regardless of which index is chosen, the figures leave no doubt as to the fact that price competitiveness diminished up until 1990, and the recovery seen in the last biennium was not strong enough to return the indicators to the levels seen in the mid-1980s.

The surprising aspect of all this is that export levels have held steady –and have sometimes even increased, as in 1988-1989– despite the deterioration of price (or cost) competitiveness. The econometric results, based on estimates of export functions (Bonelli, Franco and Fritsch, 1992), also support the conclusion that non-price-related variables have become relatively more important than price in accounting for the country's export performance. There are at least three possible explanations for this:

(i) A shift in the export product mix towards more competitive products. However, the figures presented above indicate that structural changes in the export pattern during recent years (e.g., between 1985 and 1989) have been slight, which makes this factor less relevant;

(ii) Hysteresis in export volumes due, for example, to prior unrecoverable costs. According to this explanation, the maintenance of large export volumes could be a reflection of the costs incurred by business firms in penetrating new markets or of the existence of long-term contracts (e.g., in the case of metal ores or wood pulp), with the hysteresis phenomenon in this case taking the form of a delay in reacting to sudden exchange-rate variations, due perhaps to the existence of unrecoverable costs

TABLE 4
Brazil: Export competitiveness indicators
(1988 = 100)

Year	Wage/ exchange rate ratio	Real exchange rates		
		Deflated by CPI [a]	Effective	Deflated by WPI [b]
1985	138.1	...	132.9	102.9
1986	115.0	122.1	131.3	109.7
1987	111.0	108.5	120.6	113.7
1988	100.0	100.0	100.0	100.0
1989	80.4	77.5	84.0	81.9
1990	69.7	57.8	64.1	66.0
1991	84.9	65.4	85.9	85.4
1992	79.4	69.1	83.2	86.0

Source: Economic status report by the Economics Department of the National Federation of Industry (CNI).
[a] CPI: consumer price index.
[b] WPI: wholesale price index.

(Krugman, 1989). In other words, once a company has managed to win a new market or to sign a long-term contract, it will be inclined to continue supplying that market even if price/cost margins narrow or disappear altogether (albeit only temporarily). This effect tends to be more marked if domestic demand is slack or if the firm was founded for the sole purpose of exporting. This hypothesis reconciles the indicators with the country's export performance. It also implies a narrowing of export profit margins for some time, unless other cost-cutting measures have been implemented; [11]

(iii) The existence of sectorally differentiated changes in productivity that could give comparative advantages to certain activities or products. This hypothesis will be explored in greater detail in sections V and VI.

III

Causes of Brazil's export growth in the 1980s and in selected sub-periods

This section will present the results obtained by applying the constant market shares (CMS) model to Brazilian export growth in the 1980s (from 1979 to 1989/1991) [12] and in selected sub-periods and will discuss how those results compare with the figures for the 1970s, using a sample composed of 26 countries. [13] The shares of Brazilian exports purchased by these countries, grouped by major areas, are shown in table 5.

The categories of merchandise used in the breakdown correspond to the 10 sections of the Standard International Trade Classification (SITC). Table 6 shows the share of Brazil's exports in each of these categories in 1979, 1984, 1989 and 1991.

One of the main hypotheses of the CMS model is that a country will increase its share in world trade –i.e., it will rise above the mean– if its exports: (i) are concentrated in merchandise for which demand is expanding more rapidly; (ii) are directed to markets or countries in which demand is expanding relatively more rapidly; and (iii) benefit from other forms of increased competitiveness, apart from those mentioned above.

[11] Incidentally, it should be noted that increases in labour productivity such as those recorded in 1991 and 1992 (a cumulative rise of about 15% for the biennium) also help to reduce costs.

[12] See Bonelli, Franco and Fritsch (1991 and 1992) for similar exercises for the period up to 1989. See also Batista and Fritsch (1993) for an analysis at a higher level of disaggregation, using a different methodology, for the period 1979-1990.

[13] The sample covers 77% of total Brazilian exports in 1979 and in 1984 and nearly 75% of total exports in 1989, which means that exports may have become more diversified; this, in turn, suggests a higher degree of competitiveness than was indicated by the analysis. The share of world imports accounted for by the group of countries making up the sample also expanded between 1979 and 1989 (75% in 1979, 74% in 1984 and 78% in 1989, according to the *International Financial Statistics Yearbook, 1990).* The countries included in the sample were: United States and Canada; Austria, Belgium, Denmark, France, Germany, Hungary, Italy, Netherlands, Portugal, Spain, Sweden, Switzerland and United Kingdom, plus Egypt; Argentina, Chile, Mexico, Paraguay and Venezuela; Japan, China, Hong Kong, Australia and the Union of Soviet Socialist Republics.

TABLE 5

Brazil: Exports to sample country groups, 1979, 1984, 1989 and 1991
(Percentages)

	1979	1984	1989	1991
United States + Canada	20.5	30.0	26.5	21.2
Europe [a]	35.3	28.7	31.0	32.5
Latin America	12.5	7.9	7.2	12.3
Asia + Union of Soviet Socialist Republics	8.8	10.1	10.9	10.4
Total	**77.1**	**76.7**	**75.6**	**76.5**
Share of world imports accounted for by countries in sample	75.2	74.3	79.4	80.2

Source: Brazilian foreign trade statistics.
[a] Includes Egypt.

TABLE 6

Brazil: Exports by SITC sections, 1979, 1984, 1989 and 1991
(Percentages)

SITC sections	1979	1984	1989	1991
(0) Food and live animals	41.5	35.2	16.8	21.1
(1) Beverages and tobacco	2.5	2.8	2.0	3.2
(2) Crude materials, inedible, except fuels	15.0	12.3	16.7	15.8
(3) Mineral fuels, lubricants and related materials	0.3	0.4	2.8	1.7
(4) Animal and vegetable oils, fats and waxes	2.7	1.7	1.1	0.1
(5) Chemicals and related products, n.e.s.	2.7	5.7	6.0	6.1
(6) Manufactured goods, classified chiefly by material	15.2	18.7	25.3	25.0
(7) Machinery and transport equipment	14.3	11.8	22.2	19.5
(8) Miscellaneous manufactured articles	5.4	7.4	7.0	7.3
(9) Commodities and transactions not classified elsewhere in SITC	0.3	0.1	0.2	0.2
Total	**100.0**	**100.0**	**100.0**	**100.0**

Source: United Nations, *Yearbook of International Trade Statistics*, (various issues) and Brazilian foreign trade statistics.

The implicit assumption is that if it were not for these factors, the country's share in international trade would remain constant. The difference between this norm and a country's actual trade performance is attributed to competitiveness, which can then be broken down into a product-mix effect, a market-distribution, or destination, effect and a competitiveness effect per se, which may be obtained residually as a result of the interaction between factors of demand and of supply, including such factors as productivity growth (Leamer and Stern, 1970).

A negative residual would signify that a country has not been able to maintain its trade share. A positive residual would mean that it has managed to increase that share. In either case, the result may be due, for example, to: (i) (permanently or temporarily) differential rates of increase in export prices (since exports are measured at current prices), which may be caused by exogenous factors (such as rising international prices) or endogenous factors having to do with the movement of the exchange rate; (ii) differential rates of improvement in quality; (iii) the production of new exports; (iv) improvements and increases in the efficiency of marketing activities or the financing of export sales; and (v) relative changes in the skill and speed with which orders are filled.

TABLE 7

Brazil: Sources of export growth, 1979-1991 and selected sub-periods
(Annual percentages)

	Percentage variation in exports						
	1979-1980	1980-1984	1984-1985	1985-1989	1989-1990	1990-1991a	1979-1989
Expansion of international trade	20.1	-1.0	6.3	12.2	14.6	-4.8	6.9
Export product mix	-13.9	1.4	-0.7	1.3	...[b]	...[b]	-0.5
Market distribution	6.5	-0.4	-1.6	-2.3	-2.5	15.6	-0.7
Increase in competitiveness	14.3	8.5	-8.8	-4.3	-16.6	-11.2	2.4
Total[c]	**27.0**	**8.5**	**-4.7**	**6.9**	**-4.5**	**-0.3**	**8.1**

Source: Estimates (see table 6).
[a] The figures for 1990-1991 are preliminary.
[b] Data unavailable; this category is included in the competitiveness residual.
[c] The totals do not necessarily equal the sum of the individual entries due to rounding.

Table 7 gives the results of a breakdown using the CMS method for selected periods between 1979 and 1990-1991 (in partial terms for these last years, since the information is incomplete) and for the periods 1980-1984 and 1985-1989 as a whole. Since the order in which the product-mix and market-distribution effects are computed alters the results, we chose to present an average of the two alternatives. The estimates for 1990-1991 merge these two effects into one. In the breakdown shown in this table, and in all the others that follow, results are given as a function of average national growth rates for the relevant period.

Looking at the period 1979-1989, we arrive at the conclusion that increased competitiveness accounts for about one-third of the growth rate for Brazilian exports during that time; when 1990 and 1991 are included, however, the significance of the increase in competitiveness becomes almost negligible, which gives us an idea of just how large a loss was sustained during those two years. It should also be noted that both the export pattern's product-mix effect and its market-distribution, or destination, effect played a part in slowing down Brazil's export growth rate. This is particularly true of the destination effect, which indicates that total exports are concentrated in the more slowly growing markets.

The results for the entire decade (1979-1989) are, up to a point, similar to those obtained by Horta (1983, p. 519) for the period 1971-1978: 71.4% of the growth rate for total Brazilian exports (excluding fuels) is accounted for by the expansion of world trade and 39.1% is attributable to the competitiveness effect; the product-mix effect accounts for -9.0% and the destination effect for only -1.5% of the total growth rate. Our results (i.e., the averages of the results for the two different orders in which the breakdown can be performed) for 1979-1989 for these two effects are -5.9% and -12.6%, respectively.[14]

When the two five-year periods 1979-1984 and 1984-1989 are examined, it becomes clear that the figures for the decade as a whole fail to reflect some quite marked differences. In particular, it is only during the first of these sub-periods that substantial increases in competitiveness are to be observed. If we exclude the year 1979 on the grounds that it is atypical, then the estimates shown in the above table indicate that virtually all of the increase in exports seen between 1980 and 1984 was due to improved competitiveness (i.e., greater penetration of international markets). This is all the more remarkable when we consider the fact that international trade declined between the beginning and closing years of that period.

[14] It should be noted that the breakdowns are based on quite different export growth rates: in the period 1971-1978, the average annual growth rate was 23.6%, whereas in the period 1979-1989, it was 8.1%.

When we look at the period 1979-1984, we see that one-fifth of export growth is accounted for by world trade growth, while nearly 90% can be attributed to increased competitiveness. The destination effect is positive (owing to the concentration of exports in the United States and Canada) but small, while the export pattern's product-mix effect reduced the aggregate growth rate by about 10%.

The breakdown for the following years yields strikingly different results, including a decline in competitiveness and, secondarily, a reduction in the expansion of exports owing to their concentration in markets where demand was growing more slowly. The downturn in the competitiveness of Brazil's exports, according to this method, appears to have begun as early as 1985.

The above analysis can be carried further by breaking down exports into two groups: manufactures and non-manufactures. For our purposes here, the former can be equated with SITC sections 5 through 8 (whose share of total exports rose from 37.6% in 1979 to 59.9% in 1989) and the latter with the remaining sections. This classification is much more restrictive than the one used by CACEX (according to which manufactures represented nearly 72% of total exports in 1989) and IBGE (which put the figure at 87.5% for 1989). Table 8 shows the results of the breakdown for manufactures while table 9 gives the figures for non-manufactures.

Once again, if we consider the decade 1979-1989 as a whole, we see that nearly half the growth rate for exports of manufactures (versus one-third, in the case of total exports) is attributable to increased competitiveness. As before, the product-mix effect of the export pattern is negative, but only slightly so (only 2.5% of the average rate). In contrast, the negative effect of the market-distribution factor represents about 13% of that rate. As in the case of total exports, if we divide the relevant period in two, we find that increases in competitiveness were largely concentrated in the first half of the decade. Furthermore, the whole of the decline recorded during the second half of the decade, in the case of manufactures, took place in 1985; in fact, there was actually a positive change in competitiveness –equivalent to nearly 18% of the rate– during the four-year period 1985-1989, and it would have been even greater had it not been for the very negative influence of the market-distribution effect (equivalent to nearly one-third of the rate) on the export growth rate.

Table 9 shows the results of the breakdown for SITC sections 0 through 4, which mainly include primary commodities and manufactures involving a low level of processing. The slow growth of world trade in these products as compared to manufactures is striking, since the former's increase in value amounted to only 17% for the decade (occurring mainly in 1980) versus 153% for manufactures. It is also interesting to note that, contrary to the situation with respect to manufactures, the product-mix effect for sections 0-4 was markedly positive and, because of the figures for the years from 1985 to 1989, played the largest part in determining the growth rate. This means that Brazil's exports of non-manufactures are concentrated in the products for which demand is growing most rapidly. This effect exerts the strongest influence of all from 1984 on.

An analysis of this table also reveals the source of the deterioration in the competitive position of total exports for the four years from 1985 to 1989 and, hence, the cause of the slow pace at which competitiveness increased for the decade as a whole: indeed, during this four-year period the figure for the competitiveness effect was a negative 49.2%. This figure, when added to the negative 9.8% registered for 1984/1985, more than outweighs the increase of nearly 53% recorded for this effect for the years between 1979 and 1984.

Thus, if we break down the sample into two different product categories, we see that the loss of competitiveness is chiefly due to the performance of non-manufactures. Even in the case of manufactures, however, the breakdown shows that the increase in competitiveness between 1985 and 1989 was small, not only in absolute terms but also in comparison to the growth of world trade. This is all the more serious because, as mentioned earlier, Horta (1983) estimates the increase in manufactures' competitiveness at 71% of the corresponding growth rate between 1971 and 1974, versus 43% for the years between 1974 and 1978. In our study, as we have seen, the figure plunges from nearly 75% of that rate between 1979 and 1984 to 6.5% between 1985 and 1989. In short, according to the CMS analysis, between 1985 and 1990 even the performance of Brazil's exports of manufactures was not what could be called brilliant in terms of increased competitiveness.

TABLE 8

Brazil: Sources of growth in exports of manufactures (SITC sections 5-8), 1979-1989
(Annual percentages)

	Percentage variation in exports				
	1979-1980	1980-1984	1984-1985	1985-1989	1979-1989
Expansion of international trade	10.6	2.9	10.9	16.4	9.7
Export product mix	0.3	-0.4	-1.9	...	-0.3
Market distribution	10.5	-1.7	-2.0	-4.5	-1.7
Increase in competitiveness	1.0	12.9	-7.7	2.6	5.6
Total	**22.4**	**13.6**	**-0.7**	**14.5**	**13.3**

Source: United Nations, *Yearbook of International Trade Statistics,* various issues, and Brazilian foreign trade statistics.

TABLE 9

Brazil: Sources of growth in exports corresponding to SITC sections 0-4, 1979-1989 and selected sub-periods
(Annual percentages)

	Percentage variation in exports				
	1979-1980	1980-1984	1984-1985	1985-1989	1979-1989
Expansion of international trade	23.0	-3.7	-1.4	2.8	1.5
Export product mix	-19.8	2.6	4.4	7.9	2.3
Market distribution	4.3	0.3	-1.3	-0.5	0.2
Increase in competitiveness	22.5	5.7	-9.8	-15.6	-3.5
Total	**29.9**	**5.3**	**-8.0**	**-1.0**	**3.5**

Source: United Nations, *Yearbook of International Trade Statistics*, various issues, and Brazilian foreign trade statistics.

IV

Productivity, growth and exports: representative data

Considerable attention has been devoted to the relationship between the growth of productivity and of production and export performance in the specialized literature on trade and development policy, owing to the pivotal role this relationship plays in the design of trade and growth strategies. Since productivity growth is a potentially significant factor in determining comparative advantages over the medium and long terms, a number of different hypotheses have been formulated as researchers seek to explore its causes and implications with regard to foreign trade performance.

The existing literature has not conclusively shown that more open trade policies are invariably associated with more efficient production or greater productivity, however. This may be due to a lack of formal, verifiable models, since it is only very recently that theoretical models which relate these variables have been formulated. This absence of precise, formally-established means of analysis is compounded, in the case of developing countries, by the difficulty of arriving at empirically-based estimates of the relevant variables. These difficulties notwithstanding, one of the indexes of efficiency in innovation that is

often used in empirical research projects is the amount by which the growth rate for output exceeds the growth rate of total inputs. [15]

In lieu of suitable models, research in this area has relied on general data as a source of provable hypotheses. Nishimizu and Robinson (1986), for example, outline the links between trade policy and productivity performance on the basis of three different hypotheses: [16]

i) The first is based on the existence of a positive correlation between the growth of production and the growth of productivity (Verdoorn's Law, in the case of labour productivity). This argument is founded upon the existence of economies of scale, especially in manufacturing, the contention being that a trade-generated expansion of the market may give rise to an increase in productivity and a decrease in costs (Rodrik, 1992, p. 159). Although it is generally used in relation to the expansion of exports, this argument also applies to import substitution, in which case the end result will depend upon the size and structure of the domestic market. Thus, an outward-looking policy will probably be associated with greater efficiency by virtue of the effects of a larger market for exports, which makes possible fuller use of production capacity and specialization-based economies of scale. It should also be borne in mind that the greater use of factors of production (especially the utilization of production capacity) may also be a result of trade policy. In other words, the effects of trade policy in terms of efficiency/productivity take both direct (increased competition and efficiency in resource use) and indirect forms (fuller use of production capacity, a rise in investments that incorporate new technologies, and increased skill acquisition);

ii) The second hypothesis implies the existence of a challenge-response mechanism which, even though it is not always explicitly characterized as such in studies on the subject, refers to "X-efficiency": the increase in international competition brought about by trade liberalization (and export promotion) tends to raise domestic efficiency and to reduce costs. Protectionist policies, on the other hand, tend to reduce competitiveness and lead to inefficiency, as do excessive export subsidies. The causal mechanism implies that the expansion of exports and import substitution may boost productivity, depending upon the impact of cost-cutting incentives and market structure. [17] In perfect-competition models, a more open economy helps to improve resource allocation, thus prompting an increase in the value of domestic output. However, when the companies operating in a given country wield market power, competition from imports may cause them to expand their activities or to move out of the market. The net effect of liberalization on productivity depends on the characteristics of the demand shifts that accompany liberalization, the ease of entry and exit, and the nature of the competition in general; [18]

iii) The third hypothesis is taken from the literature on growth processes subject to the influence of foreign-exchange constraints and is based on the idea that, in developing countries, domestic intermediate goods and capital are not perfectly substitutable for imported intermediate goods and capital owing to the technical progress incorporated in the latter. Therefore, overprotection and the repression of imports will generate a less successful performance in terms of efficiency than will policies that increase the availability of imported raw materials and capital, such as, for example, policies aimed at boosting exports. It should be noted that, from this vantage point, exports are important solely as a source of funds for purchasing imports.

Not all authors agree with the idea that trade regimes and productivity are related, however. This position is expressed, for example, by Rodrik when he asks whether there is any reason to believe that trade strategy options will consistently have an effect

[15] In a recent essay, Pack notes that studies on productivity growth in less developed countries base their research primarily on growth performance accounting. Although this method has been criticized, it is difficult to imagine any feasible alternative. According to the same author, flaws in the measurement of total factor productivity notwithstanding, the learning process taking place in industry in general ought to be reflected in a corresponding increase in the measurements of such productivity (Pack, 1992, p. 28).

[16] Rodrik (1992, p. 158) adds a fourth. Inward-oriented systems often suffer from an exchange bottleneck and stop-and-go macroeconomic cycles; certainly, macroeconomic instability and the resulting tendency for output to drop below the level of full capacity at periodic intervals militate against productivity growth. The author concludes that these arguments tell us nothing about trade policy *per se*.

[17] However, opponents to this position contend that, whenever possible, entrepreneurs who maximize their profit margins will reduce their costs even if there has been no increase in competition.

[18] See also Tybout (1992) for a well-organized outline of the links between the trade regime and productivity.

on the level of technical efficiency and on how it changes over time; he then goes on to answer that question in the negative, arguing that trade policy theory generally tells us nothing about the effects of liberalization on the *growth rate* of production or productivity (Rodrik, 1992, p. 157).

Moreover, these hypotheses are not mutually exclusive, and their effects may not be distinguishable or independent from one another.[19] Perhaps the most important point here is that empirical studies have not even been able to determine the direction of causality, i.e., whether the more rapid growth of total factor productivity (TFP) is the result of a more open trade policy or vice versa. It is possible, in cases where domestic demand is limited (due, for example, to a recession), that exogenous productivity growth may cause a shift in the supply curve and create export incentives. In this connection, Pack (1988, p. 350) observes that correct specification of the structure of the lag is crucial, but has received little attention; the increased growth of TFP after liberalization has been completed can be interpreted as a delayed effect of the earlier import-substitution system. Alternatively, the failure of TFP growth to accelerate when liberalization is undertaken could also be a delayed negative effect of prior import substitution efforts.

Similar arguments can be advanced in regard to the expansion of exports. The most that can be said of recent cross-country studies, which have been strongly influenced by the high growth rates of newly industrializing countries in Asia, is that differences in the growth rates of production are associated with the expansion of exports (Pinheiro, 1989). Pinheiro's careful research into the relationship between export promotion and the growth of output leads him to conclude that the somewhat frustrating results of those studies have given rise to a change in the approach taken to variations in productivity. One conclusion of particular relevance to the subject at hand is that a cross-country analysis of the production function is not the best way to study the links between the orientation of trade policy and supply-side sources of growth (Pinheiro, 1989, p. 32).

This points up the need for detailed sectoral country studies that take the trade regimes and policies of each country into account.

V

Measuring productivity and export performance

The growth of production can be broken down, on the supply side, into the expansion of the production resources used and increases in the efficiency of their use (i.e., productivity). TFP is a possible measurement of that efficiency. Estimates of its variation are, at the very least, useful as descriptive statistics on productivity. Clearly, there would be more interest in their use if they could be formulated as a function of other variables.

One frequently-used approach to the rationalization of this concept is based on the assumption of the existence of a production function that expresses output as a concave function of the inputs vector and of a time index that permits the function to shift in response to technological change or to improvements in the efficiency of existing technologies. The time-indexed elasticity of output is TFP, which represents the difference between the growth rate of output and average growth rates of inputs, weighted by the elasticity of output in terms of each input. According to the (admittedly extreme and restrictive) hypothesis that each factor is the payment or value of its marginal product and that there are no fixed inputs, these elasticities would be the same as the factor shares and TFP would be estimated using, for example, a Divisia-type index[20] or, in the case of discrete variations, a Tornqvist index.

[19] Apart from international competition, domestic factors may also influence total factor productivity.

[20] Note that if prices were not equal to marginal costs and if the cost reductions occasioned by the expansion of capital were not equal to the rate of equipment rents, then two additional sources of profitability and, hence, of TFP could arise. See Bernstein and Mohnen (1991).

In any case, the resulting estimates sometimes meet with skepticism. During the past decade there has been growing recognition of the fact that traditional Tornqvist indexes of productivity growth actually reflect much more than innovation, economies of scale and efficiency-promoting movements: problems of errors in measurement, disequilibria and biases of aggregation may easily create the illusion of trends and correlations that have no basis in the economic processes we are trying to comprehend (Tybout, 1992, p. 206).

In recent years we have also witnessed the emergence of new, more flexible and less restrictive functional ways of measuring productivity. In all of them, however, the rate of variation of TFP is defined as the portion of the growth rate of output that is not accounted for or "explained" by the combined use of the relevant inputs and factors. This is the context for the estimates presented here.

Recent estimates of TFP trends in Brazil are to be found in studies by Bonelli (1976), Pinheiro (1989 and 1992) and Bonelli (1992), with either added value or the value of output being used as a measurement of production. The methodological differences between these studies notwithstanding, the more recent studies have one thing in common: they all indicate that the growth of TFP appears to have been greater during the first half of the 1980s than during the second half of the 1970s. Since the former period was a time of slower growth owing to the 1981-1983 recession, this finding is surprising and, at first glance, appears to contradict Verdoorn's Law. However, a recent study using a cross-sectional analysis found that within each period the growth of output correlates with the growth of TFP at the two-digit level of the Brazilian industrial classification (Bonelli, 1992).

Thus far no estimates of TFP growth have been prepared for years after 1985. A pioneering effort to do so in a way that does not involve measurements of the stock of capital is presented below (on this subject see also Harberger, 1990). Let us first consider a model for breaking down added value:

$$v = a \times l + b \times c + tfp$$

where v is the growth rate of value added in real terms, a and b are weightings ($a + b = 1$, as is customary), l and c are the growth rates for inputs of labour (hours worked) and capital, respectively, and tfp is the productivity growth rate. Note that capital inputs can be represented as the real stock multiplied by the capital use rate. In terms of rates of variation (ignoring second-order variations) it can be said that:

$$c = k + w$$

where k is the real growth rate of the capital stock and w is the rate of variation in capital use. If, in addition, we assume that the potential capital/output ratio (VA) is roughly constant, then the conclusion is that the stock of capital and *potential* real output will grow at the same rate:

$$k = v^*$$

where v^* is the growth rate of potential output (or potential VA). Since the relationship between actual output and potential output is determined by the rate of utilization of production capacity, however, we can say, in terms of variation rates, that:

$$v^* = v - u$$

where u is the rate of variation in capacity use and terms of the second order are not taken into account. If we substitute these last three (approximate) identities in the first equation, we get:

$$v = a \times l + b \times [v + (w - u)] + tfp$$

If we then add the hypothesis that the use rates for capital and production capacity vary by the same proportion (i.e., that $w = u$), we find that:

$$tfp = (l - b) \times v - a \times l = a \times v - a \times l = a \times (v - l),$$

since $(l - b) = a$

It has thus been demonstrated that in the short run (which is when these approaches are probably the most valid), the variation in total factor productivity must be very close to the variation in labour productivity. Note, too, that the foregoing could also have been done starting with the concept of the value of output, instead of VA, plus material inputs. In this case we would begin with an expression for the variation of TFP such as:

$$y = a \times l + b \times c + d \times m + tfp$$

where y is the growth rate for the value of output, m is the real increase in raw material use and $a + b + d = 1$, as is customary. This raises the additional problem of how to estimate the increase in real raw material use (m). Nevertheless, if we assume that there will be little change in the product mix of output, then it would seem reasonable to hypothesize that raw material use will rise by the same proportion as output ($m = y$). In this case, we get:

$$y = a \times l + b \times y + d \times y + tfp$$

As before, the following step can be used to arrive at the variation in total factor productivity:

$$tfp = (l - b - d) \times y - a \times l = a \times (y - l)$$

which is directly related to the rate of variation of labour productivity. We next use an expression of this type to estimate the annual variation in the TFP of Brazilian industries between 1985 and 1991, taking care to update the weightings for each year. Table 10 gives the annual average for that period as well as for the two preceding five-year periods, the growth of industrial output between 1975 and 1991, and the growth rate of exports of manufactures for 1975-1990.

These figures corroborate the findings of earlier studies which have concluded that, for manufacturing as a whole: (i) the growth rate for TFP was higher during the recessionary period of 1980-1985 than it was in 1975-1980; and (ii) after 1985, increases in TFP were almost negligible, especially if we exclude the year 1991 (and 1992, which does not appear in the table). [21]

Examination of the data also reveals that the first three columns are not interrelated; in other words, the arrays of TFP variations did not remain constant during the periods analysed here. The Spearman coefficients of correlation approach 0.2, which belies the hypothesis of association. The arrays of the last three columns are indeed associated, however. The Spearman coefficient for output/exports is 0.36; for TFP/production variations it is 0.51; and for TFP/export growth it is 0.49. In no case can the hypothesis of (positive) association be ruled out. In the following section we will continue this analysis with data at a higher level of disaggregation; given the computational difficulties involved in estimating TFP at a more disaggregated level, we will use labour productivity as the central variable.

[21] Indeed, it may be seen from the computational note that during the five years from 1985 to 1990 the average rate of variation in TFP was almost nil.

TABLE 10

Brazil: Total productivity, output and exports, by industry, 1975-1980, 1980-1985 and 1986-1991
(Percentages)

Industry	Total factor productivity (TFP)				Output (1975-1990)	Exports (1975-1990)
	1975-1980	1980-1985	1985-1991	1975-1991		
Non-metallic minerals	0.84	1.66	0.46	0.95	1.55	12.4
Metal products	0.37	0.91	0.26	0.50	2.22	22.4
Machinery	4.12	-1.81	0.20	0.77	0.78	9.4
Electrical equipment	4.30	4.37	0.50	2.88	5.41	12.9
Transport equipment	1.85	2.97	-0.20	1.44	1.76	16.6
Paper and paperboard	1.91	2.09	0.53	1.45	5.51	22.4
Rubber	6.54	3.00	0.27	3.05	2.82	18.0
Chemicals	1.29	3.12	0.53	1.57	3.78	10.7
Pharmaceuticals	-2.33	1.77	-0.16	-0.28	1.62	10.4
Perfumery, etc.	4.50	1.21	0.25	1.86	6.18	17.0
Plastics	2.34	0.78	0.05	0.99	2.33	15.7
Textiles	1.89	1.40	-0.21	0.95	0.37	5.8
Wearing apparel	0.34	2.11	0.05	0.78	1.22	12.0
Foodstuffs	0.92	-0.22	0.32	0.34	2.74	4.0
Beverages	0.19	-0.13	0.49	0.20	4.62	6.1
Tobacco	3.51	2.28	0.56	2.01	3.93	9.7
Total	**0.48**	**1.09**	**0.25**	**0.58**	**2.64**	**10.4**

Source: See text.

VI

Export performance and labour productivity: an industry-by-industry analysis

In this section the existence of an association between export orientation, productivity and the growth of production will be demonstrated using data from the 1980 and 1985 industrial censuses. The analysis will be confined to labour productivity, and the more disaggregated results, at the four-digit level of the Brazilian industrial classification, refer to the metal products, machinery, paper and paperboard, and rubber industries.

The econometric calculations shown in the upper portion of table 11 demonstrate the existence of a close link between the levels of industrial labour productivity and gross investment per worker. Variations in productivity, in their turn, are also related to variations in output, in accordance with Verdoorn's Law [22] (see the bottom section). We also find that the *levels* of productivity are closely related in 1980 and 1985 (see the middle section). The table gives the results for three of the industrial classification's levels of aggregation.

Equation No. 1 indicates that approximately half of the cross-industry variation in productivity in 1985 is accounted for by gross investment per worker (a variable that serves as a substitute for the capital/labour ratio). The result applies to the analysis at both the two-digit and three-digit levels of the industrial classification. Equation No. 2 supports the conclusion that there is a close association between productivity levels in 1980 and 1985. The association becomes weaker as we move down from higher to lower levels of aggregation. A 1% increase in cross-industry productivity in 1980 is associated with a 1.14% increase in 1985 when the analysis is conducted at the two-digit level, but the increase is only 0.74% when the four-digit sample is used. Equation No. 3 corroborates Verdoorn's Law. Its results indicate that an absolute variation of 1% in the production growth rate, by industries, translates into a 0.8%

[22] This result also holds true for the relationship between the variation in total productivity and growth between 1975 and 1985 (Bonelli, 1992).

TABLE 11

Brazil: Results of regression analyses: labour productivity, investment and output [a]

Equation No.1: log (productivity) = constant + a* log (investment/worker). 1985			
2 digits (n=22)	5.858 [32.8]	+0.347 [4.82]	R2=0.54
3 digits (n=128)	5.871 [73.3]	+0.369 [10.49]	R2=0.47
Equation No. 2: log (productivity 1985) = constant + a* log (productivity 1980)			
2 digits (n=22)	-0.823 [-1.41]	+1.137 [12.80]	R2=0.89
3 digits (n=128)	0.83 [3.82]	+0.871 [28.51]	R2=0.87
4 digits (n=79)	1.708 [4.28]	+0.741 [12.59]	R2=0.67
Equation No. 3: productivity growth rate = constant + a* (output growth rate). 1980 and 1985			
2 digits (n=22)	5.270 [1.67]	+0.770 [4.66]	R2=0.52
3 digits (n=128)	-8.370 [-4.31]	+0.250 [7.12]	R2=0.29
4 digits (n=79)	-1.400 [-0.37]	+0.447 [5.31]	R2=0.27
Metal products (n=35)	0.99 [0.15]	+0.560 [4.80]	R2=0.41
Machinery (n=24)	-14.3 [-4.00]	+0.380 [2.95]	R2=0.28

Source: See text.

[a] Variations for the period 1980-1985. Values of *t* are given in parentheses. The deflator used to estimate increases in productivity in industrial activities at the two- and three-digit levels is the implicit deflator for the corresponding industrial activity.

increase in productivity at the two-digit level. At more precise levels of aggregation, not only is the coefficient lower, but production growth rates also account for a considerably smaller portion of the cross-industry variation in productivity. Therefore, the growth of output is related to productivity growth, but the direction of causality has not been determined.

The variable chosen to represent the export orientation of each industry is the percentage of total sales accounted for by exports in 1985 (VMEX). Table 12 presents the results of computations using this variable at different levels of aggregation.

Equation No. 1 in table 12 indicates that the percentage of total sales represented by exports in 1985 is positively associated with productivity growth between 1980 and 1985. However, the productivity coefficient departs from zero by a significant amount only at the 7% level (analysis at the two-digit level). Only a small part of the cross-industry VMEX variation is explained by the variation in productivity. This conclusion is corroborated when a more disaggregated sample (three digits) is used. The fact that only a small part of the cross-industry variation in export orientation is accounted for by variations in productivity may be due, among other factors, to lags between increases in productivity and in competitiveness. Equations Nos. 2 and 3 tell us that the percentage of sales represented by exports is associated with the level of productivity. Analyses of individual industries at the four-digit level (not given in the text) exhibit closer associations. For the paper and paperboard industry, the coefficient of determination is of the order of 0.8-0.9. For the metal products and machinery industries, the proportion of the cross-industry variance of VMEX that is explained by the productivity variable is of the order of 0.14-0.18.

Since the growth of output is associated with productivity growth, it seems safe to conclude that export orientation is positively influenced by the growth of manufacturing output, although the direction of causality cannot be established. Nevertheless, we may speculate that an increase in production for export would speed up productivity growth by speeding up the growth of production (i.e., an effect of scale).

TABLE 12

Brazil: Results of regression analyses: variation in productivity, 1980-1985, and exports

Equation No. 1: VMEX = constant + a^* (productivity growth rate)			
2 digits (n=22)	8.75 [5.33]	+0.121 [1.60]	R2=0.11 is not significant at 5%
3 digits (n=128)	10.97 [8.36]	+0.142 [2.74]	R2=0.06
Equation No. 2: VMEX = constant + a^* (productivity 1980)			
4 digits (n=79)	3.24 [1.33]n.s.	+0.0059 [3.01]	R2=0.10
Equation No. 3: VMEX = constant + a^* (productivity 1985)			
4 digits (n=79)	-1.55 [-0.5]n.s.	+0.0115 [4.31]	R2=0.19

Source: See text.

VII

Conclusions

In this study we have analysed questions relating to the expansion of exports and the growth of productivity and production in Brazilian industry. The effects which Brazil's recent liberalization of its foreign trade regime may have on production and productivity are underlying concerns in this regard. Analysis of the data presented in section IV suggests that both the import liberalization process and the increase in the competitiveness of exports which can be attained through higher productivity tend to serve as means of boosting the competitiveness of the industrial system as a whole; this underscores the importance of studying the interconnection between export orientation and variations in productivity.

The analysis demonstrated that labour productivity is related to the long-term growth of output. Thus, the fact that the increases in productivity recorded since the start of the 1980s have been below the

historical mean may be a consequence of the marked slowdown in industrial growth which occurred during that period. At the same time, the share of total exports accounted for by manufactures rose only marginally, with the expansion of exports being heavily concentrated in just a few years (1981, 1983-1984 and 1987-1988); this would seem to be due to the implementation of recessionary macroeconomic policies combined, in most cases, with devaluations of the currency in real terms.

In keeping with the above, the trend in industrial competitiveness, based on the unit costs of labour, appears to be one of almost continuous growth over the long term, primarily as a result of movements in the exchange rate. Productivity increased very little, if at all, in the 1980s, in contrast to the pace of productivity growth seen in the 1970s. Analysis of the index of relative unit costs of labour also suggests that in the period from the mid-1980s to 1989, the competitive position of Brazilian exports deteriorated more sharply than ever before. In sum, their competitiveness during those years was impaired by macroeconomic conditions (domestic recession plus variations in the real value of the currency) to a much greater extent than by variations in productivity.

It is interesting to note, however, that exports apparently did not diminish a great deal as their competitiveness declined, with the exception of a few very specific periods, such as late 1986 and early 1987. A number of reasons for this phenomenon may be cited, with one of the main ones being the possibility of variations in competitiveness within the manufacturing sector.

The search for alternative explanations led us to explore the possible existence of a connection between export orientation, variations in productivity and the expansion of output. Theoretical studies and representative data based on the experiences of a number of countries both hint at the possibility of associations between these variables: i) trade-driven market growth increases both output and productivity (Verdoorn's Law), which leads to cost reductions and greater penetration of external markets through a self-perpetuating mechanism; thus, export orientation is related to increases in efficiency occasioned by specialization and increased scale; ii) exposure to international competition obliges national producers to raise their efficiency and productivity levels, which leads to a reduction in costs; and iii) the effects of trade policies may be direct (increased competition and efficiency of resource use) or indirect (increases in the capacity use rate, in investments involving new technologies, and in manpower skill acquisition).

We then explored the empirical implications of these hypotheses, after attempting to measure the productivity variations. We thus showed that, based on perhaps overly restrictive hypotheses that would only apply in the short run, total factor productivity can be estimated by using labour productivity, except for a factor of proportionality as regards the share of labour earnings in income or production.

As is well known, after 1985 the growth of production slowed sharply in almost all Brazilian industries, with the average growth rate for the manufacturing sector falling to an annual rate of -2.40% for the five-year period 1987-1991. Rates of manpower absorption were therefore also negative, with a time-lag being observed in the variations of this rate in respect of variations in production. Employment in manufacturing dropped by an average of 4.25% per year in the above period, largely owing to the influence of the 1990-1991 recession. The net result of these events was an increase of about 0.25% per year in total productivity between 1985 and 1991, but this figure is strongly influenced by the 1.57% rate estimated for 1991. Although slow, the growth of total productivity was positive, on average, for most industries. Moreover, total factor productivity represented a significant portion of the growth rate in a number of industries. An exploratory analysis of the arrays of variations in export growth and productivity by industries points to the existence of a positive association between the two series: the industries with the highest productivity growth rates also had the highest production and export growth rates.

Econometric estimates for industries at disaggregated levels suggest that: i) approximately 50% of the cross-industry variation in labour productivity is accounted for by the capital/labour ratio; ii) the growth of output is linked to the growth of labour productivity; iii) the share of total sales represented by exports is positively associated with the growth rate of labour productivity; and iv) the share of total sales accounted for by exports is also positively associated with the level of productivity.

It can therefore be concluded that a positive correlation exists between export orientation and the growth rate of labour productivity during the period in question. Furthermore, since the growth of output is related to the growth rate of productivity, it seems safe

to conclude that an export orientation is positively linked to the growth rate for manufacturing output. It should be noted, however, that the direction of causality is difficult to determine; in fact, we do not even know whether the link is a direct or indirect one.

One possible interpretation of these data would be that exports of manufactures are influenced by a complex set of variables which affect their competitiveness: real exchange rates, incentives and subsidies, the behaviour of domestic and international demand and, finally, variations in productivity. Productivity, in its turn, hinges upon the level of industrial investment. Just as the existence of idle capacity (which is determined by the behaviour of domestic and international demand) negatively influences investment expenditure, the expansion of output also influences exports. This accounts for the link detected between the degree of export orientation and the growth of production, which is a somewhat surprising result in view of the fact that increased use of capacity is negatively associated with export growth, as has been demonstrated in countless econometric studies. The discovery of a positive association between the growth of exports and of production indicates –as suggested by the theoretical analysis presented at the beginning of this article– that labour productivity, which operates as a function of increases in gross investment, is one of the determinants of export growth, without prejudice to the effects of other variables not considered here, such as, for example, the export orientation of transnational corporations as compared to that of local firms, market structure, etc.

(Original: Portuguese)

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