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## Economic development and the patterns of manufactured exports

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# KIELER DISKUSSIONSBEITRÄGE

## zu aktuellen wirtschaftspolitischen Fragen

16

### Economic Development and the Patterns of Manufactured Exports

by R. Banerji and J. B. Donges

- C O N T E N T S :**
- The need to expand the export of manufactures from less developed countries has now been realised by national and international bodies. To devise meaningful policies, it seems necessary to understand whether and how the share of manufactures in a country's total exports is related to certain supply-oriented characteristics. For this purpose, a multiple regression analysis on the basis of cross-sectional data is attempted in this study.
  - In a pooled sample of developed and developing countries, the share of manufactures in total exports is positively associated not only with the level of per capita income and the degree of industrialisation, but also with the density and size of population and ( though not statistically significant ) the availability of skills. All these variables together explain statistically more than 60 per cent of the total variation in observed data on the share of manufactures in total exports.
  - The share of manufactures in total exports is likely to increase rapidly with per capita income, but only up to a certain point after which it levels off. Countries with a high density of population tend to export manufactures at an earlier stage and in greater proportion than countries with a low density.
  - For most of the developed countries the actual shares of industrial exports are seen to have exceeded the "expected" shares, whereas for most of the less developed countries the reverse holds true.
  - When the cross-section analysis is confined to less developed countries only, the share of manufactures in total exports, although positively associated with the degree of industrialisation, is conversely ( but not significantly ) related to per capita income.

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Die Kieler Diskussionsbeiträge wenden sich an die wirtschaftspolitisch interessierten Freunde des Instituts für Weltwirtschaft. In den Beiträgen, die in unregelmäßiger Folge erscheinen, erörtern Mitarbeiter des Instituts Fragen von allgemein wirtschaftspolitischem Interesse.

## Economic Development and the Patterns of Manufactured Exports\*

### I. Introduction

1. The export trade of most less developed countries is largely dominated by primary products. In order to overcome the disadvantages generally involved in the traditional trade, many LDCs have been trying to diversify their export structure and to promote the export of manufactures. There are already some success stories in this regard (e.g. South Korea, Taiwan, and recently Brazil and Spain). As is well known, the United Nations strategy for the Second Development Decade emphasises, among other things, an improvement in the international division of labour, so that the developing countries can have a greater share in the world trade in manufactures. Also in the forthcoming third UNCTAD conference (to be held in April/May 1972) it is expected that considerable attention will be devoted to this subject.

Broadly speaking, the expansion of industrial exports requires a domestic manufacturing base - a base which is likely to widen in the course of industrialisation. Economic history tells us that today's highly industrialised countries experienced a shift in their export structure from primary towards manufactured products when the secondary sector expanded in relation to the primary one. The little empirical evidence that we have on the corresponding experiences of some of today's LDCs suggests that something like this may as well be expected to happen to them. Presumably, in the process of economic development, industrialisation will bring about some increases in overall productivity, some improvements in organizational efficiency, a better quality of the labour force and of the commodities produced, and a rising venturesomeness of the entrepreneurial class. As the secondary sector develops, export competitiveness on new production lines thus may appear, so that the composition of exports will probably undergo a significant alteration in many of these countries.

2. Our interest is to see whether there is a uniform pattern of change in the export structure, particularly in relation to economic growth and country size. This idea has its origin in the well known study which was undertaken by Simon Kuznets some years ago; it suggested that there is a relationship between the foreign trade share in GNP

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\* This study is a part of a long term research project on the International Division of Labour (including the impact of import substitution and export diversification in selected LDCs), which is being carried out at the Kiel Institut für Weltwirtschaft. In the following, only preliminary results are presented. The paper is mainly aimed at stimulating further discussion and critical comments.

and per capita income together with population size.<sup>1</sup> Our study is different in so far as we are looking at exports (as opposed to total trade) and we make use of cross-section regressions. The identification of an export pattern by such means will provide a basis for expecting a certain share of manufactured export (in total exports) from a country at its given level of GDP and other related variables (to be stated presently). It is most likely that not every country's actual export performance will conform exactly to this specified pattern. The factors which are likely to explain these discrepancies between the actual and the expected performances will therefore have to be identified as well.

3. The first hypothesis to be tested asserts that the share of manufactures in total exports rises with the degree of industrialisation and the per capita income level. A second hypothesis concerns the structure of the manufactured exports itself. It is surmised that with an increase in the share of manufactures in total exports, there will also be a shift from labour intensive and/or natural resource based manufactures to products which are more skill and capital intensive.

Only the first hypothesis will be examined here. In the first place, we shall estimate an export pattern based on a mixed sample of developed and less developed countries. This will be compared at the second stage of analysis with a pattern derived from a sample consisting of LDCs only. The difference, if any, between the two patterns may point towards some distinct structural characteristics prevailing in the LDCs as a group.

4. The analysis will be on highly aggregative terms, namely in terms of the total value of manufactured exports. This is defined entirely according to the Standard International Trade Classification numbers 5, 6, 7 and 8.<sup>2</sup> This level of aggregation poses serious limitations as it assumes that the commodity composition of manufactures is similar and hence comparable between countries. This assumption can be relaxed gradually in future investigations as we shall move on from aggregates to broad sub-groups of items. A further limitation is the failure to take into account the quality differences in similar products which are manufactured and exported by different countries. In other words, we actually assume that all countries produce similar

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<sup>1</sup> S. Kuznets, "Quantitative Aspects of the Economic Growth of Nations: IX, Level and Structure of Foreign Trade - Comparisons for Recent Years", *Economic Development and Cultural Change*, Vol. 13 (1964/65), No. 1, P.II. In addition, a lot of econometric and descriptive works have been done in the recent past to explain international trade problems. In most cases, the emphasis was on the impact of foreign trade on economic growth and vice versa. Attempts have also been made to formulate and test import and export functions at different levels of aggregation. Moreover, there are several exercises, undertaken particularly by some international organisations, to construct overall network of international trade flows. And, last not least, some empirical evidence has been provided which helps to understand why the amount of international trade flows differs, sometimes substantially, between countries - even between those countries which have many common characteristics. See, for instance, J. Tinbergen, *Shaping the World Economy*, New York 1962. - C. P. Kindleberger, *Foreign Trade and the National Economy*, New Haven, London 1962. - H. Linneemann, *An Econometric Study of International Trade Flows*, Amsterdam 1966. - H. B. Lary, *Imports of Manufactures from the Less Developed Countries*, New York, London 1968. - UNCTAD, *Trade in Manufactures of Developing Countries: 1969 Review*, New York 1970.

<sup>2</sup> Chemicals (5), Manufactured goods classified by materials (6), Machinery and Transport Equipment (7), Miscellaneous manufactured articles (8).

quality products. This is admittedly a very unrealistic assumption. On the other hand it can be argued in our defence that the quality factor can be introduced later as an important variable which might help to explain the deviations from the normal trade pattern in case of individual countries.

## II. The Model

5. The normal pattern is to be estimated from a set of multiple regression equations. The endogeneous (dependent) variable in the regressions is the share of manufactures in total exports of a country (SITC 5-8/SITC 0-9).

In explaining the intercountry differences in the level and composition of manufactured exports, an apparently limitless list of factors can be cited. We have tried to identify only those factors which appear to be more important on the supply side. The relevance of these factors in explaining the observed trade patterns as well as the relative importance of each factor taken by itself can be examined only by applying some well known statistical tests. The explanatory variables chosen for the purpose are: the per capita GDP in current prices; the share of value added in manufacturing in the GDP and, alternatively, the relative degree of industrialisation; the size of population; the average density of population; and the level of available skill in a country. The rationale and the justification for including these variables in our model needs to be elaborated.

6. The per capita GDP ( $X_1$ ): It does not perhaps strain one's credulity to conceive a direct relation between the demand for export (in this case of manufactured exports) and the importing country's level of per capita GDP. The relationship between the supply of such exports and the exporting country's level of per capita income may at first appear to be less obvious. However, a link between the two can be established in the following way. Historical and cross-sectional analyses of economic growth of nations have shown that with a rising per capita income, significant changes occur in the production structures. The shift is normally from primary goods to manufacturing goods and then from manufacturing to services.<sup>1</sup> There is also a basic premise in the trade theory which states that the existence of a home market is a necessary condition for products to be qualified as potential exports.<sup>2</sup> As the domestic demand structure shifts in favour of manufacturing industries when per capita income increases, the manufactured products can be expected to take a larger and larger share in the export basket of a growing country. Hence, one may postulate on a priori grounds a positive functional

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<sup>1</sup> See H. B. Chenery, "Patterns of Industrial Growth", *The American Economic Review*, Vol. 51 (1960), pp. 624-654. - G. Fels, K. W. Schatz, and F. Wolter, *Der Zusammenhang zwischen Produktionsstruktur und Entwicklungsniveau: Versuch einer Strukturprognose für die westdeutsche Wirtschaft*, *Weltwirtschaftliches Archiv*, Vol. 106 (1971/I), pp. 240-275.

<sup>2</sup> Linder introduced this premise explicitly in his Essay in 1961. However, his study lacks an empirical analysis. In a later study he has even expressed uncertainty about the capacity of the developing countries to become successful exporters of manufactures. See S. B. Linder, "An Essay in Trade and Transformation". Uppsala 1961. - Idem, "Trade and Trade Policy for Development". London 1967. Recently, Basevi has however shown that the presence of a domestic market need not be a necessary or a sufficient condition for export. See G. Basevi, "Domestic Demand and Ability to Export", *Journal of Political Economy*, Vol. 78 (1970), pp. 330-337.

relation between the growth of per capita income and the growth of manufactured exports.<sup>1</sup>

7. The degree of industrialisation ( $X_2$  and  $X_{2a}$ ): As the industrialisation process accelerates, it can be expected that a country's ability to supply manufactured goods in the international market will expand. A positive relation between the rate of industrialisation and the share of manufacturing exports to total would thus seem to be an appropriate hypothesis in this context. The relationship will be examined using in turn two alternative measures of industrialisation:

The first one - the relative degree of industrialisation ( $X_2$ ) - is introduced as a derived variable.<sup>2</sup> The first step in this derivation was to fit a "normal" pattern of industrialisation for the sample countries by regressing the share of manufacturing in the total GDP to per capita GDP using a semilog transformation. The residuals of the regression indicated the deviations of the actual level of industrialisation from the one that could be expected at the given level of per capita income of a country. The second step was to construct an index from these residuals by assigning the number 100 (the base of the index) to those countries whose actual industrial share coincided with the estimated share. All other countries were numbered by units higher and lower than the base according to the magnitude of their absolute deviations. It is then possible to interpret this index as a common scale of measurement of industrialisation by means of which the relative position of a country vis-à-vis the rest can be easily ascertained.<sup>3</sup> The second version - the share of value added in manufacturing in GDP ( $X_{2a}$ ) - is introduced as an index of production base of the manufacturing sector in relation to the rest of the economy. The manufacturing sector is defined as consisting of those industrial activities which are covered by the code numbers 2 and 3 of the International Standard Industrial Classification of the United Nations.

8. Population and its density ( $X_3$  and  $X_4$ ): These two variables are included in our model to account for the size of a country. Population ( $X_3$ ) might be considered to have an impact on the scales on which firms are operating. It is assumed that the larger the population the more likely it will be (*ceteris paribus*) that scale effects can be realized in a way which promise an adequate export competitiveness.

As to the density of population ( $X_4$ ), it might be related positively with the export share of manufactures. Our presumption is that a country with a high man-land ratio (reflecting in many cases a low availability of natural resources per capita) is likely to

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<sup>1</sup> In order to make international comparisons meaningful it is necessary that per capita incomes be expressed in terms of a common currency. Strict comparability would require that the numeraire chosen for the purpose should itself be invariable in value. The search for such a currency however amounts to looking for a black cat in a dark room. The least one can do (and as is mostly done) is to express the national currencies in terms of U.S. dollars to which the exchange rates of most currencies are linked. This method has been adopted in this paper as well. There are countries (mostly in Latin America) whose exchange rates vis-à-vis the U.S. dollar are most volatile and adjustments have been made in such cases in order to maintain the comparability with other countries; the exchange rates in some cases were derived from a moving average trend (admittedly a crude procedure).

<sup>2</sup> The idea originates from United Nations, A Study of Industrial Growth. New York 1963.

<sup>3</sup> It is to be noted that the ranking of the countries in the development scale according to their per capita income may differ from their ranking according to the relative degree of industrialisation.

be under pressure to expand its manufacturing base and to export these products to pay for its imports.<sup>1</sup> The economic viability of such "small" countries as Hongkong, Singapore or Taiwan is clearly based on the pressure to process and export manufactured items.

9. The availability of technical and professional skills: in general, one would expect a positive correlation between the industrialisation level and the proportion of skilled and professional workers in the total labour force of a country. It is conceivable that the lack of an adequate supply of professionally skilled workers may seriously thwart all attempts to industrialise a country. Hence, differences in the availability of skills can serve as a good indicator of differences in the level of industrialisation in between countries. In this way, an indirect but positive functional relationship can also be presumed between the level of skill endowments and the export of industrial products.

It is difficult to measure accurately the skill endowment in a given country. Here, the ratio of the number of economically active population in the groups 0 and 1 of the International Standard Classification of Occupation to the total number of a economically active labour force in a country is chosen as an index of the level of skill formation. These broad groups include the number of professional, technical, administrative, executive and related workers.

10. The following alternative forms of equations are used in the analysis:

$$(1) Y_{it} = \alpha + \sum_j \beta_j X_{jit} + U_{it} \quad j = 1 \dots 5.$$

$$(2) Y_{it} = \alpha + \sum_j \beta_j \ln X_{jit} + U_{it} \quad j = 1 \dots 5.$$

$$(3) \ln Y_{it} = \alpha + \sum_j \beta_j X_{jit} + U_{it} \quad j = 1 \dots 5.$$

$$(4) \ln Y_{it} = \alpha + \sum_j \beta_j \ln X_{jit} + U_{it} \quad j = 1 \dots 5.$$

$$(5) \ln Y_{it} = \alpha + \sum_j \beta_j \ln X_{jit} + \sum_j \gamma_j (\ln X_{jit})^2 + U_{it} \quad j = 1 \dots 5.$$

where Y stands for the endogeneous, X for the exogeneous variable; the subscript "j" refers to the number of exogeneous variables (5 in total), the subscript "i" to the number of countries in the sample (varying between 64 to 70) and the subscript "t" to the number of years under consideration (1960 to 1968). The disturbance term in the equation reflects the elements of randomness in the system and it subsumes as well the effects of all other factors which have not been taken into account explicitly. It also reflects all possible measurement errors which may be present in our data. The usual assumptions about the behaviour of "U" are retained in the model.

<sup>1</sup> The plausibility of this hypothesis was checked recently by one of the authors. See J. B. Donges, "Die Entwicklungsländer als Anbieter industrieller Erzeugnisse", Die Weltwirtschaft, Year 1971:1, p. 48.

11. The variables in the model are double dimensional: they vary both over time and among countries. A pure cross-sectional analysis is based only on spatial variations, i.e. behavioural variations arising from intercountry differences at a given point of time. At least two very strong interrelated assumptions are involved in cross-sectional studies. First, it is assumed that except for the differences in the measurable variables and a stochastic element, the different countries are homogeneous. Secondly, the forecasting value of such models is subject to the further assumption that (in our case) as the per capita income and the degree of industrialisation of a country rises, it takes on the structural characteristics of the countries which are now at that level of development. While these limitations will still hold true, in a sample where cross-sectional and time-series data are pooled it is expected that at least some of the temporal behaviour of the countries involved can be captured in the model. Introduction of time-series data (even if it is only a short series, as in our sample) is likely to convey an average and a more representative relation than the one derived from cross-sectional data alone<sup>1</sup>.

12. The equation have different implications for the attributed shape of the export pattern. Equation (4) can be recognized as a constant elasticity function and is probably the one which is mostly used. The ease of interpretation of the coefficients (which themselves are the elasticities) is perhaps its greatest advantage. However, the assumption of constant elasticity (i.e. unchanged responsiveness of the endogenous variable to changes in the exogenous variable) is a very restrictive one. The export pattern and the structural changes in it are likely to be associated with changes in the elasticities with respect to changes in the exogenous variables under consideration. By assigning constant values to them by the very design of the study, we may fail to capture some important characteristics of the long-term behaviour of manufactured exports.

In contrast, all the other equations allow for variable elasticities.<sup>2</sup> The nonlinear term in equation (5) for instance, allows for decline in elasticity with rise in per capita in-

<sup>1</sup> There are strong theoretical objections to using simple least square estimators in a sample combining cross-section with time-series data. Several alternative estimators have been suggested in the literature. We have sidestepped the problem by taking arithmetic averages of the variables over time and using least square estimators to the cross-section of these average values. For discussions on the problems of pooling cross-section with time-series data see: P. Balestra and M. Nerlove, "Pooling Cross-Section and Time Series Data in the Estimation of a Dynamic Model: The Demand for Natural Gas", *Econometrica*, Vol. 34 (1966), pp. 585-612. - I. D. Wallace and A. Hussain, "The Use of Error Components Model in Combining Cross-Section with Time Series Data", *Econometrica*, Vol. 37 (1969), pp. 55-72. - G. S. Maddala, "The Use of Variance Components Models in Pooling Cross-Section and Time Series Data", *Econometrica*, Vol. 39 (1971), pp. 341-358.

<sup>2</sup> In the two variable case, the elasticity of  $y$  with respect to  $x$  is given as

$$\epsilon_1 = (\beta x) : (\alpha + \beta x), \quad \text{in function 1;}$$

$$\epsilon_2 = \beta : y, \quad \text{in function 2;}$$

$$\epsilon_3 = \beta x, \quad \text{in function 3;}$$

$$\epsilon_4 = \beta, \quad \text{in function 4;}$$

$$\epsilon_5 = \beta + 2 \gamma \ln x \quad \text{in function 5;}$$



come and the degree of industrialisation. Chenery and Taylor have used this function in a recent study.<sup>1</sup> Equation (2) is a semilog transformation. In the simplest two variable forms, it can be easily seen that the slope of such a curve decreases steadily as the magnitude of the explanatory variable increases. The partial elasticities of such a function vary with changes in the value of the endogenous variable only and are not dependent on the explanatory variables. Such a function has a greater appeal for the type of pattern this study is supposed to estimate. The function is so specified that the point of intersection of the curve (assuming two variables only - to make it simple) on the x axis is given at a positive value of x. In other words, there is a range of the value of x, over which the value of the dependent variable is zero. Many economic variables tend to move in this way. For instance, it can be envisaged that there will be a minimum level of per capita income and of industrialisation, before a country can be expected to become an exporter of manufactured items. Such "take-off" points can be estimated from the use of a function of type (2).

All five forms of function have been used here. While a comparison of the coefficients estimated from different functions will be of some interest, the ultimate choice of a function will be made on the basis of their coefficients of determination. In other words, the analyses will be carried on the basis of that function only which "explains" (in a statistical sense) the observed phenomenon better than the others, while using the same explanatory variables.

### III. Statistical Results and Analysis

13. The salient features of the cross-section regressions according to the five types of function can be briefly summarized (Tables 1-5).<sup>2</sup>

- As the coefficients of determination indicate, in no case the equations are able to "explain" fully the variations in the industrial export shares between countries. In other words, the explanatory variables selected do not seem to exhaust the list of all possible factors which operate on the supply of manufactured exports. Bearing in mind the multitude of factors that are peculiar to different countries and which are not included in the equations, the results are not, after all, as unsatisfactory as may appear at a first glance.
- In order to see whether the explanatory power of the equations "improves" as the number of exogeneous variables is increased, we have introduced the variables in a stepwise manner. Needless to say, even if the  $R^2$  rises as a result of an additional variable in the equation, the difference (in the  $R^2$ s) may or may not be statistically significant; however, a higher  $R^2$  indicates a "better" fit, which is what we are looking for. In all cases, as the number of explanatory variables is increased, the explanatory power of the equation increases as well, except for the introduction of  $X_5$  (the level of skill formation). This result may be due to a very high multicollinearity, as has been observed in case of all equations, between the level of per capita GDP and that of skill formation.<sup>3</sup> The variables population and its density are seen to

<sup>1</sup> See H. B. Chenery and L. Taylor, "Development Patterns - Among Countries and Over Time", The Review of Economics and Statistics, Vol. 50 (1968), pp. 391-416.

<sup>2</sup> Only the most interesting findings are given in these tables. The total number of regressions computed were far more than what are shown here.

<sup>3</sup> For instance, the correlation coefficient between  $X_1$  and  $X_5$  is 0.77 in equations 1 and 33; it is 0.82 in equation 7 and 49.

Table 1: Estimated Export Patterns: Results of Regression Analysis  
 Function Type 1: Number of Countries: 70

No.	Constant term	Coefficients of:						R <sup>2</sup>
		x <sub>1</sub>	x <sub>2</sub>	x <sub>2(a)</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	
1	-184.5	0.018 (0.006)	1.920 (0.371)		0.041* (0.038)	0.012 (0.004)	0.864* (0.759)	0.57
2	-16.93	0.003* (0.006)		1.774 (0.338)	0.076 (0.038)	0.010 (0.004)	0.681* (0.759)	0.57
3	-184.8	0.023 (0.0037)	1.952 (0.3711)		0.036* (0.0388)	0.012 (0.004)		0.56
4	-15.18	0.007* (0.0047)		1.810 (0.3350)	0.073* (0.0374)	0.0112 (0.004)		0.57
5	-180.0		2.086 (0.465)					0.23
6	-14.60			2.22 (0.276)				0.49
7	-196.5	0.023 (0.003)	2.102 (0.378)					0.50
8	-13.3	0.0058* (0.005)		1.962 (0.351)				0.50
9	12.3	0.022 (0.004)			0.786 (0.047)			0.29
10	-171.46		1.989 (0.478)		0.043* (0.050)			0.23
11	-15.68			2.183 (0.272)	0.067* (0.039)			0.51
12	-175.9		2.02 (0.454)			0.0112 (0.005)		0.27
13	-15.45			2.171 (0.268)		0.0099 (0.004)		0.52
14	-196.9	0.016 (0.006)	2.067 (0.375)				1.163* (0.773)	0.51
15		0.001* (0.006)		1.909 (0.353)			0.853* (0.783)	0.51
16	11.05	0.0235 (0.0044)				0.0138 (0.0051)		0.33

\* Not significant at 5 per cent level.

Table 2: Estimated Export Patterns: Results of Regression Analysis  
 Function Type 2: Number of Countries: 70

No.	Constant term	Coefficients of:					R <sup>2</sup>	
		lnx <sub>1</sub>	lnx <sub>2</sub>	lnx <sub>2(a)</sub>	lnx <sub>3</sub>	lnx <sub>4</sub>		lnx <sub>5</sub>
17	-677.3	16.08 (4.209)	125.06 (42.86)		3.12 (1.636)	6.54 (1.405)	1.54* (6.112)	0.63
18	-114.6	11.31 (4.69)		12.38** (7.38)	4.46 (1.63)	7.12 (1.44)	2.43* (6.46)	0.60
19	-690.2	16.96 (2.362)	127.35 (41.587)		3.04 (1.600)	6.55 (1.394)		0.63
20	-118.95	12.43 (3.615)		13.12** (7.065)	4.34 (1.593)	7.15 (1.430)		0.60
21	-928.8		208.0 (46.59)					0.23
22	-72.13			35.33 (5.426)				0.38
23	-1031.8	15.99 (2.711)	209.4 (38.07)					0.49
24	-87.0	5.73* (3.885)		28.45 (7.119)				0.40
25	-84.5	16.67 (2.965)			6.28 (1.643)			0.39
26	-835.4		187.1 (57.05)		1.44* (2.25)			0.23
27	-69.3			32.78 (5.758)	2.22* (1.741)			0.40
28	-796.6		174.65 (45.134)			5.74 (1.840)		0.32
29	-89.90			33.27 (4.893)		6.38 (1.529)		0.51
30	-1026.4	15.450 (4.821)	208.599 (38.83)				0.960* (6.94)	0.49
31	-85.96	5.426* (5.452)		28.325 (7.335)			0.611* (7.591)	0.40
32	-101.4	16.67 (2.796)				7.96 (1.601)		0.46

\* Not significant at 5 per cent level.

\*\* Just significant at 5 per cent level.

Table 3: Estimated Export Patterns: Results of Regression Analysis  
Function Type 3: Number of Countries: 70

No.	Constant term	Coefficients of:					R <sup>2</sup>	
		x <sub>1</sub>	x <sub>2</sub>	x <sub>2(a)</sub>	x <sub>3</sub>	x <sub>4</sub>		x <sub>5</sub>
33	-7.62	0.0007 (0.00033)	0.093 (0.02045)		0.0025* (0.00215)	0.00049 (0.00024)	0.0417* (0.04180)	0.47
34	0.524	0.000002* (0.00036)		0.08375 (0.01880)	0.0042 (0.00210)	0.00044* (0.00024)	0.0334* (0.04224)	0.46
35	-7.64	0.0009 (0.00020)	0.0946 (0.0204)		0.0023* (0.0021)	0.0005 (0.0002)		0.46
36	0.61	0.00019* (0.00026)		0.0855 (0.01861)	0.0040 (0.00205)	0.0004 (0.000024)		0.46
37	-7.613		0.102 (0.0231)					0.22
38	0.675			0.098 (0.0149)				0.39
39	-8.29	0.009 (0.0002)	0.1027 (0.0203)					0.41
40	0.706	0.0001* (0.00027)		0.092 (0.0191)				0.39
41	1.885	0.0009 (0.0002)			0.0043* (0.0024)			0.22
42	-7.103		0.096 (0.0238)		0.0025* (0.0024)			0.23
43	0.613			0.096 (0.0147)	0.0038* (0.0021)			0.42
44	-7.43		0.099 (0.022)			0.00048* (0.00027)		0.26
45	0.639			0.096 (0.014)		0.0004 (0.0002)		0.42
46	-8.311	0.0006** (0.0003)	0.1011 (0.0203)				0.0527 (0.0418)	0.42
47	0.608	-0.00007* (0.0003)		0.090 (0.0193)			0.038* (0.0428)	0.40
48		0.0009 (0.00024)				0.00059 (0.00027)		0.24

\* Not significant at 5 per cent level.

\*\* Just significant at 5 per cent level.

Table 4: Estimated Export Patterns: Results of Regression Analysis  
 Function Type 4: Number of Countries: 70

No.	Constant term	Coefficients of:					R <sup>2</sup>	
		lnx <sub>1</sub>	lnx <sub>2</sub>	lnx <sub>2(a)</sub>	lnx <sub>3</sub>	lnx <sub>4</sub>		lnx <sub>5</sub>
49	-31.01	0.609 (0.24459)	6.172 (2.4904)		0.1766** (0.0950)	0.2538 (0.0816)	0.12976* (0.35516)	0.49
50	-3.387	0.317** (0.2656)		0.842 (0.4178)	0.215 (0.0925)	0.275 (0.0816)	0.119* (0.3656)	0.48
51	-32.10	0.682 (0.137)	6.364 (2.417)		0.170** (0.093)	0.254 (0.081)		0.49
52	-3.60	0.372** (0.204)		0.878 (0.399)	0.209 (0.090)	0.276 (0.080)		0.48
53	-44.6		10.25 (2.316)					0.22
54	-2.214			1.655 (0.278)				0.34
55	-44.6		10.25 (2.316)					0.22
56	-2.124			1.655 (0.278)				0.34
57	-48.73	0.639 (0.146)	10.31 (2.059)					0.40
58	-2.319	0.075* (0.202)		1.565 (0.370)				0.34
59	-2.133	0.674 (0.156)			0.328 (0.086)			0.31
60	-37.68		8.703 (2.825)		0.107* (0.111)			0.23
61	-1.93			1.486 (0.292)	0.147* (0.088)			0.37
62	-48.33	0.599 (0.260)	10.252 (2.150)				0.070* (0.375)	0.40
63	-2.289	0.066* (0.283)		1.562 (0.381)			0.016* (0.395)	0.34
64	-2.629	0.666 (0.157)				0.326 (0.090)		0.30

\* Not significant at 5 per cent level.

\*\* Just significant at 5 per cent level.

Table 5: Estimated Export Patterns: Result of Regression Analysis<sup>1</sup>  
 Function Type 5: Number of Countries: 70

No.	Constant term	Coefficients of:										R <sup>2</sup>
		lnx <sub>1</sub>	lnx <sub>2</sub>	lnx <sub>3</sub>	lnx <sub>4</sub>	lnx <sub>5</sub>	(lnx <sub>1</sub> ) <sup>2</sup>	(lnx <sub>2</sub> ) <sup>2</sup>	(lnx <sub>3</sub> ) <sup>2</sup>	(lnx <sub>4</sub> ) <sup>2</sup>	(lnx <sub>5</sub> ) <sup>2</sup>	
65	-869.0	0.902* (2.547)	368.8* (279.63)	0.032* (0.206)	-0.146* (0.330)	-2.142* (1.082)	-0.012* (0.199)	-39.145* (30.300)	0.021* (0.040)	0.050* (0.041)	0.546* (0.294)	0.56
66	3.76	-0.157* (2.543)	-1.607* (2.413)	0.135* (0.194)	0.023* (0.312)	-2.172* (1.117)	0.020* (0.204)	0.529* (0.453)	0.001* (0.038)	0.029* (0.038)	0.612 (0.295)	0.54
67	-925.6	-1.321* (2.206)	396.1* (259.18)	0.041* (0.195)	-0.098* (0.308)		0.162* (0.177)	-42.17* (28.11)	0.015* (0.039)	0.045* (0.037)		0.53
68	10.22	-2.627* (2.279)	-2.182* (2.409)	0.119* (0.192)	0.033* (0.303)		0.224* (0.179)	0.626* (0.457)	-0.002* (0.038)	0.028* (0.036)		0.51
69	-613.8	-1.602* (2.133)	261.1* (233.5)	0.083* (0.110)	0.266 (0.080)		0.187* (0.172)	-27.54* (25.34)				0.51
70	9.655	-2.536* (2.213)	-2.269* (2.366)	0.094* (0.110)	0.260 (0.081)		0.219* (0.174)	0.641* (0.448)				0.51
71	-493.5	-2.132* (1.956)	207.35* (246.8)				0.226* (0.157)	-21.41* (26.803)				0.43
72	14.60	-3.21* (1.915)	-3.60* (2.474)				0.256* (0.155)	0.968 (0.457)				0.42
73	-38.2	-2.55* (1.878)	10.13 (2.034)				0.258* (0.151)					0.42
74	9.25	-3.77* (1.946)	1.57 (0.362)				0.311* (0.156)					0.38
75	-712.2	0.674 (0.194)	298.51* (240.48)					-31.30* (26.11)				0.41
76	6.04	-0.064* (0.203)	-4.295* (2.247)					1.095 (0.457)				0.40

\* Not significant statistically at 5 per cent level.

<sup>1</sup> Equations 66, 68, 70, 72, 74 and 76 calculated according to X<sub>2a</sub>.

influence the explanatory power in all the equations. The coefficient of determination is reduced whenever these variables are excluded. For instance, it drops from 0.63 to 0.49 in function 2 and from 0.57 to 0.50 in function 1. Again, when the density of population is introduced with the variable  $X_{2a}$  (the share of manufactures in the total GDP), excluding all the other variables from the system, the equations in some cases are able to explain as high as 50 per cent of the total variation in the share of industrial exports (equation number 13, 21 and 45).

- There is no appreciable difference in the coefficients of determination derived from the two alternative versions of industrialisation, especially when the complete set of variables is introduced. In function type 2, however, it can be seen that the use of relative degree of industrialisation ( $X_2$ ) improves the explanatory capacity of the equation by three percentage points as compared with the result obtained using the variable  $X_{2a}$  (the share of manufactures in the total GDP). This may be a consequence of a high intercorrelation between per capita income and  $X_{2a}$  ( $r = 0.66$  in equation 18) and almost no intercorrelation between per capita income and  $X_2$  ( $r = -0.006$  in equation 17). On the other hand, taken by itself,  $X_{2a}$  appears to provide a much better fit than its alternative  $X_2$  when no other variables are introduced in the regressions. This is true of all the function types that we have tried.
- Looking at the estimated regression coefficients, it can be seen that in all cases but one (function 5) the signs correspond to our a priori expectations, namely that they ought to be positive. So far as the signs are concerned, the results appear to support the view that the export of manufactured products is positively associated with the level of per capita income, the degree of industrialisation, the density and size of population and the availability of skills. The interpretation of the coefficients in function 5 however, is somewhat difficult. The non-linear terms in all the equations under this function have at least one negative sign which is contrary to the propositions made earlier. The positive signs of the non-linear income coefficient (except in equation 65) suggest that the income elasticities of export increase with a rising income.<sup>1</sup> This sounds plausible enough. But simultaneously, it is puzzling to see the negative signs in the non-linear industrialisation terms (obtained only in those cases when the relative degree of industrialisation concept was applied) - which allow for a decline in elasticities. This makes sense only when the per capita income is rising due to a rapid growth of the primary and tertiary sectors but not as a result of industrialisation. Apart from the difficulties in interpreting the coefficients, function 5 has the least appeal because almost all the estimated coefficients are statistically not significant. This is an interesting phenomenon since otherwise all the equations under this function type have relatively high coefficients of determination.
- Except for function type 5, the relationship between the regression coefficients and their standard errors suggests that, by and large, the exogeneous variables selected on a priori grounds do in fact influence the share of manufactured export in the total exports. The coefficients are in most cases significant at at least 5 per cent confidence interval. The variable  $X_5$  (the available "skill") is statistically not significant in any of the equations under consideration. We have already indicated the existence of a high multicollinearity between this variable and the per capita income. Further-

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<sup>1</sup> This will of course depend also on the magnitude of the negative coefficient in the non-linear term.

more, it is entirely conceivable that the "skill" definition we have used is not suitable for the type of information we are seeking and that a more refined and sophisticated concept of skill will perhaps provide us with a better result. This latter possibility has not been explored in this study. Comparing the different functions it can be seen that the function type 2 and 4 have the least number of coefficients that are not significant. In types 1 and 3, the coefficients of the per capita income tend to be statistically not significant in those equations where the variable  $X_{2a}$  occurs. Through a process of eliminating the functions on the basis of coefficients that are not significant and of the magnitudes of the coefficients of determination, it becomes clear that the equations estimated with the function type 2 provide the best fit to the actual data. Therefore, we shall focus, in what follows, on the regression numbers 17 to 32.

14. The export pattern that emerges from the positive interactions among the variables is shown in figure 1. It indicates the probable development path of an economy as its per capita income increases gradually from a very low level to a very high one. There are in fact three curves of similar shape which correspond to three different levels of population and its density. These "normal" export patterns were plotted from regression 20 by using predicted values of  $X_{2a}$  from cross-section regressions at different levels of per capita income and at preassigned values of population and its density. For our purpose we have taken the present density of population in Brazil as an example of low density, that of Nigeria as medium density and that of India as high density<sup>1</sup>. It can be noticed that each time the level of density is raised the whole curve is displaced vertically upwards. This corresponds to our earlier assertion that countries with high density are likely to export manufactured goods earlier and in greater proportion than countries with a low density. The salient features of this pattern as derived from a mixed sample can be briefly summarized:

- The first thing to notice about the export pattern is that it tends to conform to our hypothesis of an increasing share of manufactures in total exports as an economy grows in terms of its per capita income. The share of manufactured exports is seen to accelerate rapidly up to a per capita income level of US- \$ 1000 after which it increases at a relatively slower rate. It would also appear from curves I and III that countries which have low density of population are likely to remain net importers of manufactured goods up to a certain range of per capita income (in respect of curve III it is around US- \$ 80) before they start to export these products. This seems to be a plausible observation particularly for those low density but natural-resource rich countries whose comparative advantages lie in transforming domestic resources into foreign exchange directly through primary exports rather than through exports of manufactured goods.
- A purely numerical exercise based on the "normal" patterns would suggest the following. Imagine four hypothetical countries with the same population (say 57 million) and same density (say 61 persons per sq. km), but having per capita income of \$ 100, \$ 500, \$ 1000 and \$ 2000, respectively. After assigning the expected share of manufactures to total GDP at these levels of income, the "normal" share of industrial exports will then be 15.3 per cent, 45.0 per cent, 54.4 per cent,

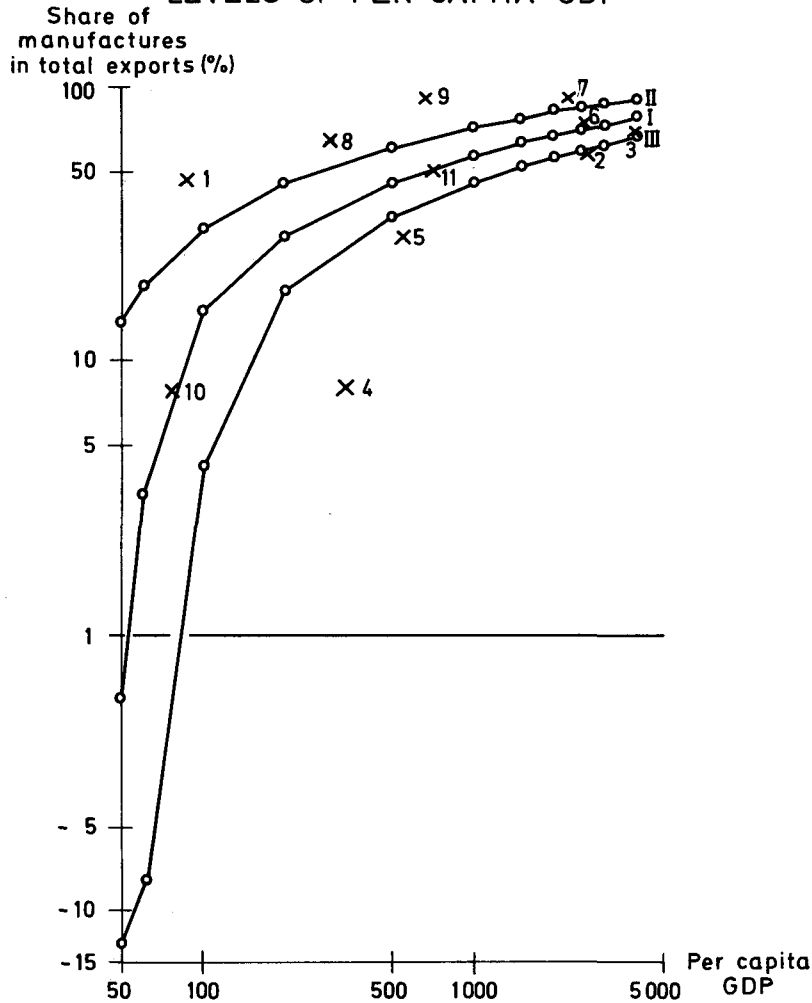
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<sup>1</sup> Curve I is based on a population of 57.1 million and a density of 61 persons per sq. km, curve II on a population of 500 million and a density of 153 persons per sq. km, and curve III on a population of 88 million and a density of 10 persons per sq. km.



Fig. 1

EXPECTED EXPORT PATTERNS OF THREE  
HYPOTHETICAL COUNTRIES WITH LOW (III), MEDIUM (I)  
AND HIGH (II) DENSITY OF POPULATION AT DIFFERENT  
LEVELS OF PER CAPITA GDP



I The curve indicates the possible development path (of manufacture exports) of a country with the size of Nigeria's economy.

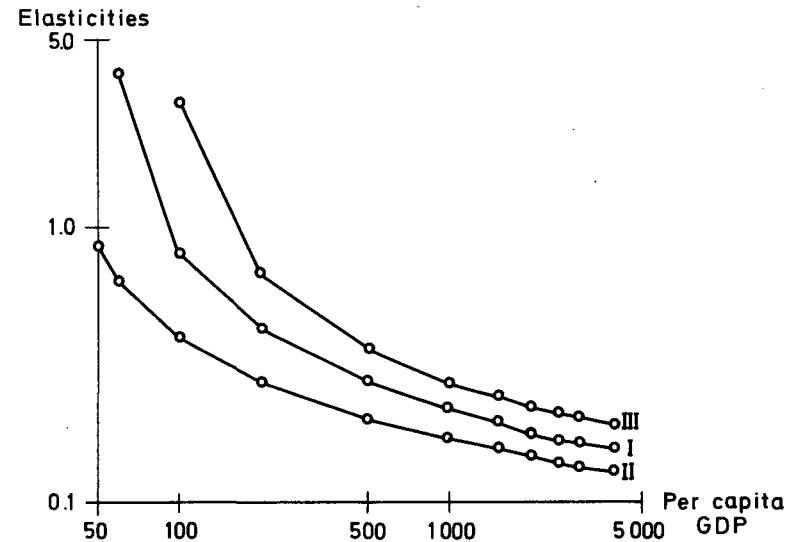
II A country of India's economic size.

III A country of Brazil's economic size.

1 India 2 Canada 3 USA 4 Brazil 5 Mexico 6 France 7 Germany 8 Taiwan 9 Hongkong 10 Nigeria 11 Spain

Fig. 2

THE ELASTICITIES CORRESPONDING TO THREE  
EXPORT PATTERNS AT DIFFERENT LEVELS  
OF PER CAPITA GDP



and 67.2 per cent, respectively. Keeping everything else constant, if we compare four countries with a higher population (say 88 million) and a lower density (say 10 persons per sq. km) the "normal" industrial shares would show as 4.2 per cent, 34.0 per cent, 45.3 per cent, and 56.1 per cent, respectively.

- To see the extent to which these "normal" patterns correspond to the actual observed shares of manufactured exports, 11 countries with widely different per capita income, density, and level of industrialisation are also plotted on figure 1. In cases of most countries the actual shares are seen to lie close to their "expected" shares, (when their levels of density are taken into account). Brazil and to a lesser extent Mexico appear to be the most relevant exceptions, where the actual exports are far short of what is expected from the normal pattern. Both countries are known to have followed (at least over the period which we have taken into account) a strategy of inward-looking industrialisation policies which have been largely blamed for their poor performance in the industrial export.<sup>1</sup> The location of these countries in figure 1 is most probably just a reflection of this phenomenon. This argument however does not seem to hold true in the case of India which has often been criticised for having neglected its export sector.<sup>2</sup> Given her per capita income which is around US- \$ 90 a year, our analysis tend to suggest that the India's actual share of manufactures in total exports has in fact been in excess of what could be "expected" at this level of income. This does not preclude the possibility, however, that in absolute amount perhaps India's manufactured export has not increased to the extent that could have been possible under an optimal export-oriented régime.

The export responsiveness of manufactured products to changes in the per capita income (the total elasticities) are shown in figure 2. The absolute values of elasticities at a given income are seen to vary inversely with the level of density of population and at a given density they decline with a rising income. For a country with medium density (our definition) the supply responsiveness is positive and is highly elastic (3.74) at a per capita income of \$ 60 and it steadily converges to a value of 0.16 at an income level of \$ 4000 per capita. On the other hand, for a country with high density, the supply elasticity is just below unity at an income level of \$ 50 and it converges towards a value of 0.13 at a per capita income of \$ 4000.

15. In Tables 6 and 7, the deviations between the actual share of manufactures export and the calculated shares are shown for the countries that were in the sample. The estimated shares are derived directly from the regression 17. Since as high as 37 per cent of the total variation still remained unexplained, it could only be expected that the deviations on both sides would be rather wide. A large part of the "unexplained" variation may reflect, among other factors, (like endowments of natural resources), the various forms of trade impediments and trade stimuli that are in existence at national and supra-national level. It is beyond the scope of this paper to analyse for each country the special factors which are at work.<sup>3</sup> We shall confine ourselves to

<sup>1</sup> See J. Bergsman, *Industrialization and Trade Policies: Brazil*. London, New York, Toronto 1970. - T. King, *Mexico - Industrialization and Trade Policies Since 1940*. London, New York, Toronto 1970.

<sup>2</sup> See J. N. Bhagwati and P. Desai, *India - Planning for Industrialization and Trade Policies Since 1951*. London, New York, Bombay 1970.

<sup>3</sup> Detailed case studies in respect of some more interesting countries such as Spain, India, Hongkong, South Korea, Brazil, Mexico, Philippines, Malaysia and perhaps a few African countries will be reported in due course.

Table 6: Countries whose actual shares of manufactures in the total exports exceed the estimated shares.  
(Average 1960-68; based on equation no. 17)

Countries	Actual Share	Estimated Share	Countries	Actual Share	Estimated Share
<b>Developed:</b>			<b>Less Developed:</b>		
Austria	77.5	63.8	Chile	68.5	29.6
Belg./Luxembg.	81.0	66.8	Guyana	3.9	-7.3
Canada	48.0	34.4	Nicaragua	6.5	3.1
Finland	57.6	38.7	Peru	26.1	13.7
Germany W.	88.8	83.2	Surinam	10.4	-9.9
Iceland	1.9	-0.9	Hongkong	86.4	75.7
Italy	77.4	60.8	India	46.7	29.8
Japan	91.1	66.4	Jordan	6.2	-0.4
Norway	65.9	38.8	Korea	45.2	24.3
Portugal	58.7	48.1	W. Malaysia	30.0	14.8
Sweden	69.0	54.0	Pakistan	35.8	20.3
UK	83.9	75.7	Syria	11.1	9.3
U.S.A.	64.2	62.5	Taiwan	48.8	38.2
<b>Semi-industrialised:</b>			Algeria	6.6	-5.5
S. Africa	34.3	27.8	Liberia	1.15	-11.7
Israel	74.5	47.6	Sierra Leone	61.0	-3.6
Malta	50.2	39.0	Tunisia	16.2	11.3

Table 7: Countries whose actual shares of manufactures in the total exports are below the estimated shares.  
(Average 1960-68; based on equation No. 17)

Countries	Actual Share	Estimated Share	Countries	Actual Share	Estimated Share
<b>Developed:</b>			Costa Rica	10.0	16.4
Australia	16.7	31.7	Dominican Republic	2.5	21.6
Denmark	41.8	58.3	Ecuador	1.2	11.7
France	73.1	73.5	El Salvador	16.4	24.5
Ireland	24.3	48.0	Guatemala	11.2	16.4
Netherland	55.8	68.1	Honduras	4.7	6.5
New Zealand	5.0	32.0	Jamaica	0.73	26.3
<b>Semi-industrialised:</b>			Mexico	24.3	39.4
Cyprus	6.3	14.2	Panama	0.84	12.0
Greece	14.6	29.7	Trinidad + Tobago	6.1	29.5
Spain	38.7	47.0	Venezuela	1.1	17.9
Turkey	5.1	22.6	Cambodia	0.63	4.6
<b>Less Developed:</b>			Ceylon	0.96	16.8
Argentina	6.4	40.4	Fiji	2.4	5.3
Barbados	3.8	19.5	Iran	3.7	8.9
Brazil	5.5	18.5	Philippines	8.0	33.2
Br. Hond.	4.6	31.4	Singapore	26.6	41.3
Colombia	5.5	18.2	Thailand	6.4	14.0
			Ghana	3.3	21.3
			Morocco	7.7	13.6
			Nigeria	5.4	5.8
			UAR	18.5	24.9

some general observations which appear to be typical for groups of countries taken together:

- The actual shares of industrial exports are seen to have exceeded the "expected" shares for most of the developed countries. Nearly all these countries belong to some form of custom union or else enjoy special trade privileges. For the United States and France the equation seems to explain very well the actual observed share of industrial exports. It is most interesting however to observe six developed countries whose actual shares are in different degrees below those expected. One possible explanation may be that almost all these countries are specialized to a large extent in the export of agricultural and processed food products and therefore the actual share of industrial exports is not germane to their per capita income level and their level of industrialisation. This seems to be particularly true of the low density oceanic countries.
- Among the developing countries with positive deviations (i.e. actual shares greater than expected) there are six small countries whose estimated shares have negative signs. In other words, the calculations according to our model would imply that these countries should have been net importers of industrial products with zero export. As it is, it is a rare developing country that is not a net importer of manufactured goods. However, even for these countries, although the trade balances may be negative, there are mostly positive scores on their export accounts. Hence, to expect a country to be a net importer with no exports at all would seem to be a strange finding. The result appears all the more surprising since for all these six countries the estimated share of industrialisation (on the basis of which equation 17 is calculated) is higher than the actual share. Thus normally one would have expected the estimated export shares to be higher than the actual ones. But the results do not change even when one enters the actual share of manufactures in total GDP as an explanatory variable as is done in equation 20. The per capita GDP for each of these countries is also high enough as not to warrant a negative export. On closer examination, it is seen that all the countries in question have a density of population which can at best be described as between very low to less than medium (our definition)<sup>1</sup> and this probably explains the occurrence of negative export shares.<sup>2</sup> It was already argued that countries with low density could be expected to manufacture and export industrial goods at a higher level of per capita GDP and in smaller proportions than countries with a high density. Presumably the estimated shares reflect this underlying hypothesis. However, the actual items of manufactured export in case of three out of these six countries cannot really be termed as industrial products in the strict sense of the term. Their exports consist principally of metals and precious stones - diamonds in Guyana and Sierra Leone and aluminium in Surinam. This also holds true for Chile whose principal export consists of, as is well known, unwrought copper.
- The positive deviations in case of most South and Southeast Asian developing countries can in general be attributed to a combined result of their recent thrust towards industrialisation and efforts towards export promotion. The most prominent examples in this respect are the countries like South Korea, Taiwan and Hongkong.

<sup>1</sup> Average density (1960-68): Guyana, 3; Surinam, 2; Jordan, 19; Sierra Leone, 33; Liberia, 10; Algeria, 5.

<sup>2</sup> This should also explain for the negative sign in case of Iceland (which has an average density of 1.8 persons) in the developed country group.

However, before deriving any favourable conclusion about the export performance of these countries on the basis of the regression results alone a caveat needs to be added. We have been working in terms of shares and not of absolute values. In saying that the actual shares have been higher than expected, it is not implied that the trade restricting forces like tariff and non-tariff barriers put up by the actual and potential importing countries have not been operationally significant in these countries. On the contrary, it is entirely realistic to assume that in volume their actual exports may have been less than what would have been the case in the absence of such restrictions. The high shares of manufactures may only be a reflection of their own efforts towards industrialisation and their preparations for a truly export oriented economy.

- For 27 out of 44 developing countries in our sample, the actual export shares are far below their calculated shares (Table 7). This is despite the fact that for many of these countries the actual shares of the manufacturing sector to the total GDP are higher than what can be "expected" at their respective per capita income level. In other words, these are the countries where industrialisation has proceeded at a rapid speed and yet have failed to raise their share of industrial exports in the total to an expected level. The countries in question are Argentina, Brazil, British Honduras, Colombia, Dominican Republic, Ecuador, El Salvador and Mexico in Latin America; Philippines and to a lesser extent Thailand in Asia; UAR, Ghana and Morocco in Africa. It is not difficult to identify most of these countries as belonging to a group which have over a decade or more followed an active import-substituting industrialisation policy. It is plausible, therefore, that our results merely reflect, at least partially, the built-in bias against exports that such policies are being presently discredited for<sup>1</sup>.
- For the rest of the developing countries in Table 7 the estimated shares of industrial output (to repeat, this is used as an explanatory variable in equation 17) are greater than their actual share and this may have introduced an upward bias in the estimated shares of industrial exports. However, even when the actual shares of manufactures are used as in equation 20, the negative deviations tend to remain large. In other words, the shares of industrial exports do not seem to be in line with their relatively high per capita income (especially as compared with many other developing countries) and in some cases to their high density (for instance Singapore and Barbados). This may have something to do with the structural characteristics of these countries. For most of them, the comparative advantages seem to be in the export of agricultural products and natural-resource based goods ranging from cereals to mineral fuel<sup>2</sup>. The possibility of direct transformation of the domestic resources into industrial goods through trade appear to have obviated any special urge towards the expansion of industrial sector and more particularly towards export promotion along these lines. Thus not only are the deviations from the expected shares large for these countries, the actual shares of industrial exports themselves are very small as well.

<sup>1</sup> See I. Little, T. Scitovsky and M. Scott, *Industry and Trade in Some Developing Countries - A Comparative Study*, London, New York, Toronto 1970.

<sup>2</sup> Venezuela, Panama, Trinidad and Tobago and Iran rely mostly on the export of mineral fuels; Barbados is a sugar based economy; Honduras lives from the export of bananas and crude materials - Jamaica from food and crude materials; Cambodia's principal exports are rice and rubber and Ceylon's tea and some crude materials.

- Almost similar arguments are apparently valid for Cyprus, Greece and Turkey which have been classified as semi-industrialised economies. All three are heavily dependent on the exports of agro-based products and crude materials. Also their levels of industrialisation have not reached a stage which would seem to be in accordance with their per capita GDPs. The case of Spain is a bit different. It is only recently that the country has moved from an inward-looking import-substituting industrialisation strategy to an active export-oriented economy. The transformation process is not yet complete and the negative deviation may just be a reflection of this. The positive deviations in case of South Africa, Israel and Malta are perhaps attributable - among other factors (such as a strong industrial base) - to special trade relations they seem to enjoy in most industrialised nations.

16. The pattern which emerged from the pooled sample (of developed and developing countries) is not replicated when the sample is restricted to the developing countries only. The results of 3 regressions (function type 1, 2 and 4) on 64 LDCs and using the same exogeneous variables are shown in Table 8<sup>1</sup>.

A simple linear function is seen to provide the best fit for this sample. The income coefficient is negative (though not significant) in two regressions where all the other variables have the predicted signs. With function type 4, all the variables have positive signs but at the same time they are not statistically significant and the coefficient of determination is very low. Using equation 77 the estimated pattern is shown in figure 3. It has been derived in the same way as the earlier figure namely by assigning estimated values of industrialisation at different per capita incomes and with different assumptions about the density of population. According to this pattern the share of industrial exports is seen to rise up to an income level of around US- \$ 200 and then it falls successively with a rising income. The total income elasticities are negative indicating a converse relationship between changes in per capita income and changes in the share of manufactured exports.

17. If we were to test our hypothesis of a rising share of manufactured exports in the total on the basis of the pattern which is derived from a LDCs-sample alone, we would obviously have to reject the hypothesis or else look for alternative explanations. The industrialisation pattern in the LDCs appears to have been rather erratic. "Planned" industrialisation in countries with low per capita income has created in many cases a manufacturing base which may seem to be over the average, when seen in the light of an international cross-sectional regression. In some of them the exports of industrial products are also assuming an increasing share of their total exports. On the other hand, a large number of relatively "rich" developing countries are economically viable primarily because of their natural-resource based wealth. Also the level of industrialisation in most of them is below the average again when seen in the light of an international cross-sectional pattern. Above all, the bulk of their exports consists of primary products. In view of these observations it becomes easier to understand why the pattern derived in figure 3 is what it is. It merely reflects the reality of the situation in the developing countries.

On the other hand, in order to derive meaningful conclusions about the probable long-run behavioural pattern of an economy in the course of its growth, a pooled

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<sup>1</sup> It should be stressed that this table is not directly comparable with the earlier tables primarily because it does not refer to an entirely different set of countries; many developing countries are common to both samples.

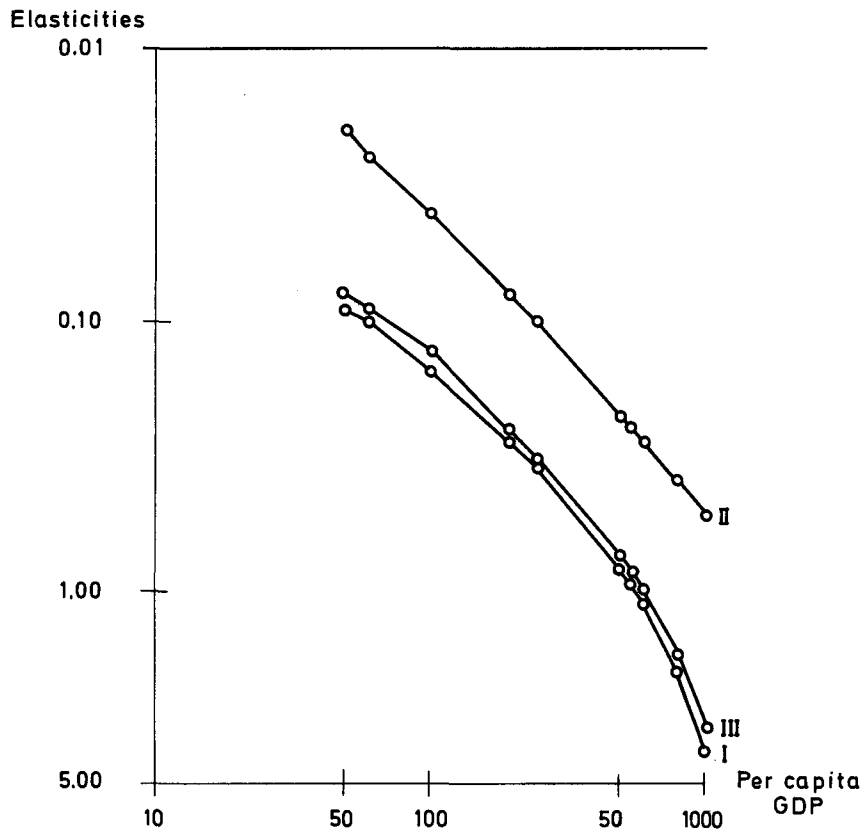
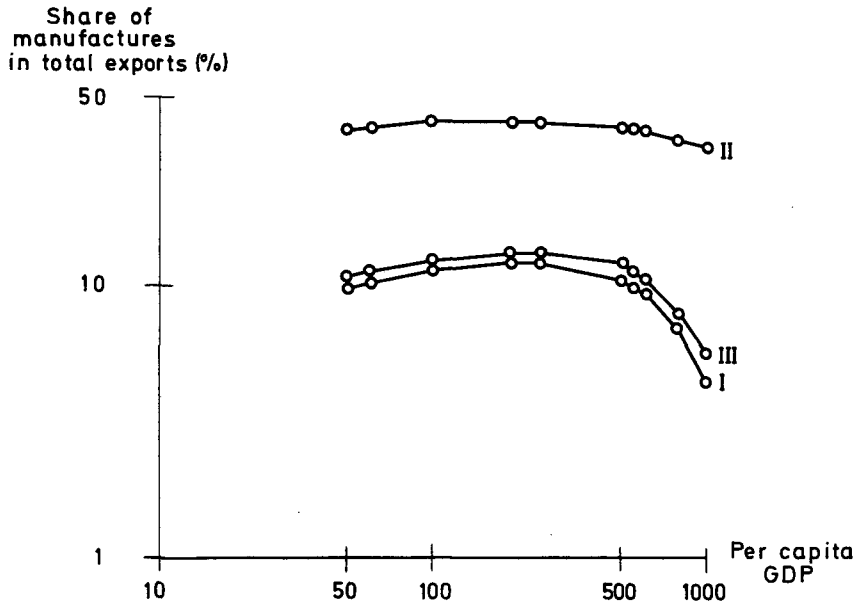
Table 8: Estimated Export Patterns: Results of Regression Analysis for LDCs  
 Function Type: 1, 2 and 4      Number of Countries: 64

No.	Constant term	Coefficients of:								R <sup>2</sup>
		X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	lnX <sub>1</sub>	lnX <sub>2</sub>	lnX <sub>3</sub>	lnX <sub>4</sub>	
77	1.22	-0.017* (0.008)	0.747 (0.224)	0.062 (0.021)	0.015 (0.002)					0.56
78	-17.5					-0.537* (3.355)	6.007* (4.532)	1.083* (1.355)	4.313 (1.063)	0.34
79	- 1.77					0.185* (0.363)	0.589* (0.490)	0.138* (0.147)	0.206* (0.115)	0.20

\* Not significant at 5 per cent level.

Fig. 3

ESTIMATED EXPORT PATTERNS (OF MANUFACTURES) FOR DEVELOPING COUNTRIES ONLY, AT MEDIUM (I), HIGH (II), AND LOW (III) DENSITY OF POPULATION AND THE CORRESPONDING ELASTICITIES



I The curve indicates the possible development path (of manufacture exports) of a country with the size of Nigeria's economy.

II A country of India's economic size.

III A country of Brazil's economic size.



sample is the most appropriate starting point. The range of structural variations in such a sample is very wide and the estimated coefficients are more likely to reflect the result of interactions among the variables with long-run implications. Such possibilities are severely limited in a sample which consists of countries with similar structure. Since the structure itself is likely to undergo alterations in the process of growth, a pattern which incorporates the experiences of divergent structures should be clearly preferable for drawing any long-run conclusion. It is for this reason, we maintain that our hypothesis is certainly not refuted because of a reverse pattern drawn from a group of developing countries only. In any case, the positive and statistically significant industrialisation coefficients even in this sample confirms at least that part of our hypothesis which states that with a widening manufacturing base at home the share of industrial exports will rise as well. In other words, the countries that have chosen the path of rapid industrialisation as a possible means to increase their level of per capita income are likely to replicate the pattern indicated in figure 1, provided that they do not commit themselves to an extreme import substitution strategy. Individual case studies in the light of this hypothesis will be the subject matter of our future investigations.

### Summary and Conclusion

18. This study had a limited scope. In the first place, with the help of a regression analysis based on a cross-section of pooled sample, a long-run pattern of industrial exports was established. According to this pattern, the share of manufacture in the total exports increases *pari passu* with per capita GDP and the degree of industrialisation. This result is in accordance with the hypothesis we wanted to examine. This pattern was not repeated with a regression analysis on a sample consisting of developing countries only. While the industrialisation variable was positively related to the share of industrial exports, the per capita income variable had a negative sign. It was argued that this was due to the presence of many developing countries in the sample which have relatively high per capita income and are rich in natural resources but have low levels of industrialisation.

In the regression models, only the factors affecting the supply of industrial exports were taken into account. As a consequence a large part of the total variation in the regressions remained unexplained. It was still possible to identify some of the reasons for the deviations (in both directions) of groups of countries from the "normal" pattern. The deviations in most cases could be attributed to the unique structural characteristics of the related countries.

The analysis was in terms of the share of the manufactured exports to the total; nothing was said about the absolute magnitude. Therefore it was cautioned that a high share did not necessarily indicate a high volume of exports. The trade restricting forces could very well have shrunk the volume of industrial exports even in those countries which showed an above the average performance in terms of shares. Such contentions can only be examined at greater length by making in-depth country studies, some of which are already underway in this Institute.

## IV. Sources of data

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- United Nations, Monthly Bulletin of Statistics, various issues, New York.
- United Nations, Demographic Yearbook, 1969, New York.

## Level of Skill

- International Labour Office, Yearbook of Labour Statistics, 1968, 1969, Geneva.

## Exports

- United Nations, Yearbook of International Trade Statistics, 1960 to 1969, New York.
- OECD, Trade by Commodities (Market Summaries: Exports), various issues, Paris.