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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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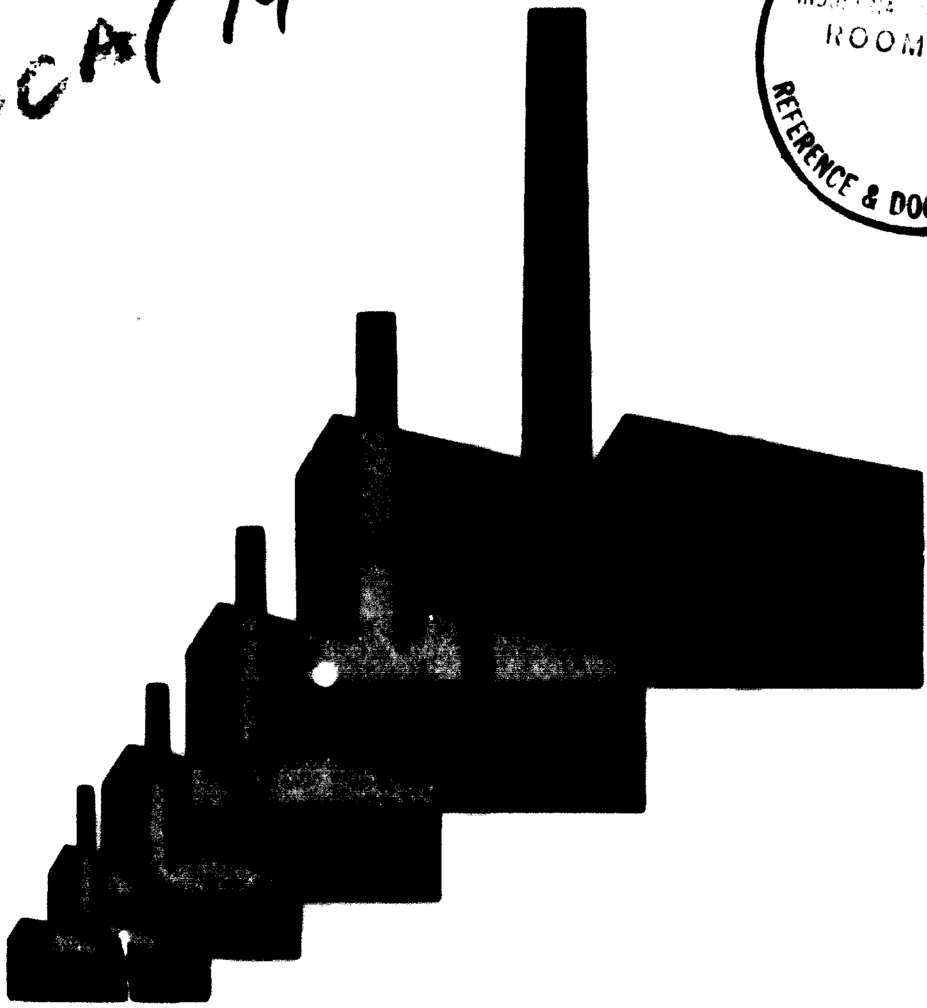
A STUDY OF INDUSTRIAL GROWTH



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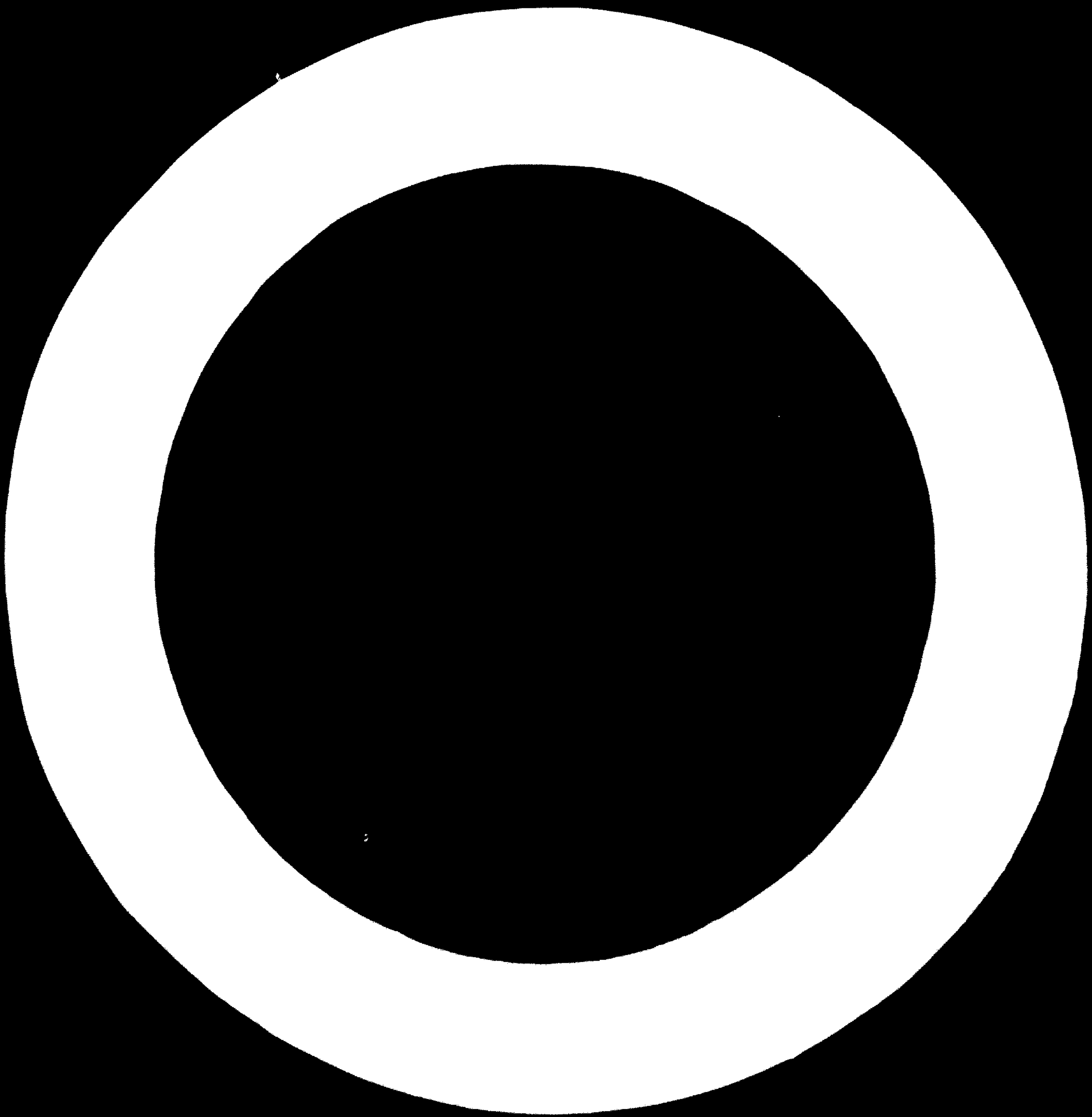

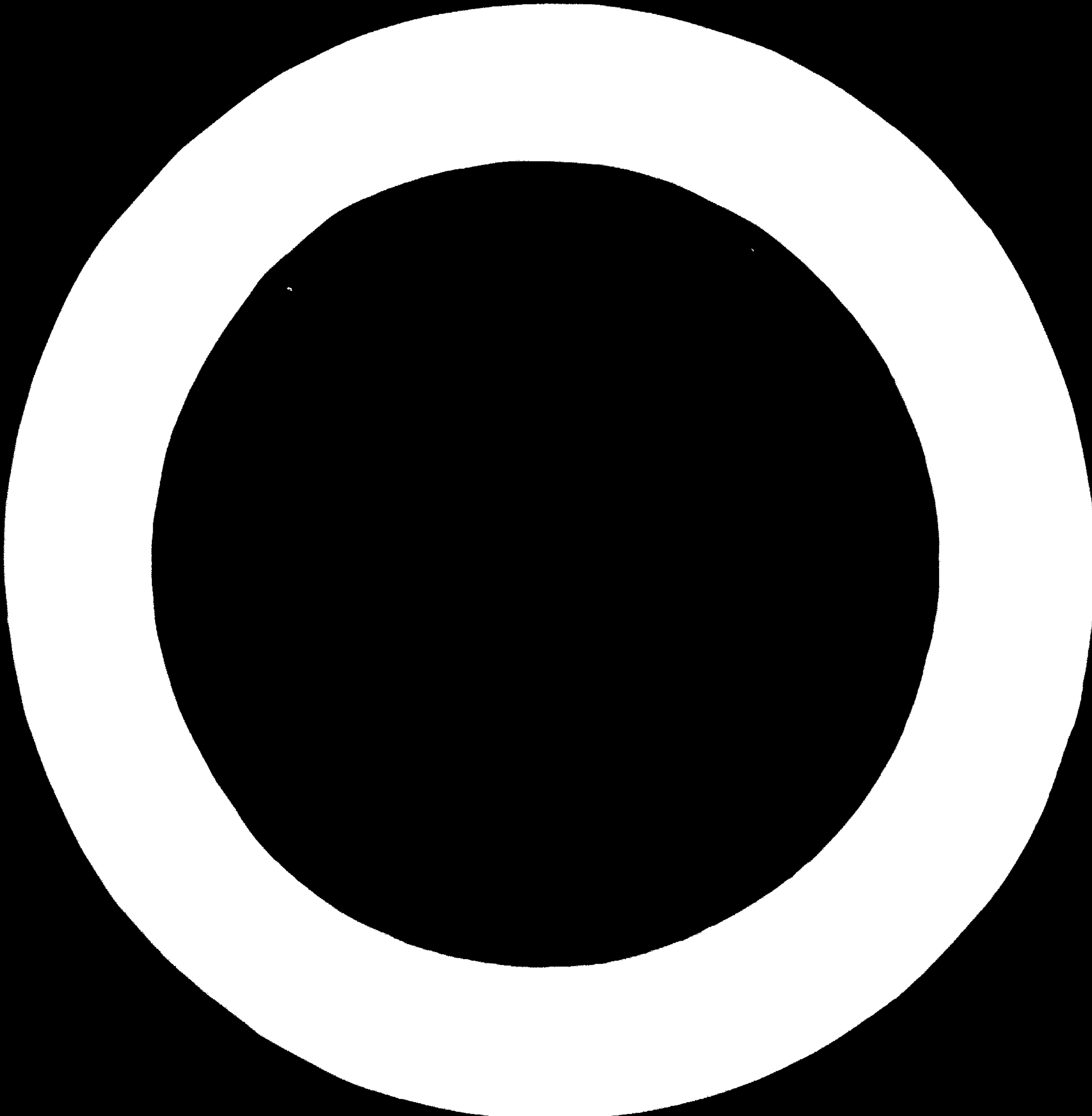

Department of Economic and Social Affairs

A STUDY OF INDUSTRIAL GROWTH

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FOREWORD

This report has been prepared as part of a series of research projects dealing with techniques of industrial programming under the United Nations work programme on industrialization, approved by the Committee for Industrial Development at its first session (E/3476/Rev.1) and the Economic and Social Council in resolution 817 (XXXI). This report has been prepared by the Research and Evaluation Division of the Centre for Industrial Development, Department of Economic and Social Affairs, and the basic part of the analysis involved has been carried out in collaboration with the Research Centre in Economic Growth of Stanford University.

NOTES AND ABBREVIATIONS

Among the symbols and terms used in the tables throughout the report, the following should be noted in particular:

1. A full stop (.) is used to indicate a decimal point and a comma (,) to distinguish thousands and millions;

2. The term "billion" signifies a thousand million;

3. The term "log" designates common (or Briggs') logarithms in the tables presented in the text; it designates natural (or Naperian) logarithms in the tables presented in appendix I, as so indicated occasionally;

4. The sign $ (or dollars) refers to the United States dollars of the year 1953, unless otherwise stated;

5. Annual rates of growth or change refer to annual compound rates, unless otherwise stated;

6. All other symbols and terms are occasionally explained either in the text related to, or in the footnotes attached to, any particular tables where they are used.

Certain abbreviations have been used: GNP for gross national product; GDP for gross domestic product; ISIC for International Standard Industrial Classification of all Economic Activities; ECLA for Economic Commission for Latin America; OEEC for Organization for European Economic Co-operation; UK for the United Kingdom of Great Britain and Northern Ireland; USA for the United States of America; UAR for the United Arab Republic; USSR for the Union of Soviet Socialist Republics; "Rhodesia and Nyasaland" stands for the Federation of Rhodesia and Nyasaland.

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INTRODUCTION

Rapid industrial growth constitutes in the majority of cases the most potent dynamic factor in the process of accelerated economic growth. Industry is in itself a highly dynamic activity; the incomes per person engaged are normally substantially higher in industry than in agriculture; also industry tends to exercise a dynamic impact on the other sectors of the economy, including agriculture, and upon the entire social and institutional climate, through its demand for skills and changes in the pattern of consumption and general patterns of living. It is for these reasons that Governments of developing countries generally consider industrialization as synonymous with economic progress, and give the highest priority to industrialization in their strive for accelerated economic development.

A relationship similar to that which exists between the general level of development of a country and the development of industry can be observed within the industrial sector itself, as regards the sequence of the emergence of certain industrial branches and their relative size. The conventional picture of the sequence of industrialization in under-developed countries in its earlier stages is as follows. The economic and institutional background is, in general, characterized by scarcity of capital, of managerial talent and technical skills, poor infrastructure, lack of external economies and, because of the low level of per capita income and inadequate transportation facilities, limited markets for industrial goods. These conditions tend to favour, as can be expected, the types of industry that are, as a rule, technologically relatively simple to operate, require less capital per unit of output, produce consumer goods in the category of the primary necessities, and can produce these economically at lower levels of output. Examples can be found in the food processing and textile industries. Gradually, as more favourable conditions set in, the structure tends to become more diversified through the development of other branches, from light chemicals, leather, pulp and paper, etc., up to steel production, heavy chemicals and other intermediaries, machine building, etc.

The objective of the present study is to investigate to what extent the development referred to in the preceding paragraphs conforms to some pattern, in the sense that the level and composition of manufacturing industry in a given country could be related in some quantitative way to a certain number of general economic characteristics of that country. If this proved to be the case, the relationships obtained would provide a highly useful analytical tool, and would make it possible to determine a set of benchmarks regarding the level and composition of manufacturing industry in relation to the general level of economic development of the country in question. In those cases where actual production, either in total manufacturing or in specific branches, falls severely short of such benchmarks, this would then be indicative of existing possibilities for the development of the relevant sectors, which would deserve further exploration. The relationships would also provide a first approximation of the general structural tendencies under a process of "autonomous" industrial growth — that is, a process of growth that might be expected under conditions of "spontaneous" industrialization associated with a given rate of growth of general economic indicators taken as independent variables. It goes without saying that such a growth pattern need not be considered as having normative value; it corresponds to the statistical universe from which it is derived and is thus conditioned by the economic and institutional characteristics of the countries included in that universe. It is clear, for instance, that the existence of a strong element of government intervention in the process of industrialization of a given country will, as could be expected, profoundly affect its pattern. The point is discussed in some detail later on.

The scope and significance of applications of the results of this study will be discussed in the section Use of Results. It will be noted, however, at this stage, that the objective of the study is to provide a complement rather than a substitute for detailed analytical country studies which would determine the level and structure of industrialization of individual countries in the light of their particular needs, resources and policies. The relationships derived in this study are based on a simplified model which comprises a limited number of the most important explanatory variables. It may be expected that in each particular case other variables would come into play, which may substantially influence the individual pattern. Moreover, some of the factors which affect the rate and structure of industrial development, such as active government intervention, are not amenable to analytical treatment within the framework of the present model altough, as will be seen later in part III of this study, an attempt has been made to explore the impact of such variables.

In the following, manufacturing industry is taken to include all transforming industries and to exclude mining and power generation. Total manufacturing is subdivided into thirteen industrial sectors.[1] The objective of this analysis is to express the quantitative relations referred to above in the form of a set of equations in which the levels of total manufacturing output and of outputs in each of the thirteen sectors — both expressed in value added[2] are "explained"[3] in terms of a few selected macro-economic variables.

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[1] Based on the ISIC 2-digit classification, with some combinations of sectors.

[2] Gross value at market prices of output minus cost of materials and power used

[3] As will be discussed later on, the term "explained" [illegible]

The basic tool employed in the study is multiple regression analysis. Two types of regression analysis are used: cross-section regressions relating the value added data (for total industry and each one of the thirteen sectors) of the sample countries in a given year to the corresponding values of the explanatory variables in the same year; second, a time-series analysis concerning similar relations within countries over time.

The general analytical method used in the present study is based upon a study published by Chenery in 1960.[4] The present study has introduced a certain number of elaborations and refinements in the method; it has also made use of amplified basic data, especially as regards manufacturing output.[5]

The main text of the present study contains a general presentation of the methods used and a discussion of the results obtained. The technical details of the statistical analysis are given in appendix I, and a description of the basic data used in the regressions in appendix II.

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be understood as meaning that the equations imply a one-way causal relationship in the sense that the concepts for which the explanatory variable stand are the "causes" that "determine" the production levels.

[4] Hollis B. Chenery, "Patterns of Industrial Growth", *American Economic Review*, September 1960, vol. L, No. 4, pp. 624-654.

[5] Manufacturing output data were compiled for over fifty countries on an internationally comparable basis by the United Nations Statistical Office and published in *Patterns of Industrial Growth, 1938-1958*, Sales No.: 59.XVII.6.

I. METHOD AND MODEL

In this part are discussed the principles underlying the methods of analysis applied, the choice of the independent variables used in the relations, and the form of the equations in which these relations are expressed.

A. Regression analysis

Two approaches can be used in the analysis. In the first approach, the cross-section analysis given a sample consisting of data for a certain number of countries, the variation in industrial output is studied as a function of the corresponding independent variables regardless of the country from which these data originate. In the other approach, the time-series analysis, the variation in industrial output are examined *for each country and/or for a group of countries* as a function of the variations over time of the corresponding independent variables: to reach reliable conclusions in the latter approach, it is necessary that the analysis be carried out for a number of countries and over a sufficiently long period of time, so that the results can be standaridized with an acceptable degree of generality.

The present study relies mainly on cross-section analysis. A preliminary regression analysis which was carried out for the purpose of selection of the explanatory variables to be included in the equations was based on the 1953 data for 53 countries, and the final analysis which resulted in what are later referred to as the "standard" equations, were based on the same data plus those for 42 countries in 1958. Time-series data on manufacturing output and other relevant magnitudes are available on a comparable basis for a limited number of countries, and even for these countries World War II has produced a major break in all significant economic relations, so that only a very short period following the post-war recovery can be taken into consideration. The principal purpose of applying time-series analysis was to check the usefulness of the cross-section relations for projections. A general discussion of the model is presented in the light of the results obtained in the two approaches in part IV: "Over-time variation of industrial output". The problem of the applicability of the results for projections is discussed in part V: "Use of results".

B. Variables

1. Output

Industrial output was measured by value added; it was considered that the latter constituted the most appropriate measure of the relative importance of an industry both as compared with other industries and in the context of the national economy as a whole. It is also a measure of output for which there is the greatest degree of international comparability since the publication of the recent United Nations study, *Patterns of Industrial Growth 1938-1958*, referred to earlier, which provided most of the basic data for the present analysis.

2. Explanatory variables

A priori *considerations*

The level and composition of industrial production in a given country is influenced by factors on both the demand and the supply side.

In a simplified economic system, the factors on the demand side will predominate heavily. Assume an economy in which there is no foreign trade, a constant technology, and a constant population. The level and composition of consumer demand will depend mainly on the level of income. Under the assumed absence of foreign trade this will determine the production levels of the individual consumer goods industries and with a given technology, determine in turn the production levels of the intermediate industries. It will thus be possible to derive an equation for the output of each industry as a function of the income level alone, with fixed parameters representing demand elasticities and technological relations.

It should be noted, however, that even under such simplifying assumptions the production functions for given industries would not necessarily be identical among different countries having the same income level. This is due to the fact that, although there is evidence of considerable uniformity in consumer preferences for a large group of commodities, there are significant differences in consumer patterns among countries having the same income level, not only because of climatic and national factors, but also due to differences in government policies which may allot varying proportions of total output to investment and to consumption; moreover, technologies, although assumed to be constant within each country, may differ among countries, and so do the endowments with natural resources.

In an economy open to international trade the situation becomes more complex. A given demand pattern can now be partly satisfied by imports of some products that are paid for by exports of other products. Factors on the supply side will now play an important role involving the principle of comparative advantage. A further complication will arise through the introduction into the system of the possibility of choice between alternative production techniques. In addition to the income level, the following factors may be relevant to the levels of industrial output, both over-all and by sector:

(*a*) The size of the domestic market;

(*b*) The availability of specific natural resources;

(*c*) The availability of technical skills and entrepreneurial talent;

(*d*) The relative cost of capital and labour;
(*e*) Government policy toward trade and industry.

Candidate variables

A tentative set of quantitatively measurable "candidate variables" have been first selected that are assumed to represent the factors which appear to be relevant on *a priori* grounds. The following variables have been included in the set, subject to further investigation.

(i) *Per capita income* (y). As stated above, the level of income seems to be the most decisive factor for the level and composition of industrial output under a simplified assumption of an economy with no international trade and no choice of technology. Even when these simplifying conditions are dropped, the level of income still plays a sufficiently dominant role to overshadow many other elements responsible for the variation to be explained.

As is well known, at higher income levels the proportion of personal income spent on food declines, and that spent on consumer durables and other commodities of higher income elasticity increases; this will tend to have a corresponding effect on the pattern of production. The distribution of total demand among investment, government consumption and private consumption, also tends to vary with the level of per capita income. On the supply side, the level of per capita income will tend to be correlated with the relative costs of labour and capital and, to a certain extent, also with the availability of skills and technical knowledge; it will thus be indicative of the probable extension of industrial production into more capital intensive and technologically more complex fields.

(ii) *Population* (P). Population might be considered, as a first approximation, to have a proportional effect on the level of industrial production, since the demand for industrial products will, *ceteris paribus*, be proportional to population, and so will be the supply of industrial labour force. However, the proportionality may not strictly hold for all industrial branches, because certain industries cannot be operated economically below a certain minimum scale.[6] Of course, the size of market is not independent of per capita income level within a country considered; neither is it independent of the possibilities of international trade.

(iii) *Rate of economic development*. In addition to the level of economic development—as expressed by per capita income—the *rate* of development may have an independent impact on the level—and especially the composition—of industrial demand, especially the demand for producer goods. The rate of increase in per capita income (r) and the percentage share of gross domestic capital formation in gross domestic product (I/Y) have thus been tentatively introduced as candidate variables subject to further testing.

(iv) *Government policy*. Aside from direct investment, governments can exercise considerable influence on the level and composition of industrial production through such means as protective measures, tax policies, subsidies, and other direct or indirect incentives or disincentives. Most of these factors cannot be expressed quantitatively in the form of variables. On the other hand, the level of government expenditure—or consumption—may have a significant effect on the composition of total demand. The percentage share of government expenditure on current account in gross domestic product (G/Y) has been tentatively included in the set of candidate variables.

(v) *Natural resources*. Natural resource endowments are likely to be important determinants of output in some industries—such as iron and steels, basic chemicals and foodstuffs. They are less important when the raw materials are fairly ubiquitous—such as raw materials for brick and cement or synthetic chemical industries; or in industries where there is little weight loss in processing (e.g., textiles).[7] Natural resources also play a minor role in industries based on substantial value added by skilled labour, unless the latter is considered as a natural resource. It is difficult to measure the resource endowment in general in terms of any single variable. As a possible candidate, the percentage share of primary exports in total (X_p/X) has been included in the tentative set.

(vi) *Trading position*. The relative importance of foreign trade in a country's economy, as expressed in the ratio of imports plus exports to gross domestic product (X + M)/Y, has also been investigated, although on an *a priori* consideration it would seem that this impact would vary with the circumstances associated with the relative level of foreign trade. Thus, a high level of foreign trade may indicate that the marginal cost of securing foreign exchange is relatively low; this would be the case, for instance, when a country is endowed with rich resources of valuable minerals that can be mined at relatively low cost. It may then be advantageous for the country to import a substantial part of the requirements of industrial products, rather than to produce these locally. On the other hand, the reverse may be true in countries where a high level of foreign trade is related to a scarcity of resources. In such cases, since foreign exchange could not be obtained from exports of primary commodities to pay for imports of manufactured goods, these countries have developed strong industrial sectors based on exports of goods incorporating a high proportion of domestic value

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[6] The two explanatory variables considered thus far, *y* and P, determine together national income. The latter variable, however, cannot be taken to replace the former two. This may be illustrated by the following example. Two countries are compared, of which the first one has a population of 10 million and a per capita income level of $1,000, and the second a population of 100 million and a per capita income level of $100. For both countries the national income is $10 billion. Suppose that the demand function for commodity *i* in country *j* takes the form:

$$D_{ij} = C_i Y_j^{a_i} P_j$$

in which D_i is the demand, C_i a constant; and a_i the income elasticity of demand for commodity *i*; the population elasticity of demand is assumed to equal one. If a_i is, say, 1.5, then

$$\frac{D_1}{D_2} = \frac{C_i\,(1{,}000^{1.5})\,(10)}{C_i\,(100^{1.5})\,(100)} = 10^{0.5} = 3.16$$

in other words, the high-income country in the example will have a demand for commodity *i* more than three times as large as that of the low-income country, even though their total income is the same.

[7] This would also seem to apply to petroleum refining, but here the competition for domestic refining by the crude oil producing companies may play a role.

added; these exports pay for imports of raw materials, including those consumed in their export industries.[8]

(vii) *Technological factors.* The economies of large-scale production and the extent to which capital can be economically substituted for labour (or vice versa) affect the choice between imports and domestic production. In smaller and less developed countries, where the domestic market, especially of producer goods, is small in relation to the economic size of plant, the ensuing lack of economies of scale will check the development of the corresponding industries. Such countries may often have, on the other hand, a cost advantage in producing such commodities as textiles, processed foods, simple metal manufactures and similar products, because of their relatively simple technology, limited scale requirements and large input of labour available at low cost. By the same token, economies of scale and high capital requirements tend to favour high-income countries in the production of commodities such as steel and basic chemicals.

Some of the variables previously introduced may bear on these aspects, in particular per capita income (y) and population (P). An additional variable has been tentatively introduced to indicate the degree of mechanization, namely, the horsepower capacity of installed power per worker in manufacturing industry (K/L).

(viii) *Other factors.* Other factors, such as availability of technical and entrepreneurial skills and the relative costs of labour and capital are, in general, highly correlated with the level of per capita income. For this reason, no specific candidate variables have been introduced to account for these factors.

The variables selected: per capita income and population

The selection of the most appropriate combination of explanatory variables among the above eight candidates was carried out applying the usual criteria of multiple regression analysis; the optimum combination of variables is chosen in such a way as to comprise the minimum number necessary for an adequate "explanation" of the dependent variables.[9]

Following a statistical test along these lines, only two candidates, per capita income (y) and population (P), were retained. All other variables proved to be significant in the explanation of only a few of the thirteen industrial sectors.[10] The statistical test and the considerations leading to the final choice are given in appendix I.A.

The relative level of industrialization

A set of preliminary equations which was derived using the two selected explanatory variables did not prove to be sufficiently satisfactory for practical use. An examination of the residuals[11] from these preliminary equations, computed for the sample countries, showed a noticeable degree of positive correlation among the different sectors within each country; in other words, when actual total industrial output in a given country is, for whatever reason, higher or lower than would correspond to the country's position as regards per capita income and population, the output levels in most of the industrial sectors will also tend to show residuals of the same sign, though to varying degrees. Moreover, when the countries in the sample were split into low-income and high-income groups, the regression coefficients obtained separately for the two groups showed substantial differences.

For this reason, an additional explanatory variable, D, "the relative degree of industrialization", was introduced. The quantitative expression of this variable was assumed to be represented by the actual position of a country's *total* manufacturing output in relation to the value of the latter as derived from the preliminary regression equations using per capita income (y) and population (P) alone; in other words, the value of D was obtained for each country as the residual from that regression equation.[12]

Obviously, the new variable, D, can be introduced only in the equations for the thirteen industrial sectors and not in the equation for total manufacturing. As will be discussed later, the values of D proved to be relatively stable for each country over time, at least in the short run. Its introduction in the sector equations resulted in a substantially better "fit" of the equations.[13]

It is interesting to note that the introduction of D as third independent variable left unchanged the values of the regression coefficients on the other two explanatory variables and also of the constant terms in the equation;[14] it can thus be regarded as providing for a correction term that serves to distribute the over-all residual of *total* manufacturing output over the thirteen composite sectors.

[8] This is particularly the case of Japan, but applies also to such traditional exporters of manufactured goods as the United Kingdom, Belgium, etc.

[9] Concretely, this implies that a variable is retained in the final combination only when:

(*a*) Its inclusion contributes materially to the "fit", while at the same time its regression coefficient is significantly different from zero; and

(*b*) The sign and size of its coefficient in the regression equations is consistent with its economic interpretation. (Thus, for example, the coefficient of I/Y in the regression equation for a capital-goods producing industry should be positive on *a priori* grounds. If this coefficient turns out to be negative, further investigation would have to be carried out in order to determine whether I/Y would have to be replaced by another variable related to the rate of development or be discarded).

[10] In the present study, which purports to be an analysis of the pattern of industrialization *in general*, the model has been designed in such a way that one and the same form of equation is applied for all sectors.

[11] The term "residuals" is used in the sense customary in this type of analysis—i.e., indicating the difference between the observed values of industrial output and the "predicted" values, that is, those calculated from the regression equations on the basis of observed values of the independent variables.

[12] Total manufacturing itself cannot be chosen as a third explanatory variable, because of its high correlation with the other explanatory variables.

[13] See appendix I.C(5).

[14] On condition that the regressions for different sectors are carried out with the same sample countries—see also appendix I.C(3).

C. The final form of regression equations

A preliminary investigation suggests that the linear equations in the logarithmic value of the variables provides for a better fit than any other more complicated form.

The final regression equations are as follows:

for total manufacturing:

$$\log V_0 = \alpha_0 + \beta_0 \log y + \gamma_0 \log P \qquad \text{(I)}$$

and *for the individual sectors:*

$$\log V_i = \alpha_i + \beta_i \log y + \gamma_i \log P + \delta_i \log D \qquad \text{(II)}$$
$$(i = 1, 2 \ldots 13)$$

in which:

V is value added, in millions of 1953 US dollars;

y is per capita income in 1953 US dollars;

P is size of population in millions;

D is the ratio between the actual and the calculated value of V_0;[16]

α's are constants and β's, γ's and δ's the partial elasticity coefficients on the respective explanatory variables.[17]

The above set of equations is estimated on the basis of cross-section data alone. As will be seen in appendix I.E, the application of the same form of equations to time-series data could not be expected to yield meaningful results.

It should be observed that the linear form of the logarithmic equations precludes consistent compliance with the additivity condition; that is, the condition that the sum of the predicted values for the thirteen sectors in a given country should equal the value added of total manufacturing in the same country. This, however, does not materially affect the practical usefulness of the equations, as is discussed in detail in the chapter "Use of Results".

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[15] The objective of the equations is to "explain" the value added of total manufacturing and of the individual sectors in a given country in terms of the observed values of the explanatory variables in the same country. For such relations to be valid it is not necessary to assume that there exists a one-way causal relationship between the variables, in the sense that the factors for which the explanatory variables stand "determine" manufacturing output. The causal relationship may to some extent run the other way round: for instance, the level of manufacturing output will substantially contribute to determining the level of per capita income. The equations considered should thus be considered as being the expressions of the interdependence between the "to-be-explained" and the "explanatory" variables.

[16] The value of D for country j is obtained with the formula:

$$\log D_j = \log V_{0j} - \log \overset{*}{V}_{0j}$$
$$= \log V_{0j} - (\overset{*}{\alpha}_0 + \overset{*}{\beta}_0 \log y_j + \overset{*}{\gamma}_0 \log P_j)$$

in which $\overset{*}{\alpha}_0$, $\overset{*}{\beta}_0$ and $\overset{*}{\gamma}_0$ are the least-squares estimates of the parameters in equation (I).

[17] A partial elasticity coefficient indicates the quotient of the rate of change in value added and the rate of change of the given explanatory variable, the other explanatory variables remaining constant. Thus, β_i is equal to the per cent increase (or decrease) in value added of the i-th sector corresponding to one per cent increase (or decrease) in per capita income, other variables (P and D) remaining unchanged. In mathematical terms:

$$\beta_i = \frac{\delta V_i}{V_i} \Big/ \frac{\delta y}{y}$$

II. RESULTS OF CROSS-SECTION REGRESSIONS

A. The regression equations

The cross-section analysis has been carried out on the basis of data on value added, per capita income and population [18] for the standard sample which included all the non-centrally-planned countries [19] for which sufficient data were available on a comparable basis. The sample thus covers countries with a wide range of levels of economic development. The centrally-planned economies were not included in the standard sample, since a mixture of data derived from two institutionally different types of economy would increase the heterogeneity of the sample and give analytically inefficient results.[20] To examine the difference in the rate and structure of industrial growth between the centrally-planned and the non-centrally-planned economies a section of this study has been devoted to an analysis of the deviations from the "normal" pattern derived from the standard sample.[21]

Initially, two separate cross-section regressions were carried out: one on a 1953 sample comprising 53 countries and the other on a 1958 sample of 42 countries.[22] The differences between the two regressions proved to be negligible in almost all important respects; moreover, the five-year interval between the two sample years did not appear to be long enough to justify a meaningful isolation of the between-sample (over-time) variation of industrial output as against the within-sample (cross-country) variation.[23] Therefore, in the step, a standard cross-section pattern has been derived by combining the data of the two years.

B. Presentation of the results

The standard regression equations thus obtained are presented in table 1. The *income elasticity of output* (β) for total manufacturing is about 1.37; that is to say,

[18] For the reasons explained in appendix I.B the country data used in the regressions are weighted on the basis of per capita incomes.

[19] With the exception of the United States. The latter country stands, in many important respects, far apart from the other non-centrally-planned countries, and its inclusion would tend to distort the results.

[20] There is the additional difficulty of the conceptual differences in the data between the two types of economy, which reduces the comparability.

[21] See III.B.

[22] The samples used in the regressions relating to several of the sectors exclude some of the countries of the full samples. The lists of the countries used in the various regressions are given in the tables of appendix I where the results of these regressions are given in their full form.

[23] See IV.1 and also appendix I.D.

Table 1

RESULTS OF CROSS-SECTION ANALYSIS: 1953 AND 1958 COMBINED SAMPLE

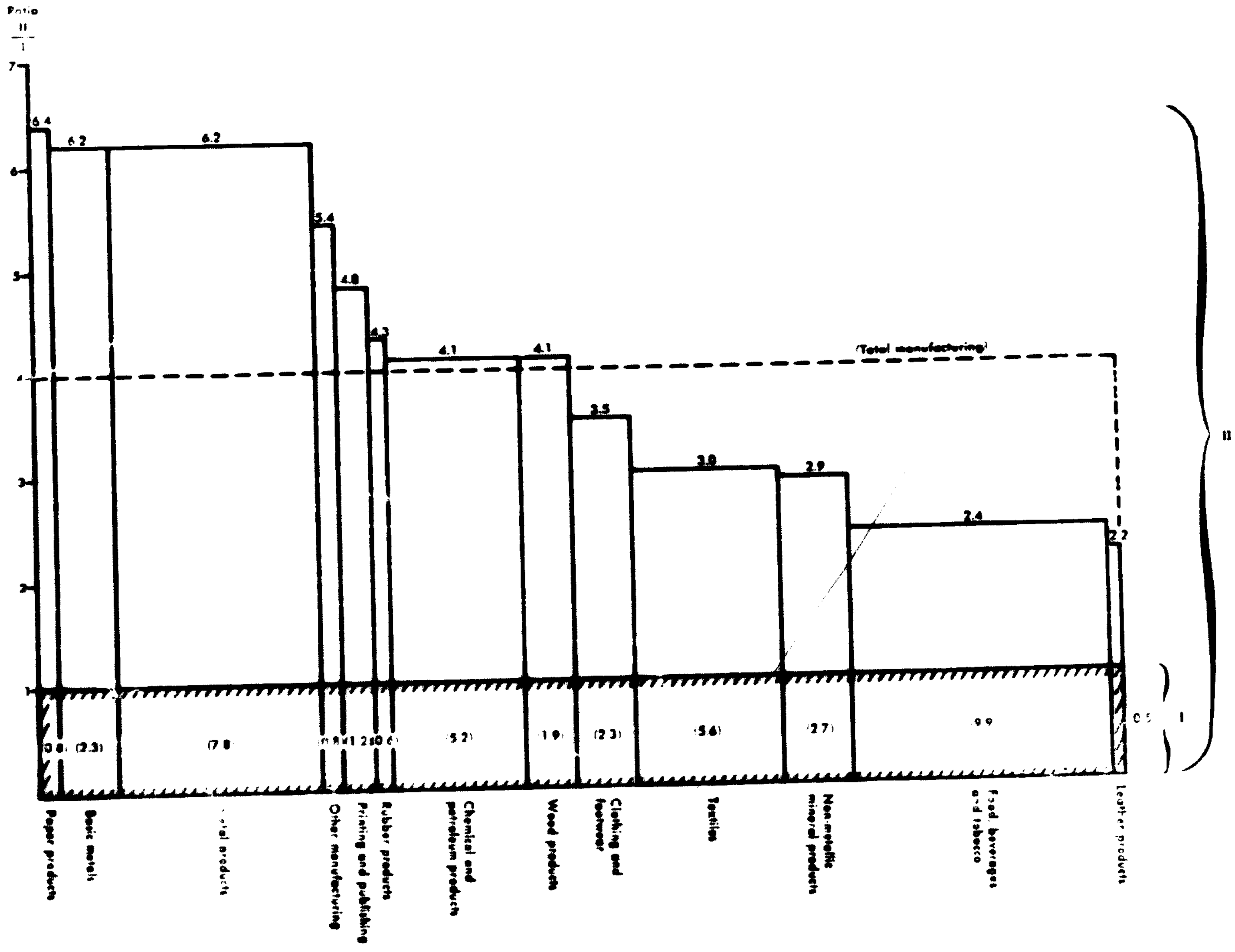
Manufacturing sector (ISIC classification)	*Regression equation*				
Total manufacturing (20-39)	$\log V_0$	1.637	1.369 log y	1.124 log P	
Food, beverages, and tobacco (20-22)	$\log V_1$	1.032	.978 log y	.862 log P	.884 log D
Textiles (23)	$\log V_2$	2.549	1.205 log y	1.329 log P	.964 log D
Clothing and footwear (24)	$\log V_3$	2.709	1.361 log y	.962 log P	.877 log D
Wood products (25-26)	$\log V_4$	3.288	1.531 log y	1.030 log P	1.008 log D
Paper and paper products (27)	$\log V_5$	− 5.008	2.035 log y	1.116 log P	1.699 log D
Printing and publishing (28)	$\log V_6$	3.926	1.718 log y	1.041 log P	.873 log D
Leather products (29)	$\log V_7$	2.160	.893 log y	.857 log P	1.251 log D
Rubber products (30)	$\log V_8$	4.176	1.582 log y	1.201 log P	.281 log D
Chemicals and petroleum coal products (31-32)	$\log V_9$	3.476	1.547 log y	1.395 log P	.712 log D
Non-metallic mineral products (33)	$\log V_{10}$	2.258	1.157 log y	1.014 log P	1.116 log D
Basic metals (34)	$\log V_{11}$	5.269	1.991 log y	1.649 log P	1.915 log D
Metal products (35-38)	$\log V_{12}$	4.175	1.984 log y	1.312 log P	1.566 log D
Other manufacturing (39)	$\log V_{13}$	4.872	1.847 log y	1.333 log P	1.053 log D

N. B. — V_i's are measured in millions of US dollars and y in US dollars (both at 1953 prices) and P in millions; the variables and constant terms are expressed in common logarithms. See appendix I.D for the statistical details of the above estimations. (In appendix I regression equations are presented with constant terms expressed in natural logarithms and "population" measured in thousands and not in millions.)

Chart I

A. Income effects

Two economies with different per capita income levels: (I) $200; and (II) $500; with the same size of population (40 million) and the same relative degree of industrialization (D = 1). Numbers in parentheses denote per capita value added in 1953 US dollars at income level I.



assuming that population is constant, the value added of total industry increases slightly over one-third more than proportionately with per capita income. As regards individual sectors, only "leather products" varies less than proportionally with per capita income, and "food, beverage and tobacco" approximately proportionally ($\beta_1 \simeq 1$). The response to income in "textiles" and "non-metallic minerals" is smaller than in total manufacturing, which means that, although production in these sectors tends to rise more than proportionally with income, their share in total manufacturing tends to decline. In "clothing and footwear" the income elasticity of output is almost equal to the elasticity for total manufacturing; this sector tends to maintain its relative share in total manufacturing output at varying per capita income levels. For all other sectors the income elasticities are higher than for total manufacturing; thus, output in these sectors not only will increase more than proportionally with higher incomes, but so will their share in total manufacturing rise.

These results are illustrated in chart 1, which gives a comparison of the results for two countries with per capita income levels of $200 and $500, respectively, the same population (40 million) and the same relative degree of industrialization (unity).[24] It will be seen from the chart that for total manufacturing the ratio between the value added at $500 and at $200 per capita income levels is about 4.0.[25] "Paper and products", "basic metals" and "metal products" show the highest ratios (6.2 to 6.4) in value added between the two income levels; these ratios indicate that at the $500 income level the share of these sectors in gross domestic product will be approximately 2.5 times the corresponding share at the $200 income level.

The *population elasticity* (γ) for total manufacturing was found to be 1.12, which means that between countries having the same per capita income level, total manufacturing value added varies approximately one-eight more than in proportion to the size of the population. Of the individual sectors, "food, beverage and tobacco" and "leather products" show elasticities on population smaller than one, indicating that at the same level of per capita income the per capita outputs in these sectors in larger countries tend to be slightly lower than in smaller countries. For "clothing and footwear", "wood products", "printing and publishing", and "non-metallic minerals" the elasticities are approximately equal to unity, so that the aggregate levels of value added in these sectors vary roughly in proportion to the size of population. The remaining sectors show higher population elasticities than total manufacturing, the highest elasticities are in "chemicals" (1.39) and especially "basic metals" (1.65), sectors where economies of scale are known to play a major role.

Chart 2 illustrates the population effects on industrial output along the lines of chart 1. The chart compares two countries having the same per capita income ($500) and the same relative degree of industrialization, one of which has a population ten times larger than the other (40 million as against 4 millions). The chart indicates that per capita manufacturing output in the larger country will tend to be approximately one-third higher than in the smaller one. Turning to the individual sectors, per capita output of "basic metals", which is highly responsive to size, proves to be almost 4.5 times higher, and "chemicals and petroleum products", "metal products", and "textiles" 2 to 2.5 times higher in the larger country than in the smaller country.

As regards the *elasticity of output with respect to the relative degree of industrialization* (δ), table 1 indicates that a given deviation from the "normal" for total manufacturing will tend to have an approximately proportional impact on "textiles", "wood products", and "other" industries. Five other sectors – "basic metals", "metal products", "paper and paper products", "leather products", and "non-metallic mineral products" tend to respond more than proportionately, the remaining five sectors less than proportionately. The greatest deviations are to be noted in "rubber products" on the lower end (with an elasticity of only 0.28) and, as could be expected, "basic metals" on the upper end (elasticity 1.91).

Chart 3 again illustrates graphically those differences by sectors. The two countries compared have in this case the same per capita income ($500) and population (10 million) but, whereas one country is "normal" as regards the over-all level of industrialization ($D = 1$), the other shows a relatively high degree of industrialization ($D = 1.4$). As can be seen in the chart, the output in "basic metals" is almost twice as high in the latter country as in the former, and the outputs in "paper and paper products" and "metal products" over one and a half times as high; on the other hand, for the typical consumer-goods industries, "food products" and "clothing", the differences are only 35 per cent, which is lower than the difference in total manufacturing output; and for "chemicals and petroleum products" and especially "rubber products" even lower (25 per cent and 10 per cent, respectively).

C. Discussion of the results

1. General observations

As already mentioned, per capita income appears to be by far the most important factor in "explaining" the variation of per capita industrial output between countries. For total manufacturing outputs a comparison between charts 1 and 2 shows an average income elasticity

[24] In the chart, the sectors are placed in the order of declining income elasticities. The width of each column is proportional to the value added (the levels of which are calculated in per capita terms) at the $200 per capita income level. The step line thus indicates for each sector the ratio of the values added at the two income levels and therefore the areas above the income level line 1 indicate the increments of value added in respective sectors corresponding to the 150% increase in per capita income.

[25] In the chart the high income line for total manufacturing is drawn at the level corresponding to the aggregate sector outputs. Because the calculated sector outputs are not adjusted to the additivity criterion, referred to earlier, this level is not exactly in accordance with the one that would be obtained on the basis of the income elasticity in the equation for "total manufacturing".

Chart 2

B. Size effects

Two economies with different populations: (I) 4 million; (II) 40 million; with the same per capita income ($500) and relative degree of industrialization (D = 1). Numbers in parentheses denote per capita value added in 1953 US dollars at population level I.

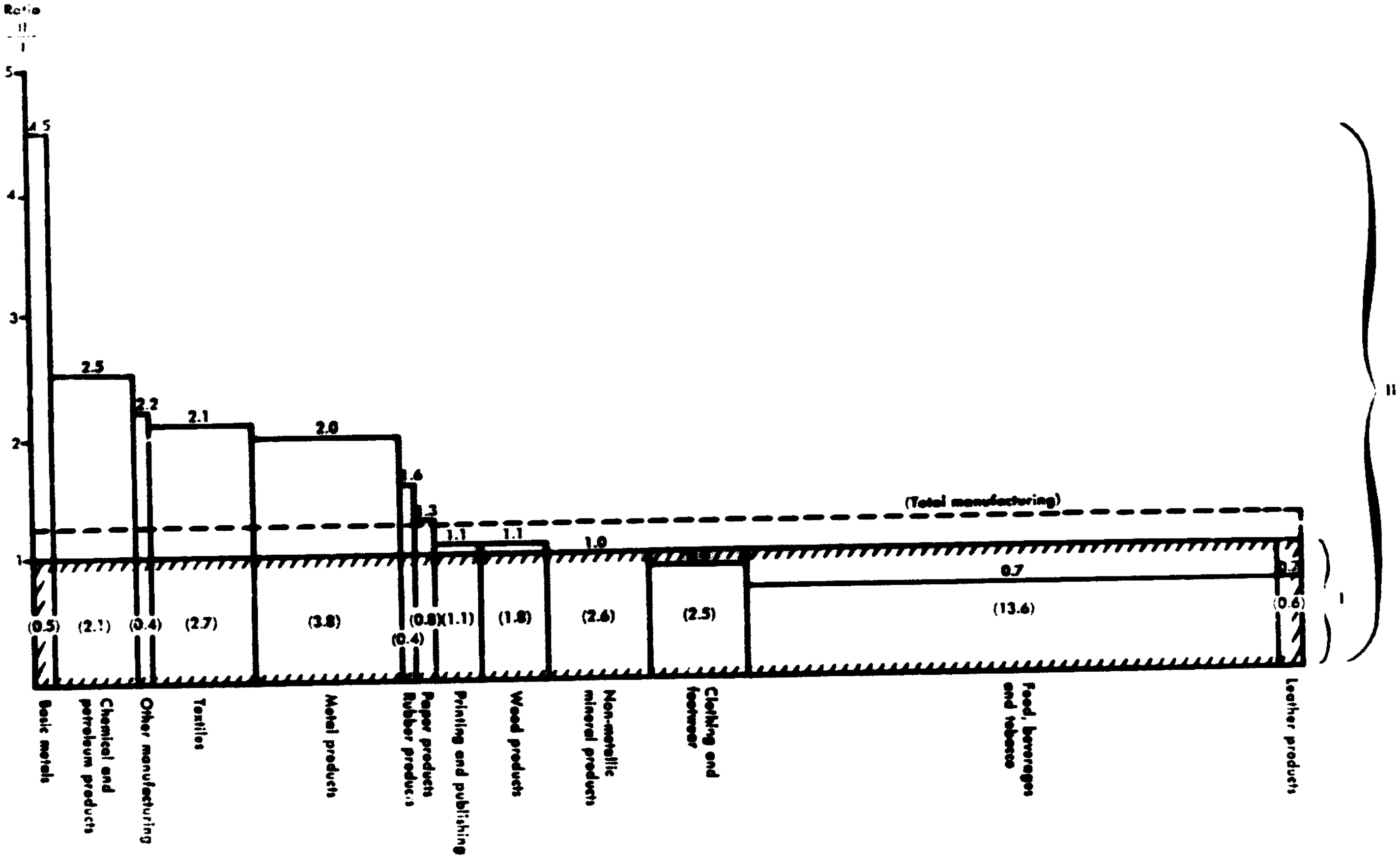
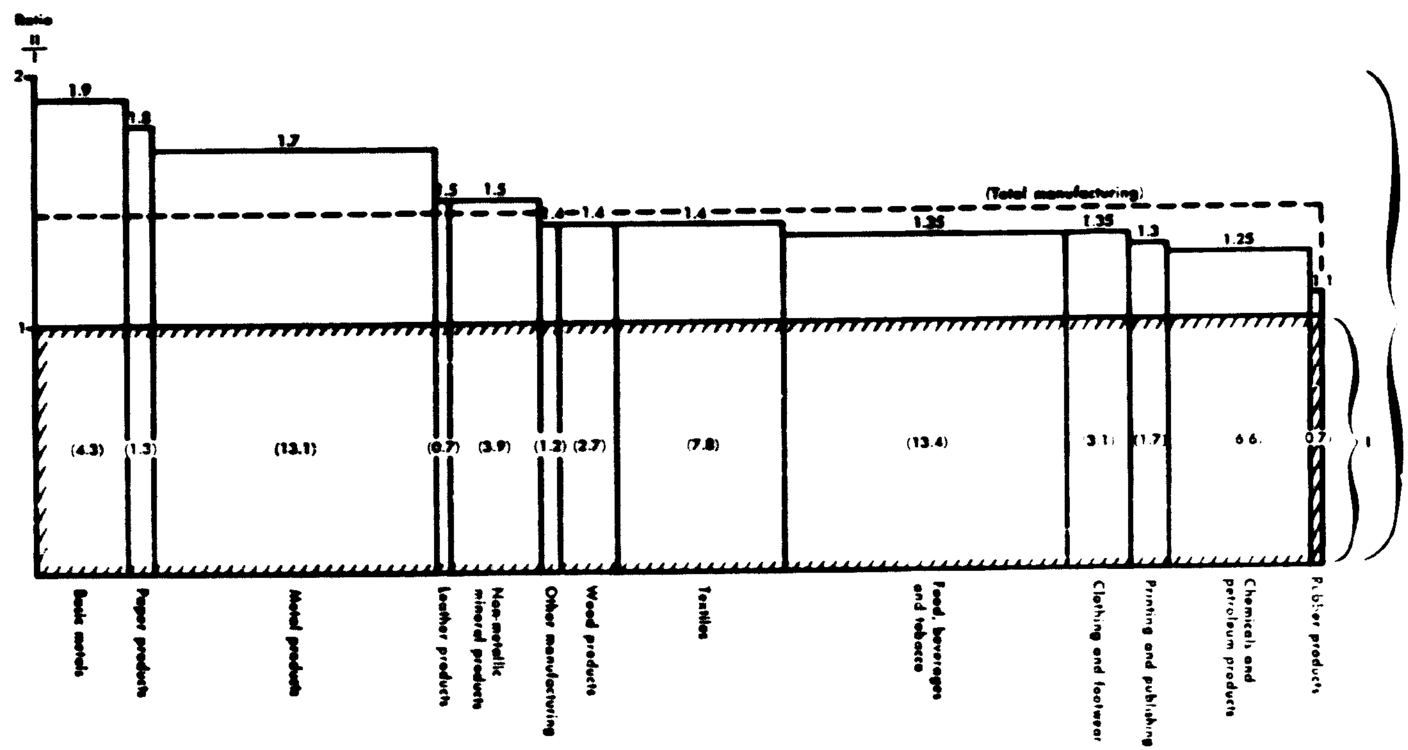


Chart 3

C. Relative degree of industrialization

Two economies with different levels of industrialization: (I) D = 1.0; (II) D = 1.4; with the same per capita income ($500) and population (10 million). Numbers in parentheses denote per capita value added in 1953 US dollars at D = 1.



of production[26] of 1.6, as compared with an average population elasticity of only 0.13 (= 1.3:10).

A comparison between the three patterns of sequence shown in charts 1, 2 and 3 reveals, at first sight, a remarkable stability in the relative position of each sector. This implies that the effects of the three explanatory variables on the output of a given sector are, on the whole, more or less comparable. This general implication is further elaborated in the following section in relation to the main characteristics of various sectors roughly classified into consumer- and producer-oriented industries. A close examination will reveal that certain sectors tend to respond more than others to certain particular factors; such cases will be discussed in relation to the "size" factors (see sections 3 and 4).

The behaviour of the constant terms in the equations will be also briefly commented upon at this point. The magnitude of the constant terms in the equations follows, in general, a reverse pattern of that of the elasticities: a relatively high constant term in a sector equation tends to be associated with relatively low values of elasticities, and vice versa. The most pronounced examples of the first case are found in "food, beverages and tobacco", "leather products",[27] and also to some extent in "non-metallic mineral products"; this reflects the fact that, generally speaking, at very early stages of industrialization, these are the only manufacturing industries which exist often in the form of cottage industries; the progress of industrialization tends to impart to these industries only moderate paces of growth so that their relative importance gradually declines. The most pronounced case of the reverse pattern is found, again as might be expected, in "basic metals": here the value of output will be negligible at earlier stages of development, but will rise steeply as industrialization proceeds.

2. Consumer- and producer-oriented industries

There appears to be an appreciable degree of correspondence between the tendencies discussed in the previous section and the position of various sectors in the so-called "vertical" sequence of manufacturing production processes. For simplicity's sake, the sectors will be grouped in two categories: consumer-oriented and producer-oriented industries. In the former group are included "food, beverage and tobacco", "textiles", "clothing and footwear", "wood products", "printing and publishing", and "leather products" that is, sectors which are either producing directly for the consumer market or, in the case of "textiles and leather products", are only one step removed from final consumption. In the latter group are included industries producing mainly capital goods and intermediate products; "paper products", "rubber products", "chemicals", "basic metals", and "metal products". "Non-metallic minerals" and "other manufacturing" are left out of the subdivision, because the component industries of these sectors may vary from country to country.

It will be seen from table 1 that all consumer-oriented industries have, with only a few exceptions, higher constant terms in the regression equations than any of the producer-oriented industries and lower elasticities with respect to each of the explanatory variables. The income elasticities for the consumer-oriented industries range from 0.89 to 1.72, and for the producer-oriented industries from 1.55 to 2.03. Similarly, the population elasticities range, for the producer-oriented industries, from 1.12 to 1.65, while, for the consumer-oriented industries, they range from 0.86 to 1.33. There are two notable exceptions from the above pattern with respect to elasticities on D, in the case of "rubber products" and "chemicals and petroleum products".

3. "Size" effects

The illustration in chart 2 indicates clearly the distinction between industries that are responsive to the size of population — which is taken to indicate roughly the size of the national market[28] — and those that are not re-

[26] The average elasticity is the quotient of the two ratios: (i) ratio of the value added of total manufacturing at the two levels (4.0) and (ii) ratio of the corresponding per capita incomes (2.5); the total manufacturing value added in this particular example is measured as the sum of the computed values for the thirteen sectors.

[27] It will be noted in table 1 that the constant term for "food, beverage, and tobacco" is even higher than the constant term for "total manufacturing". This indicates that the lower range of applicability of the standard equations does not extend into the very low zones of per capita income and population. Thus the formulae would give, for a per capita income level of less than $40 (in 1953 prices) and a population lower than one million, a higher value added figure for "food, beverage, and tobacco" than for "total manufacturing", which is obviously illogical. It will be observed that the magnitudes of the constant terms depend on the particular units of measurement applicable to the variables. In table 2, Y (total national income) is measured in billions instead of millions.

[28] It will be noted that "population" is not by itself the most appropriate measure of "size". Indeed, the effective size of market also depends on the level of per capita income. Therefore, it may be more appropriate to express the size factor in terms of total national income, Y (= yP). When the regression equations are correspondingly transformed, part of the "income effects" will have to be shifted to the "size effects", to avoid double counting. From the original form of equations:

$$V_i = A_i y^{\beta_i} P^{\gamma_i} D^{\delta_i}, \quad \left\{ \begin{array}{l} i = 0, 1, \dots 13. \\ \delta_0 = 1, \text{ by definition} \end{array} \right\}$$

where A_i is the anti-log of α; in equations (I) and (II), the following forms of equation are derived:

$$V_i = A_i y^{\beta_i - \gamma_i} Y^{\gamma_i} D^{\delta_i}, \ (i = 0, 1, \dots 13); \qquad \text{(III)}$$

or, expressing the dependent variables in per capita terms,

$$\frac{V_i}{P} = A_i y^{\beta_i - \gamma_i - 1} Y^{\gamma_i - 1} D^{\delta_i} \ (i = 0, 1, \dots 13). \qquad \text{(IIIa)}$$

In both (III) and (IIIa), δ, the elasticity of value added with respect to the relative degree of industrialization remains the same as in the original form. In equation (IIIa), $\gamma - 1$ represents the size-of-market elasticity of per capita value added; this elasticity is equal to the population elasticity of total output in the original form of the equations *minus* one; the example presented in chart 2, where value added is shown in per capita terms, is directly related to this elasticity. In this type of formula, the effect of per capita income on per capita value added is smaller — by $(\gamma - 1)$ — than the β in the original form. In equation (III), where value added is measured in aggregate terms, however, the elasticity coefficient on per capita income has to be further reduced by 1 to $\beta - \gamma$. This is due to the fact that in the derived equations above, the elasticity co-efficients on per capita income measure only the "residual" part of the income effects after the "size" effects have been accounted for; in other words, "per sponsive to it. The former include "chemicals", "textiles", "metal products", and especially "basic metals". These are industries in which economies of scale are known to play an important role up to fairly high levels of operation so that a larger size of the market will tend materially to lower unit costs of production and exert a favourable effect upon their competitive position vis-à-vis foreign producers. "Other industries" also appear to belong to this group, while "rubber products" and "paper and products" hold intermediate positions. The remaining sectors show negligible responsiveness to size and the per capita output in "food, beverage, and tobacco" and "leather products" even tends to decrease with larger aggregate size of market.[29] It will be noted in this connexion that some industries, though not themselves subject to economies of scale, may sell their products to other industries that are highly responsive to the size factor, so that their production is indirectly affected by it. It is not always possible to separate this indirect effect from the direct effect; the observed results will reflect a combination of both.

capita" income now stands only as an additional variable to specify a certain qualitative aspect of a nation's economic potentiality, the latter being measured, in general, in terms of the nation's total national income. The effects of the market size and the economies of scale, which in the original form of the equations were assumed to be reflected in the population elasticities, are now associated with total national income—a concept which is generally regarded as defining most adequately a country's stage of development and its growth potentialities.

[29] The "size" effect, when measured in terms of size of population, is directly related to the size of domestic market rather than the market including exports. In most of the "advanced" European countries, foreign trade possibilities constitute a significant element in the size of market. A federation of several territories or a regional union of several countries would have a similar consequence. In the present analysis, the possible impact of such possibilities will be reflected in the value of D.

4. The "residual effects" of per capita income

Table 2 presents the results of rearrangement of the estimated regression parameters into the form (III.a). As seen from this table, the per capita output of "total manufacturing" is now subject to the elasticity of only 1.245 with respect to per capita income (as compared with 1.369 in the standard equation for V_0), because the remaining part of the full "income effect" is already incorporated in the elasticity on total income (0.124). With this rearrangement, there arise certain changes in the sequence of various sectors in terms of the relative magnitude of percapita-income elasticities. This is illustrated in chart 4, in which two countries are compared with the same total income ($5 billion) and the same relative degree of industrialization (D = 1), one of which has a per capita income of $100 (and thus a population of 50 million) and the other of $500 (and thus a population of 10 million).

The new pattern of the sequence of various sectors which is observed in this chart, is significantly different from the pattern shown in chart 1. An interesting development is the rise in the relative positions of "printing and publishing" and "clothing", in view of the well-known relatively high income elasticities of consumer demand for those products (Engel's law). Although the factors on the supply side still play a role, the per capita income coefficients in the transformed equations seem to be more comparable (than the coefficients in the standard equations) with the income elasticities that would ordinarily obtain from a regression analysis of consumer demand by major groups of commodities correspondingly classified.[30] Of course, such comparison should be limited to predominantly consumer-oriented products.

[30] See, for example, the comparative study of income elasticities of consumer demand for a number of countries in H. S. Houthakker, "An International Comparison of Household Expenditure Patterns", *Econometrica*, October, 1957.

Table 2

A DERIVATIVE FORM OF EQUATIONS: WITH DEPENDENT VARIABLES EXPRESSED IN PER CAPITA TERMS AND "SIZE" VARIABLE IN TERMS OF TOTAL INCOME ($Y = yP$)

Manufacturing sector (ISIC classification)	*Derived equations*				
Total manufacturing (20-39)	$\log(V_0/P)$	1.265 +	1.245 log y	.124 log Y	
Food, beverages, and tobacco (20-22)	$\log(V_1/P)$	1.446	1.116 log y	.138 log Y	.884 log D
Textiles (23)	$\log(V_2/P)$	1.562	.876 log y	.329 log Y	.964 log D
Clothing and footwear (24)	$\log(V_3/P)$	2.823	1.399 log y	.038 log Y	.877 log D
Wood products (25-26)	$\log(V_4/P)$	3.198	1.501 log y	.030 log Y	1.008 log D
Paper and paper products (27)	$\log(V_5/P)$	4.660	1.919 log y	.116 log Y	1.699 log D
Printing and publishing (28)	$\log(V_6/P)$	3.803	1.677 log y	.041 log Y	.873 log D
Leather products (29)	$\log(V_7/P)$	2.589	1.036 log y	.143 log Y	1.251 log D
Rubber products (30)	$\log(V_8/P)$	3.573	1.381 log y	.201 log Y	.281 log D
Chemicals and petroleum and coal products (31-32)	$\log(V_9/P)$	[illegible].291	1.152 log y	.395 log Y	.712 log D
Non-metallic mineral products (33)	$\log(V_{10}/P)$	2.216	1.143 log y	.014 log Y	1.116 log D
Basic metals (34)	$\log(V_{11}/P)$	3.122	1.342 log y	.649 log Y	1.915 log D
Metal products (35-38)	$\log(V_{12}/P)$	3.239	1.672 log y	.312 log Y	1.566 log D
Other manufacturing (39)	$\log(V_{13}/P)$	3.873	1.514 log y	.333 log Y	1.653 log D

* Derived from the regression equations in table 1; here V_i/p and y are measured in U.S. dollars and Y in *billions* of U.S. dollars (all at 1953 prices); constant terms (in common logarithms) are correspondingly adjusted.

Another change in the relative positions of sectors in the sequence is the decline in the position of "basic metals", which may be attributable to the extremely high size effect for this sector. The position of "chemicals and petroleum and coal products" is now also found even below the line of total manufacturing; and "textiles" appear at the lower end of the sequence. The relatively low "residual income effects", as one might call the transformed income elasticities in these sectors, merely reflect the low values of the original income coefficients (β) as compared to population coefficients (γ). The reasons why they are so may be better explained by considering the relative importance of "other factors" — in particular, the elasticity coefficients on the third variable, D.

5. Relative degree of industrialization (D)

This variable reflects, as was mentioned earlier, the combined effect of all factors, other than per capita income and population, on manufacturing output in the individual sectors. It might be useful to review some of the most important elements in this complex variable.

(i) *Extent of participation of countries in free trade*

The freeing of trade — for instance, the establishment of the "common market" in Europe — provides individual countries with substantially larger markets than those corresponding to their own levels of income and population. The "normal" structure of industry for these countries would thus correspond to considerably larger effective market areas. To the extent that this tends to raise the values of D for the countries considered, the introduction of this variable will adjust the "normal" levels of sector outputs correspondingly. This is especially the case for the relatively small European countries (Austria, Belgium, Netherlands, Norway, and Denmark.)

(ii) *Effects of government policy*

In the centrally planned economies — a discussion of which is given later in this study — government control of the composition of demand, the structure of national product, and the patterns of trade, seems to have led to a higher level of manufacturing for given per capita incomes. A considerable degree of government intervention in some of the "mixed" economies also appears to lead to a higher rate of industrialization. Government intervention often takes the form of strong preferential treatment of some particular industries. Such "intentional" patterns of industrialization may vary not only among different countries at a given point of time, but very often also over successive phases of planning in a given country. The impact of such policies can thus hardly be "standardized" into a sectoral pattern. The relationship between the relative degree of industrialization and government intervention has to be interpreted in the light of these circumstances.

(iii) *Endowment in natural resources and their utilization*

The availability of foreign exchange through primary exports which provides the means of importing manufactured goods appears to have reduced the need for some countries (e.g. Ceylon, Venezuela and Chile) to develop domestic industry; conversely, the lack of exportable primary products has led some other countries (e.g. Japan and China-Taiwan) to develop their industrial output in excess of what would correspond to their income and population levels. The development of certain manufacturing industries may be facilitated, on the other hand, by the availability of related domestic raw materials. As regards the cases referred to at the end of II.4 — "basic metal" and "textiles" in particular — their relative positions in the sequence of sectors are seen to be high with respect to the elasticity coefficients on D, as illustrated in chart 3. Of course, the impact of this resource factor — either positive or negative — upon import substitution in particular fields will be reflected in the value of D only to the extent that such impact is strong and pervasive enough to affect the over-all level of industrialization. In fact, "chemicals and petroleum products" appear to be relatively unresponsive to the "D" factor. This may possibly imply that certain industries, especially oil-refining, happened to be favoured, more often then otherwise, in countries whose over-all industrialization was as yet below normal.

In addition to those economic factors, the computed value of D for a country obviously comprises the errors of observations involved in the compiled data for the country,[31] and also, as will be discussed below, the element of non-linearity in the "normal" relationships derived from cross-country data in particular. In spite of these statistical "impurities", the value of D, measured as the residual defined above, seems to be a fairly good index of a given country's relative degree of industrialization, the variation of which is of a somewhat long-run nature.[32]

6. Non-linearity in the normal relationship

As was mentioned earlier, separate cross-section analyses for low-income (L-group) and high-income (H-group) countries reveal the existence of significant differences in the regression coefficients between the two groups (see table 1-5 in appendix 1-B). The reasons why, not with standing these differences, the "all-country" sample has been used in the present study to derive the standard set of equations, are as follows:

(i) The sample size varies for different sectors, especially for the L-group: inter-sectoral comparability is thus not sufficiently satisfactory to derive a reliable pattern for this group;

(ii) The scatter around the normal of the observed pattern is generally high in the L-group: an analysis of time-series data (see appendix 1-E) also confirms the relatively high variability of the growth pattern among low-income countries;

[31] See the discussion in V.B.

[32] See the discussion in IV.D.

(iii) The dividing line of $200 between the two groups is in itself arbitrary; the inflexion lines which correspond to intersections between the regression surfaces of L-group and the H-group vary widely for different sectors; thus, it is difficult to determine the normal pattern for countries with per capita income around $200 using a model based on two separate groups.

On the other hand, the all-country cross-section regression analysis, which is limited to the two explanatory variables (per capita income and population), is heavily biased by the pattern of the H-group countries; this bias is further accentuated by applying weights proportionate to per capita incomes. The introduction of the relative degree of industrialization (D) as a third explanatory variable in the sector equations results in a significant reduction of this bias. In this way it is possible to derive a set of equations based on a larger and more reliable sample covering the full income range.[33]

[33] Applying arbitrarily assumed levels and rates of increase of the two variables, y and P, to the standard V_n-equation (table I) and the L-group V_n-equation (table I-5 in appendix), respectively, one could derive the values of D that would indicate the positions of the hypothetical countries on the L-group regression surfaces in relation to their "normal" positions defined in terms of the standard equation. These values of D, which are very low at a low income level, will gradually increase as income increases, approaching the value of unity around $200 per capita income level. A calculation shows that introducing those values of D into the standard sector equations generally results in a significant reduction of the gaps from the corresponding L-group sector equations which would exist in case the variable D were not introduced.

III. RESIDUALS FROM THE REGRESSION EQUATIONS

A. Introduction

The residuals from the regression equations can be used to test the effects upon the structure of manufacturing industries of a variety of factors not specifically incorporated in the standard equations, such as natural resource endowment, government policies, political and social factors, and other environmental conditions. Since the discrepancy between the observed and the predicted values of total manufacturing output in each country is treated as an additional explanatory variable in the sector equations, the analysis of the residuals concerns in this context not the level of output, but the sectoral composition of total output. In the following, the residuals are computed as the differences between the 1958 observed *percentage* composition of sectoral outputs and the corresponding "normal" composition.[34] Although the algebraic sum of such differences for the thirteen sectors is obviously equal to zero, the sum of their *absolute* values may be considered as an indicator of the importance of these sectoral residuals as a whole. An analysis of the residuals from the cross-section equations as applied to over-time variations of industrial output is to be introduced later in part IV.

The implications of the residual patterns can be studied meaningfully only on the basis of concrete and detailed information on each country's particular conditions. Moreover, the pattern of computed residuals is subject to errors of observations, especially those due to cross-country differences in the structure of relative prices, which were assumed to be negligible in the conversion of national currency into United States dollars.[35] The residual patterns presented in the following are not adjusted for this type of error or for other sources of biases in the basic observations, such as variations in the coverage of manufacturing censuses and subsequent adjustments based on reasonable but more or less arbitrary assumptions — and conceptual variations in available estimates of value added. As long as these difficultities remain, the present study does not aim at providing a full analysis of its residual factors, but only a general evaluation of the results.[36]

It is focused at this stage upon the general validity of the standard equations as a descriptive model of a "normal" pattern, rather than a specific analysis of "unexplained" variations.

B. Predominantly free-enterprise countries (sample countries)

The residual patterns of the fifty-three sample countries are presented in tables 3, 4 and 5 in summary forms.[37] Without further processing of the residuals, it is difficult to detect systematic association with some specific factors; in particular as regards a government action aimed at promoting industrial development in the "semi-planned" mixed economies,[38] the time-coverage of the available data is unfortunately not long enough to trace their impact upon the structure of manufacturing production.

The results in tables 3, 4 and 5, lead to the following tentative conclusions: (*a*) first, the extremely large residuals for some under-developed countries can be associated with their "mono-crop" type of economy. The "normal" pattern implied in the standard equations thus seems to fit better to economies of a more diversified type; (*b*) second, as far as regional patterns of residuals are concerned, the findings seem to conform to the general regional characteristics of the regions such as stage of industrial development and resource endowment; (*c*) finally, the pattern of the residuals for certain particular sectors (especially, "food, beverage

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[34] In the computation of the "normal" percentage composition, the "normal" level of each sectoral output is already adjusted to the observed level of total output, i.e.,

$$\dot{V}_i = k\dot{A}_i y^{\dot{\beta}_i} P^{\dot{\gamma}_i} D^{\dot{\delta}_i}$$

where

$$k = V_0 / \sum_{i=1}^{13} \dot{A}_i y^{\dot{\beta}_i} P^{\dot{\gamma}_i} D^{\dot{\delta}_i}$$

for each country; a better method will be suggested later to make allowance for the possible prediction biases by sector (see V.B.). The set of equations used in the above computation is the "standard" one which is based on the 1953 and 1958 combined sample (table 1).

[35] In processing the basic data, a unique exchange rate was applied to both income and value added (by sector) data for each country. Apart from the relative prices, the possible over or under evaluation of the applied exchange is also reflected in the estimated value of D.

[36] Apart from errors of observation, account should also be taken of the conceptual aspects of the variable D which were discussed in detail in the preceding section; the connotation of this variable may very from country to country. The residual pattern of individual countries thus depends on the extent to which all relevant "explanatory" factors other than per capita income and population are reflected in the computed values of D of respective countries.

[37] The calculation is based on 1958 data for countries for which these data were available; for the other countries the residuals are assumed to be equal to those obtained on the basis of the 1953 data.

[38] For this purpose, thirteen "semi-planned" economics were tentatively chosen out of the sample countries (Argentina, Chile, Denmark, France, India, Israel, Italy, Japan, Mexico, Netherlands, Norway, Sweden, and UAR) in view of the fact that those countries have had certain over-all economic plans which have been carried out more or less systematically. In general, however, uniformity in the behaviour of those countries during the 1950's proved to be not too convincing because of the very high cross-country variations. Especially in the newly-developing countries where vigorous government industrialization policies have not been initiated until very recently, the time coverage of the available data is insufficient to warrant any conclusions.

Table 3

DEVIATIONS FROM "NORMAL" PATTERNS BY COUNTRY, 1958

Country	*"Textiles" and "Clothing"*	*Other light manufacturing* [a]	*"Basic metals" and "Metal products"*	*Other heavy manufacturing* [b]	*Sum of absolute deviations* [c]
Asia					
Burma	—2.0	+7.7	2.0	3.7	48.9
Ceylon	13.8	—31.2	+14.8	2.6	96.4
China (Taiwan)	—3.3	—4.0	+1.5	5.8	33.6
Indonesia	+4.5	—21.0	+1.2	23.3	82.5
Korea (Rep. of)	+11.4	—15.2	1.2	2.6	46.5
Pakistan	+15.1	—13.7	9.4	19.8	82.0
Philippines	—12.9	+32.5	10.5	9.1	71.7
Thailand	—16.4	23.5	—2.6	4.5	58.7
India	+15.3	—8.0	+2.4	9.7	50.5
Israel	4.7	—20.4	+4.9	10.8	48.7
Iraq	+4.3	—20.4	+1.8	14.3	42.5
Africa					
UAR	22.3	—16.6	+1.0	6.7	57.3
Rhodesia and Nyasaland	—9.9	—19.0	+33.7	4.8	69.8
South Africa	—5.1	10.0	+16.8	1.7	38.1
Algeria	—2.7	+1.5	+4.7	3.5	23.5
Kenya	—10.9	—11.3	+16.0	+6.2	61.6
Morocco	+6.0	+1.0	1.5	—8.5	35.0
Tunisia	—1.1	—7.6	+8.4	0.3	35.4
Latin America					
Argentina	+3.4	+7.1	—10.0	—0.5	26.1
Brazil	—4.3	—0.1	—3.6	8.0	22.8
Chile	—0.7	—16.4	+20.3	—3.2	58.0
Colombia	—4.1	+5.9	+8.1	+1.9	32.9
Mexico	—7.6	+5.6	1.1	3.1	46.5
Peru	—5.9	—1.5	7.6	3.2	27.0
Costa Rica	—3.2	+15.3	5.2	7.2	36.6
Dominican Republic	—11.1	+27.9	—9.6	7.2	64.3
Ecuador	+3.0	7.9	+2.2	2.7	28.8
Guatemala	—2.8	2.1	+4.7	9.6	26.9
Honduras	+0.4	0.0	+3.7	4.1	36.6
Paraguay	+12.0	—17.7	4.8	10.5	68.9
Puerto Rico	+7.7	+2.4	11.1	1.0	48.3
Venezuela	—3.5	—1.6	+14.0	+19.1	50.3
Europe (1)					
Turkey	+11.4	—2.0	+1.8	+11.2	38.6
Portugal	+18.5	—6.6	5.2	6.7	60.9
Greece	+18.2	—17.1	+2.4	—3.5	53.3
Spain	+4.6	—1.1	+4.3	+0.8	36.7
Europe (2)					
Austria	—1.0	—2.0	0.9	+0.4	13.2
Belgium and Luxembourg	—1.3	—9.8	4.3	4.2	36.4
Denmark	—0.5	+5.1	—1.1	3.5	20.7
Finland	—1.5	—13.6	1.2	+10.9	45.6
France	+1.4	—4.5	+3.4	0.3	18.6
Germany (Fed. Rep. of)	+0.4	+0.5	3.6	2.7	12.1
Ireland	+7.3	—0.3	0.2	—6.8	19.4
Italy	—4.6	+2.4	—2.3	+4.5	20.6
Netherlands	—0.3	+3.9	—4.8	+1.2	22.5

Table 3 (continued)

Country	" *Textiles* " and " *Clothing* "	*Other light manufacturing* [a]	" *Basic metals* " and " *Metal products* "	*Other heavy manufacturing* [b]	*Sum of absolute deviations* [c]
Europe (2) (continued)					
Norway	+2.0	+7.5	−11.4	+5.9	43.4
Sweden	+2.4	−1.8	3.4	+0.8	21.0
Switzerland	+0.6	−7.1	1.2	+5.3	25.6
United Kingdom	−0.1	1.7	2.7	−4.3	18.9
Others					
Australia	−1.1	−3.8	+4.6	+0.3	16.3
New Zealand	−0.7	−1.2	+3.5	−4.0	16.8
Canada	−3.4	+7.4	−9.6	+5.6	27.8
Japan	−5.1	−7.7	+7.8	+5.0	31.2

N.B. Figures indicate the differences (in percentage points) between the observed and the predicted percentage composition of manufacturing sectors, as in 1958.

[a] Includes "food, beverages and tobacco", wood products", "printing and publishing", and "leather products".

[b] Includes "paper and products", "rubber products", "chemicals and petroleum products", "non-metallic mineral products" and "other manufacturing".

[c] Sum of the absolute values of the deviations for the thirteen sectors $\left(\sum_{i=1}^{13} / R_i /^{r} \right)$. The countries shown above are all included in the regression sample. Country residuals are computed from the standard set of regression equations obtained from the 1953 and 1958 combined sample (table 1).

and tobacco" and "non-metallic mineral products") seems to reflect a definite non-linearity of the observed relationships: this means that the descriptive validity of the "normal" relationships would be increased if a proper allowance for such non-linearity could be made, namely, that the partial elasticities are considered variable at certain levels of the corresponding explanatory variables.[39]

To elaborate upon the above observations, it appears useful to examine the tables in a little more detail.

Table 3 presents the residual pattern for each of the fifty-three sample countries. An association with primary exports would help to explain for a given country the high residuals in some resource-oriented sectors. The most pronounced cases are found in the "basic metals" industries of Rhodesia and Nyasaland and Chile. The high positive deviations in "other heavy manufacturing" of countries like Indonesia, Iraq, and Venezuela seem to be closely related to their "petroleum products" (oil refining). Similar association may be applied, although to a somewhat lesser extent, to some of the crude-rubber producing countries as regards their "rubber products" sector (e.g. Ceylon,[40] and Indonesia). High positive residuals in "textiles" are observed in Pakistan, India, UAR, and Turkey, which are all net exporters of raw materials for textiles, and some net exporters of fabricated textiles.[41]

As regards the regional patterns of deviations shown in table 4, in a few cases both the weighted and unweighted residuals are significantly different from zero. In Africa, for example, the deviation in "metal products" is significantly positive, but Latin American countries show, on the whole, a strong positive bias in "chemicals and petroleum products" at the expense of "metal products" which still seems to be on a level substantially below normal. Among the four European less developed countries (Portugal, Spain, Greece and Turkey), a common feature is a positive deviation for "textiles" and negative deviations for "chemicals and petroleum products." The variation of residual patterns among the Asian countries is relatively high, with the only exception of " rubber products " reflecting presumably their pattern of resource endowments.

When a number of countries are grouped together, the sum of absolute deviations tends to decrease significantly. This can be seen with the regional groupings of under-developed countries (table 4) and also when these countries are regrouped according to the size of total manufacturing output.[42] Yet, a similar tendency appears to be much less pronounced when the countries with lower per capita incomes alone are put together (table 5). If the sectoral residual patterns were significant for this particular group, this implies that the "normal" relationships should be modified with some allowance

[39] See footnote [13].

[40] The high positive deviation in "rubber products" in Ceylon is partly compensated by negative deviations in sectors included in "other heavy manufacturing", thus resulting in a moderate positive deviation of only 2.6 per cent points for the group as a whole, as indicated in table 3.

[41] However, in countries producing abundant agricultural raw materials, such as rice, tea, sugar, fruit, and tobacco, the "food, beverage and tobacco" sector is barely above the "normal" level, and in many cases is below "normal" levels.

[42] The thirty-six "under-developed" countries (as defined in table 4) are grouped into four classes in terms of their 1958 total manufacturing value added: (1) more than $1,000 million (six countries), (2) between $1,000 million and $500 million (eight countries), (3) between $500 million and $200 million (ten countries) and (4) less than $200 million (twelve countries); the sums of absolute deviations for the thirteen sectors, computed in terms of weighted group averages (as in the case of table 4 or table 5), proved to be as low as (1) 9.5 (%), (2) 20.1 (%), (3) 21.4 (%) and (4) 18.6 (%), respectively.

Chart 4

C. Residual per capita income effect

Two economies with the same total income ($5 billion dollars) but with different per capita incomes:
(I) $200; (II) $500; D = 1 in both cases. Numbers in parentheses denote per capita value added in 1953 US dollars at income level I.

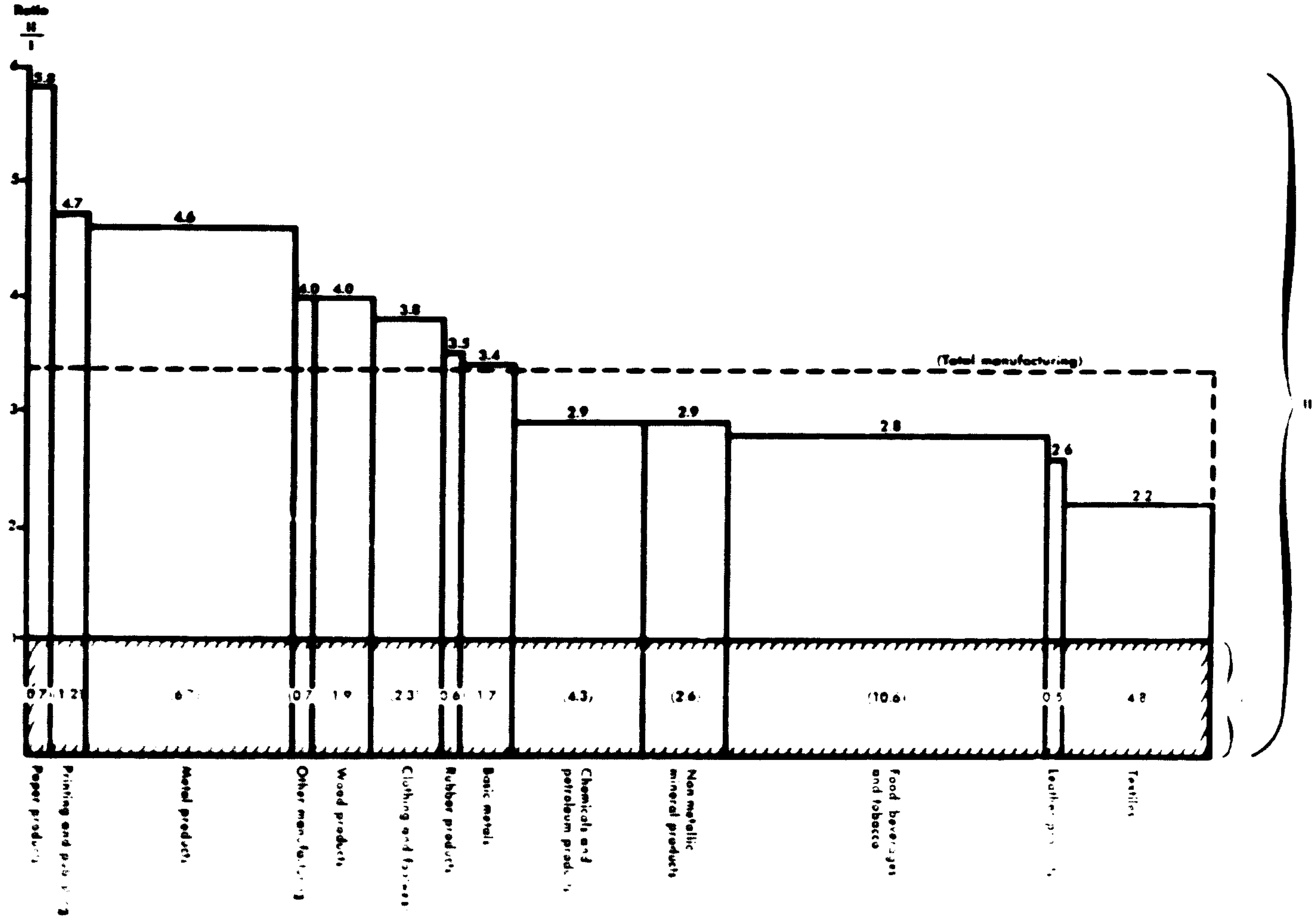


Table 4

AVERAGE DEVIATION FROM "NORMAL" PATTERNS BY REGION: 1958

Manufacturing sector	*[Asia]*		*[Africa]*		*[Latin America]*		*[Europe (1)]*	
	Weighted	*Unweighted*	*Weighted*	*Unweighted*	*Weighted*	*Unweighted*	*Weighted*	*Unweighted*
Food, beverages and tobacco....	3.5 (±4.5)	8.6 (±5.6)	7.5* (±2.6)	8.6* (±3.3)	3.7* (±1.6)	2.5 (±3.6)	−7.5 (±3.6)	−9.8 (±4.8)
Textiles......................	11.3* (±3.4)	2.6 (±3.5)	−0.8 (±4.4)	+0.8 (±4.5)	−0.6 (±2.6)	+0.2 (±1.3)	+6.7* (±2.0)	8.6* (±2.2)
Clothing and footwear..........	1.6 (±1.0)	0.5 (±1.4	+0.3 (±1.4)	−0.9 (±1.8)	−0.9 (±0.6)	0.1 (±0.9)	+2.1 (±2.9)	4.6 (±3.6)
Wood products................	−0.1 (±1.4)	+2.7 (±1.9)	−0.8* (±0.4)	−0.7 (±0.6)	−0.8 (±0.4)	−0.3 (±0.9)	+4.0 (±2.1)	+3.9 (±2.9)
Paper and products............	+1.0* (±0.3)	+0.2 (±0.3)	−0.2 (±0.3)	−0.2 (±0.3)	−0.4* (±0.1)	−0.3 (±0.2)	−0.2 (±0.5)	−0.2 (±0.2)
Printing and publishing.........	−0.6 (±0.5)	+0.8 (±0.9)	−0.4 (±0.5)	+0.2 (±1.0)	−0.1 (±0.2)	−0.8* (±0.3)	−0.6 (±0.4)	−0.8 (±0.5)
Leather products..............	−0.6* (±0.3)	−0.8* (±0.3)	−0.3 (±0.5)	+0.2 (±1.0)	−0.0 (±0.1)	−0.2 (±0.2)	+0.5 (±0.4)	+0.0 (±0.4)
Rubber products...............	+2.3* (±0.6)	+1.1* (±0.5)	−0.1 (±0.5)	−0.7 (±0.3)	+0.2 (±0.2)	+0.2 (±0.2)	+0.6 (±0.5)	+0.0 (±0.5)
Chemicals and petroleam products	−8.1* (±2.8)	+1.4 (±3.4)	−1.7* (±0.5)	−0.8 (±1.2)	+5.5* (±1.3)	4.2* (±1.7)	−3.3* (±1.1)	−3.2* (±1.6)
Non-metallic mineral products..	−1.2* (±0.6)	−1.4 (±1.2)	−1.4* (±0.7)	−1.4 (±0.3)	−0.6 (±0.4)	−1.4 (±1.1)	+1.5 (±2.1)	−1.4 (±1.9)
Basic metals..................	0.3 (±0.3)	−0.2 (±0.3)	3.7 (±3.0)	+4.6 (±4.3)	−0.7 (±1.6)	+1.3 (±2.0)	+1.7 (±1.3)	+0.2 (±1.6)
Metal products	+1.1 (±1.6)	+2.1 (±2.1)	+9.0* (±2.1)	+7.1* (±2.2)	4.9* (±1.3)	−5.1* (±1.3)	−4.5 (±2.4)	−1.5 (±2.6)
Other manufacturing	−0.3 (±0.5)	+0.7 (±0.4)	+0.0 (±0.2)	+0.4 (±0.2)	−0.5 (±0.3)	+0.1 (±0.5)	−0.8* (±0.3)	−0.5 (±0.4)
Sum of absolute deviations......	31.9	23.1	26.0	26.5	18.6	16.4	33.9	34.7

N.B. Regional mean values of the deviations by sector: each country's deviation is weighted by its total manufacturing value added. Numbers in parentheses indicate the standard errors of means; only asterisked means are significantly different from zero at more than 90% confidence level. For countries included in the respective regions, see table 3; the above excludes [Europe (2)] and [Others].

for the variation in income elasticities at varying income levels.[43] In fact, there seems to be a rather distinctive non-linearity in the relationships for "food, beverage and tobacco" and "non-metallic mineral products": in both cases, the constant terms in the regression equations are relatively high, while their elasticity coefficients are relatively low. Out of the thirty-six "under-developed" countries, twenty-two show negative deviations in "food, beverages and tobacco" and the absolute values of those negative deviations are on the average much larger than the absolute values of positive deviations; in the case of "non-metallic mineral products", as many as twenty-seven out of the thirty-six countries show negative deviations.[44]

[43] Table 5 (column 3) shows that the weighted mean deviations by sector for the low-income group happen to be significantly different from zero in nine out of the thirteen cases, whereas the unweighted mean deviations are significant only in "food, beverage and tobacco", "basic metals" and "other manufacturing". A closer examination reveals, however, that the weighted residual pattern in this particular case is too strongly affected by somewhat uncertain data for India which weighs as much as 60 out of 100 in this group (the insufficient coverage of the Indian census data resulted in different sets of manufacturing data which contradict one another. Especially high gaps are in the relative share of "textiles" and "clothing" industries in the total Indian manufacturing output. See appendix II).

[44] Somewhat higher income elasticities combined with lower constant terms would thus seem to reduce the tendency of over

C. Centrally planned economies

prediction of these sectors for low-income countries. The reverse is to some extent true for the sectors the regression equations of which are characterized by high elasticity coefficients and low constant terms. An examination of many examples has revealed, on the other hand, that the adjustment factor, K, introduced earlier, tends to be larger than unity for low values of independent variables, especially of per capita income: this implies that the computed "normal" patterns for lower-income countries are likely to involve upward biases for such sectors as "food, beverages and tobacco" and "non-metallic mineral products". It might be assumed that such biases follow a general pattern; as a rule of thumb, the most reasonable approximation of this pattern could be obtained by treating the adjustment factor, K, as if it were an additional variable for the sector equations whose characteristics are very closely related to D. This method is suggested later in the context part V.B: Use of Results.

The analysis of the residuals from the cross-section equation has been extended to the industrial structure of the seven centrally planned economies, which were not included in the regression sample.[46] The results are summarized in table 6.

The lack of strict comparability of the basic data between the centrally planned countries and those in the regression sample should be taken into account in interpreting the results. First it is not certain to what extent the concept of net "material" product corresponds to the concepts of national income or value added used in the present study; there are also problems of conversion of the data expressed in national currency into US dollars. The estimated values of the "relative degree

[46] These countries are: Albania, Bulgaria, Czechoslovakia Eastern Germany, Hungary, Poland, and Yugoslavia. USSR is excluded from the analysis for the same reasons as USA is excluded. An application of similar analysis to these two big countries results in rather peculiar residual patterns, part of which seems to be caused by non-linearity in the "normal" relationships.

Table 5

AVERAGE DEVIATIONS FROM "NORMAL" PATTERNS FOR THE TOTAL GROUP OF "UNDER-DEVELOPED" COUNTRIES AND THE HIGH-INCOME AND LOW-INCOME SUB-GROUPS, 1958

Manufacturing sector	*1* *Total "Under-developed"*		*2* *Countries with under $150 per capita income*		*3* *Other "Under-developed"*	
	Weighted	*Unweighted*	*Weighted*	*Unweighted*	*Weighted*	*Unweighted*
Food, beverages and tobacco	—1.1 (±1.7)	—4.7* (±2.5)	—7.3* (±1.8)	—11.9* (±2.9)	+1.0 (±2.3)	+1.9 (±3.3)
Textiles	+3.5* (±1.4)	+3.0* (±1.3)	+12.9* (±2.4)	+3.7 (±2.4)	+.3 (±1.2)	.8 (±1.2)
Clothing and footwear	—.4 (±.[illegible])	+.2 (±.8)	—1.4 (±.8)	—.9 (±.6)	—.1 (±.8)	+.9 (±1.2)
Wood products	+.2 (±.6)	+.8 (±.8)	—.5 (±1.0)	+1.7 (±1.3)	+.4 (±.7)	.4 (±.9)
Paper and products	+.0 (±.1)	—.1 (±.1)	+1.0* (±.2)	.2 (±.1)	—.3* (±.1)	—.3* (±.2)
Printing and publishing	—.3 (±.2)	—.1 (±.4)	—.6 (±.4)	.9 (±.7)	.2 (±.2)	1.0* (±.2)
Leather products	—.1 (±.1)	—.3 (±.2)	—.5* (±.3)	.4 (±.5)	+.0 (±.1)	—.2 (±.2)
Rubber products	+.8* (±.2)	+.2 (±.2)	2.0* (±.5)	+.4 (±.4)	+.3 (±.2)	.1 (±.3)
Chemical and petroleum products	—.0 (±1.6)	+1.6 (±1.3)	—6.8* (±3.5)	+3.0 (±2.3)	+2.3 (±1.4)	+.3 (±1.3)
Non-metallic mineral products	—.5 (±.4)	—1.4* (±.5)	—1.2* (±.5)	—1.4* (±.7)	.3 (±.6)	1.5* (±.7)
Basic metals	+.4 (±.8)	+1.3 (±1.2)	+1.0 (±1.2)	+1.4 (±1.8)	+.2 (±1.2)	+1.3 (±1.5)
Metal products	—1.9* (±1.1)	—.1 (±1.2)	+1.9* (±1.0)	+2.9* (±1.6)	—3.2* (±1.6)	2.7 (±1.6)
Other manufacturing	—.5* (±.2)	+.3 (±.2)	—.6* (±.3)	+.4 (±.2)	.4* (±.1)	+.2 (±.4)
Sum of absolute deviations	9.7	14.1	37.7	29.0	9.1	11.5

N.B. See the note in table 4 for the method of weighting.

The countries shown in table 3 other than those in [Europe (2)] and [Others] are treated here as "under-developed" countries. Out of a total number of 36, the following countries had in 1958 a per capita income of less than $150 (in 1953 prices): Burma, Ceylon, China (Taiwan), Indonesia, Korea (Rep. of), Pakistan, Thailand, India, Iraq, Rhodesia and Nyasaland, Kenya, Tunisia, UAR, Peru, Ecuador, Guatemala and Paraguay.

* Means significantly different from zero at more than 90% confidence level.

of industrialization" (D) may thus be subject to a significant margin of error. Moreover, the industrial classification involved in the available data does not strictly conform with the ISIC; for example, "publishing" is excluded from manufacturing in all cases; "mining" is included in the related manufacturing sectors in Poland and Yugoslavia; and there are extensive discrepancies in the classification of ISIC 3-digit level.

In spite of these qualifications, the data presented in table 6 appear to lend themselves to some highly interesting observations. The most striking feature is the high value of D in all seven countries, ranging from 1.5 in Poland and Yugoslavia to 2.0 in Czechoslovakia and 2.4 in Albania, which would indicate that the relative share of industry in total income tends to be 50 to 100 or even 140% higher than the "normal" defined in relation to the non-centrally-planned economies.

As regards the sector distribution, the most pertinent features are the negative values of the deviation for "food, beverages and tobacco", in all seven countries. On the other hand, "textiles" and "wood products", which belong as much to the category of producer goods as that of consumer goods, seem to have developed more or less parallel to heavy-industrial sectors. "Rubber products", "chemicals and petroleum products", "basic metals" and "metal products" account together for 48.8% of total manufacturing output of the group as a whole, which is very close to the corresponding "normal" of 47.7; for non-centrally-planned economies, but it should be kept in mind that the above figure relates to the composition of manufacturing output at the high level of D. Since a high value of D tends generally to favour the heavy, producer-oriented industries, the smallness of the residuals is an additional corroboration of the fact that these countries are, on the average, substantially more developed in those sectors than would be "normal" in countries of comparable per capita income and population.

The average pattern above presents a wide range of dispersion over the individual countries reflecting significant differences among the seven countries. The last row in table 6 indicates that the total residuals, as expressed by the sums of absolute residuals for all sectors, turn out to be larger for the relatively less developed countries, such as Albania and Bulgaria, than for the more advanced countries in this group. It may be recalled that a similar tendency was observed in the pattern of the residuals for the non-centrally-planned economies. Some of the factors underlying this tendency in newly developing economies — in particular, those responsible for the considerable fluidity of the industrial structure on both the demand and supply side—would seem to apply also in this case, although at a much higher level of the relative degree of industrialization

Table 6

CENTRALLY PLANNED ECONOMIES: RELATIVE DEGREE OF INDUSTRIALIZATION AND DEVIATIONS FROM THE "NORMAL" COMPOSITION OF MANUFACTURING INDUSTRIES

	Albania 1958	*Bulgaria 1956*	*Czechoslovakia 1958*	*Eastern Germany 1957*	*Hungary 1957*	*Poland 1957*	*Yugoslavia 1958*	*7 countries total*	*Percentage composition of group totals (Observed)*	*Percentage composition of group totals (Normal)*
Value of D............	[2.4]	[1.6]	[2.0]	[1.8]	[1.8]	[1.5]	[1.5]	[1.72]		
	Deviations from the normal percentage composition									
Food, beverages and tobacco...	—18.5	—14.8	—4.5	—10.0	—11.8	—4.6	—11.8	—7.7	(10.4)	(18.1)
Textiles	+18.3	+5.4	+7.5	+3.0	+2.9	+1.8	—0.9	+5.5	(20.0)	(14.5)
Clothing and footwear		—5.8	+5.3	—1.0	+0.6	+2.4				
Leather products										
Rubber products	+0.3	+0.1	+0.1	+2.0	+0.1	—1.2	—0.1	—0.6	(8.7)	(9.3)
Chemicals and petroleum products	+3.4	+9.3	—1.9		—2.4		—2.5			
Non-metallic mineral products	2.0	—0.4	+4.7	+1.0	+0.1	+3.4	+3.5	+2.9	(8.4)	(5.5)
Basic metals	+0.8	+4.4	—7.2	—2.0	+5.0	+0.7	+5.6	+1.7	(40.1)	(38.4)
Metal products	—8.6	—3.2		+8.0	+7.8	+1.3	+1.9			
Wood products........	+10.1	+8.5	+2.6	+0.5	—2.1	+1.1	+6.1	+2.1	(7.0)	(4.9)
Paper and paper products	—2.7	—1.8	—2.7	—1.5	—2.8	—1.8	—1.8	—2.1	(1.7)	(3.8)
Printing, excluding publishing..	—2.1	+1.8	—2.3	—2.0	—2.1	—3.1	—0.1	—1.7	(3.7)	(5.4)
Other manufacturing	+0.8	—	—1.5	+2.0	+4.7		+0.2			
(Sum of absolute deviations) ...	(67.6)	(55.5)	(40.3)	(33.0)	(42.4)	(21.4)	(34.5)	(24.3)		

N.B. See the notes in tables 3 and 4.

The residual pattern for "7 countries total" is the "weighted" average — i.e., refers to the composition of the group sums of outputs.

IV. OVER-TIME VARIATION OF INDUSTRIAL OUTPUT

A. Introduction

As mentioned earlier (in part II) the "standard" cross-section equations, which have been adopted as the key element of the model in the present study, are based on a combined sample for two different years. This procedure is justified by the evidence presented in detail in appendix I.D. In short, the differences between the two separate cross-section regressions for 1953 and 1958 fall in general within a margin of error acceptable for this type of analysis; hence, the cross-section relationship appears to be fairly stable over time — at least over the five-year interval between the two sample years. This, however, does not offer a sufficient justification for applying the cross-section regression equations to the study of industrial growth over time. The analysis has to be supplemented by a direct study of the over-time variation.

The over-time (between-sample) variations involved in the combined sample for the "standard" regressions could not be isolated as such for a direct analysis, because part of the countries included in the 1953 sample were not included from the 1958 sample.[46] Instead, annual time series data were analysed for a somewhat longer period (1950-1957).

The study of long-run industrial growth could be carried out by extending the regression analysis backwards to the pre-war period. Since the pre-war data compiled on a comparable basis are available only for a small number of countries, the test was carried out only in terms of the errors of projection for the period 1938 to 1953, the projection being based on the standard cross-section equations.

Apart from these explorations, attention will be directed to other methods of projection, especially those which have recently been undertaken by various government and international planning agencies, or related bodies. Compared to those *ad hoc* projections, most of which are based on detailed and concrete information specifically relevant to individual countries, the present study is severely simplified as regards both information and methodology. Nevertheless, a comparison of the "normal" pattern (or "reference" pattern as it might be more exactly designated) with these *ad hoc* projections may reveal some interesting indications from the point of view of the practical application of the results of the present study. The discussion of that aspect of the problem is presented in part V. Use of Results.

[46] An analysis of the variations in the values of D between 1953 and 1958 will be given in section IV.D below.

B. Regression analysis of short-run time series

The methods applied in this test and the results obtained are described in appendix I.E. The shortness of the time-period under investigation and certain technical difficulties inherent in the handling of time series data represent serious statistical handicaps. In the analysis of year-to-year behaviour, one of the most serious difficulties arises from the problem of leads and lags, the pattern of which can hardly be standardized for different countries. Moreover, such factors as market size and resource endowments are basically long-run variables, which are better treated as constant in the short-run. The same applies to the variable D. On the other hand, some of the factors which are considered as constants in cross-section relationships are no longer constants, but variables in over-time relationships.

In general, however, the growth patterns revealed from a few tentative analyses of time series do not seem to contradict the "normal" pattern implied in the standard cross-section equations. In fact, when the analysis is reduced to simple regressions of manufacturing output in per capita income alone, the resulting estimates of income elasticities prove to be reasonably comparable with the corresponding estimates derived from cross-section data.[47]

In addition, the time series data for individual countries indicate that countries with very low per capita incomes (e.g. less than \$100) tend to have rather erratic patterns as compared with countries with higher per capita incomes. This observation is in accordance with that found in cross-section data; namely, that the regression fit is significantly for a sample composed of low-income countries only.[48] Another similarity between the cross-section and time-series patterns is that the elasticities for low-income countries tend to be on the average higher than those for higher-income countries. Such tendency appears particularly in sectors such as "foods, beverages and tobacco", "textiles", "leather products", and also "non-metallic mineral products", which consist of industries operating with relatively simple technologies. This may explain why in the corre-

[47] See appendix I.E, table I-14. These simple regressions involve many simplifying assumptions of a rather drastic nature; namely, (i) that there is no "size" effect discernible in the short-run; (ii) that the "autonomous" trend in expansion of industrial output is negligible, or cannot be isolated from income effects; (iii) that the relative degree of industrialization (D) is, by definition, a constant for each country for the time period under consideration; and (iv) that possible lead-and-lag relationships are of such a stochastic nature that a hypothesis of no time lag is better than any other, when the time-series regressions for individual countries are combined.

[48] See appendix I.B(1), table I-5, and appendix I.E, table I-13.

sponding cross-section estimates the growth of these industries at the earlier stage of industrialization tends to relatively high values of regression constants at the expense of the regression coefficients on income and or population.

C. Errors of projection, 1938-1953 (for selected countries)

Table 7 shows the errors of the projections for the 15-year period from 1938 to 1953, which result from the application of the standard equations to each of the seventeen countries for which relevant data were available. The projections relate only to the increase between the two points of time, 1938 and 1953. The predicted increase for each sector is measured from the 1938 "normal" to the 1953 "normal", and hence does not take into account any gaps between the observed and the normal patterns that may exist in the base year.[49] To give an equal weight to every country, the resulting deviations of the predicted levels in 1953 from the actual data are expressed in terms of ratios to (or percentages of) the predicted levels for 1953.

One notable feature of the results is that the computed changes in the values of the relative degree of industrialization (D) for these seventeen countries are relatively small, hardly exceeding 25 per cent during the fifteen-year period; in almost all cases in which the values of D decreased, the initial positions were above normal D > 1 in 1938), while the countries whose initial positions were significantly below normal tended to show increases in D.

The pattern of projection deviations shows à wide variance among countries; the average variation among sectors is even higher.[50] This implies that, although the countries show a rather uniform tendency in their growth patterns (as defined by the behaviour of the three variables), there appear certain particular divergences from those predicted by the cross-section equations. Only in four out of the thirteen sectors, however, the mean deviations appear to be significantly different from zero. Those sectors are "chemicals and petroleum products", for which the equation shows a tendency of under-prediction; and "clothing", "printing and publishing", and "basic metals", for which the equations appear to over-predict. The under-prediction in "chemicals and petroleum products" probably reflects the trends in the industrial history during the period considered which witnessed notable development of new chemical products (such as plastics) as well as a steep increase in the use of refined petroleum as fuel in automobile transport. The over-prediction in "clothing" and "printing and publishing" may be attributed to the fact that in the advanced European countries these industries were already highly developed in 1938. The strong and systematic over-prediction in "basic metals" may be related to the fact that the countries in question fall largely within the high-income group. The income elasticity for basic metals in this group has been found to be 1.16, substantially lower than that in the low-income group (2.98), and in the two groups combined (1.99).[51] The high value of this error thus does not appear to affect the applicability of the standard cross-section equation for "basic metals" to the growth pattern in the newly developing (low-income) countries.

D. Over-time changes in "relative degree of industrialization"

In order that the variable D can be meaningful as an expression of the relative degree of industrialization, it has to be reasonably stable at least in the short run and its variation over time over longer periods should, for individual countries, follow more or less predictable patterns. The compliance with these criteria will be investigated in the present section.

In chart 5 are plotted the computed values of D of sample countries for the two years, 1953 and 1958. It will be observed that the country points are, on the whole, grouped around a 45-degree line. This indicates a remarkable stability over this five-year period in the value of D within each country. There are a few cases where significant deviations are observed, such as Korea (Rep. of), Pakistan and Brazil,[52] but in general, the deviations from normal seem to reflect underlying structural conditions that change only slowly over time. It will be observed, furthermore, that there is a slightly higher concentration of country points at the left hand upper side of the 45-degree line than at the other side. This would be in accordance with the plausible assumption of a moderate time trend towards more industrialization, irrespective of the variations in income and population; the five year interval on which the comparison is based would seem too short, however, to justify any quantitative estimate of this trend.

It will further be investigated whether there is any appreciable tendency for lagging countries (i.e., countries with relatively low value of D) to approach the "normal" level (D 1). The data presented in table 7 on the

[49] In other words, the computations deal with index numbers of value added by sector which are equal to 100 for 1938, *both* for the observed and normal levels. Another method of projection, which takes into account the base year patterns of deviations, will be discussed later.

[50] An analysis of variance gives the following results:

With D

	Variation	*d.f.*	*Mean variation*
Between-sector	32,148.1	12	2,679.0
Within-sector	130,838.0	193	677.9
Total	162,987.0	205	

This indicates that the between-sector variation relative to the within-sector (between-country) variation is quite significant at the 95 per cent confidence level.

When the prediction is made without involving D, the prediction errors show a slightly lower average between-sector variation, but a significantly higher average within-sector (between-country) variation:

Without D

	Variation	*d.f.*	*Mean variation*
Between-sector	24,349.5	12	2,029.1
Within sector	218,936.7	193	1,134.4
Total	243,285.2	205	

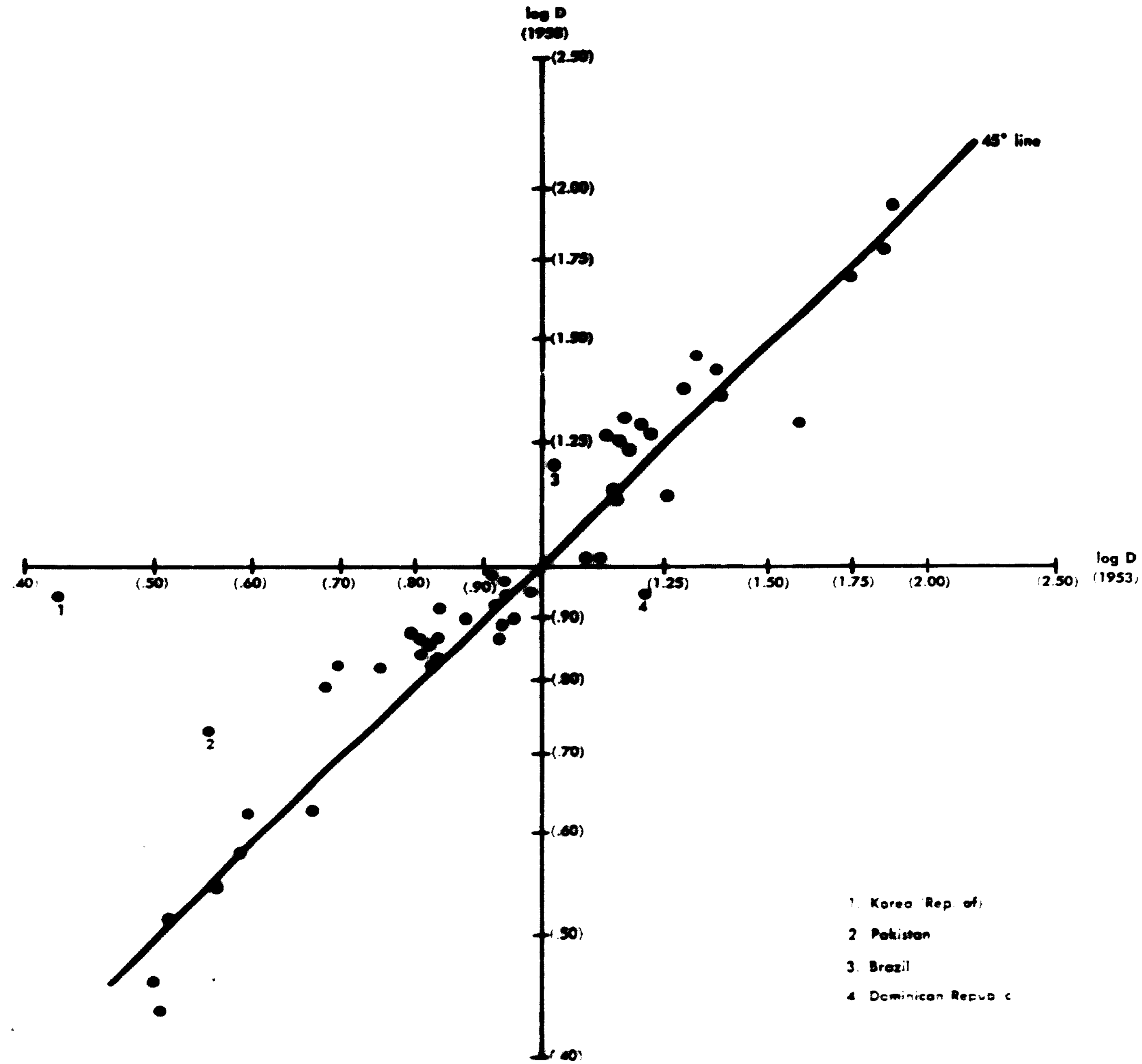
[51] See table I.5 and appendix I.B and table 1 in the text.

[52] The exceptionally high deviation from the 45-degree line for the Republic of Korea may be explained by the disturbances of the Korean War, which still heavily affected the 1953 position of this country's economy.

Chart 5

Comparison of the relative degrees of industrialization : 1953 and 1958

Numbers in parentheses mark the 1953 and 1958 values of D



Table

ERRORS OF PROJECTION, 1938-

	Australia	*Belgium*	*Canada*	*Denmark*	*Finland*	*France*	*Germany (Fed. Rep. of*
Food, beverages and tobacco	+ 0.1	—11.5	+ 7.3	+ 9.4	+ 53.4	— 18.4	+ 10.6
Textiles	— 13.5	— 5.3	—30.1	+ 8.5	— 4.4	— 24.8	+ 4.6
Clothing and footwear	—32.6	—21.3	—31.2	—10.8	—11.6	— 28.6	+ 40.4
Wood products	+ 8.8	+ 12.8	—16.4	16.3	—30.4	— 3.7	— 9.7
Paper products	N. A.	—13.9	—19.5	—14.8	—47.2	— 24.0	—11.6
Printing and publishing	—34.4	N. A.	—35.7	4.0	3.6	— 23.7	21.9
Leather products	+ 12.2	—37.2	—28.7	N. A.	— 2.4	— 33.7	—38.4
Rubber products	—14.6	44.5	—31.8	+ 5.6	— 9.3	+ 17.4	+ 15.6
Chemicals and petroleum products	+ 17.0	8.4	+ 0.1	+ 7.7	+ 73.2	+ 19.7	+ 33.1
Non-metallic mineral products	—14.8	N. A.	+ 71.9	0.0	+ 2.3	+ 5.7	— 2.7
Basic metals	— 3[illegible].6	0.2	—45.0	—22.7	— 3.7	— 11.7	—40.3
Metal products	+ 9.3	— 3.6	— 2.9	—12.2	+ 7.4	+ 18.0	— 1.6
Other manufacturing	—32.4	N. A.	+ 9.9	— 7.1	—29.4	N. A.	— 3.9
Values of D — 1938	.75	1.21	1.04	1.02	1.09	.81	1.12
Values of D — 1953	.81	1.15	.93	1.28	1.18	.80	1.38

* Mean error not significantly different from zero at the 95% confidence level.

within-country variation of D between 1938 and 1953 seem to point, as was discussed in the previous section, in this direction, and so does the presentation in chart 5. In chart 6 the relevant data are presented in a different way which reveals even more clearly the tendency referred to above. In this chart the changes in D from 1953 to 1958 are correlated with the 1953 values of D. It will be observed, in fact, that the greater proportion of the points on the left-hand side of the vertical axis is found in the second (positive) quadrant, which indicates that a country with a relatively low level of industrialization tends to show an increase in D, in other words, a higher pace of industrialization than the normal. On the right-hand side of the vertical axis, the scatter is too indefinite to discern a tendency in any particular direction. For the thirty-six "under-developed" countries in the sample (as shown in table 3), the weighted average value of D[53] was seen to increase from .89 in 1953 to .96 in 1958.

[53] Using total manufacturing value added of respective countries as weights. For the remaining seventeen countries (more or less "advanced"), the increase in the similarly computed average was less pronounced: 1.04 to 1.07. Since the 1958 data are mostly

7

1953 (IN PERCENTAGE POINTS)

Ireland	Italy	Japan	Netherlands	New Zealand	Norway	Sweden	Switzerland	United Kingdom	United States	Arith. mean (Stand. error)
+11.4	+5.7	—5.5	—10.1	+20.8	+1.7	3.3	5.5	1.5	19.4	3.3* (± 4.1)
+34.8	—24.7	—40.5	—2.1	+51.1	+5.8	16.2	—21.8	27.1	20.8	7.4* (± 5.7)
—26.5	—40.1	—37.9	—37.8	37.4	+18.8	—10.5	19.4	28.5	56.8	17.5 (± 6.5)
—33.6	+6.5	+83.0	+54.3	—18.0	—1.0	—24.8	14.2	18.5	39.8	3.2* (± 7.6)
+9.9	—32.0	+67.0	—7.7	+69.1	—23.0	32.3	18.3	15.5	47.7	10.1* (± 9.2)
—25.2	N. A.	+1.5	—12.7	—36.9	—18.1	—1.8	—4.6	16.1	43.9	14.8 (± 4.9)
+44.4	—39.2	5.2	+43.9	+16.6	+0.3	+5.1	+11.2	31.2	44.5	7.3* (± 7.4)
N. A.	+13.0	34.7	28.9	N. A.	—12.6	130.0	—20.4	2.0	2.2	+13.4* (± 10.0)
—0.5	+61.8	—3.7	+23.6	—6.7	+37.8	+72.5	—0.2	28.2	20.0	+23.1 (± 6.2)
+91.2	+6.3	—1.3	—11.1	—20.4	+43.3	+0.2	+11.2	18.3	+13.4	+13.3* (± 7.6)
N. A.	—26.2	—1.2	—3.7	N. A.	—36.4	—34.0	+1.3	—9.1	21.6	18.8 (± 4.4)
—12.0	—7.0	+27.4	+12.0	—13.8	—7.1	—3.8	1.4	0.2	32.0	+2.5* (± 3.3)
N. A.	N. A.	+10.9	N. A.	N. A.	—25.4	+15.7	—8.5	—1.6	—27.6	9.0* (± 5.2)
.75	.97	1.14	1.20	.71	1.20	.78	1.26	1.08	.57	
.91	1.14	1.17	1.26	.82	1.31	.97	1.11	.94	.60	

As regards the behaviour of low-income countries, it will be remembered that V_0 equation estimated for the low-income group alone involved a somewhat higher income elasticity than the standard V_0 equation. The difference between the two equations is such that, for a low-income country with a per capita income growth of 2 per cent per annum, the pace of industrialization along the former equation results in *an increase* in D, roughly of the order of 1 per cent per annum.[54]

Apart from such a general tendency, however, long-run changes in D in individual countries will depend on the existing possibilities for industrialization and the intensiveness of the efforts made by these countries to exploit these possibilities.

extrapolated from the 1953 censuses according to available indexes of industrial production, it can be expected that the "observed" rates of increase generally involve a positive bias.

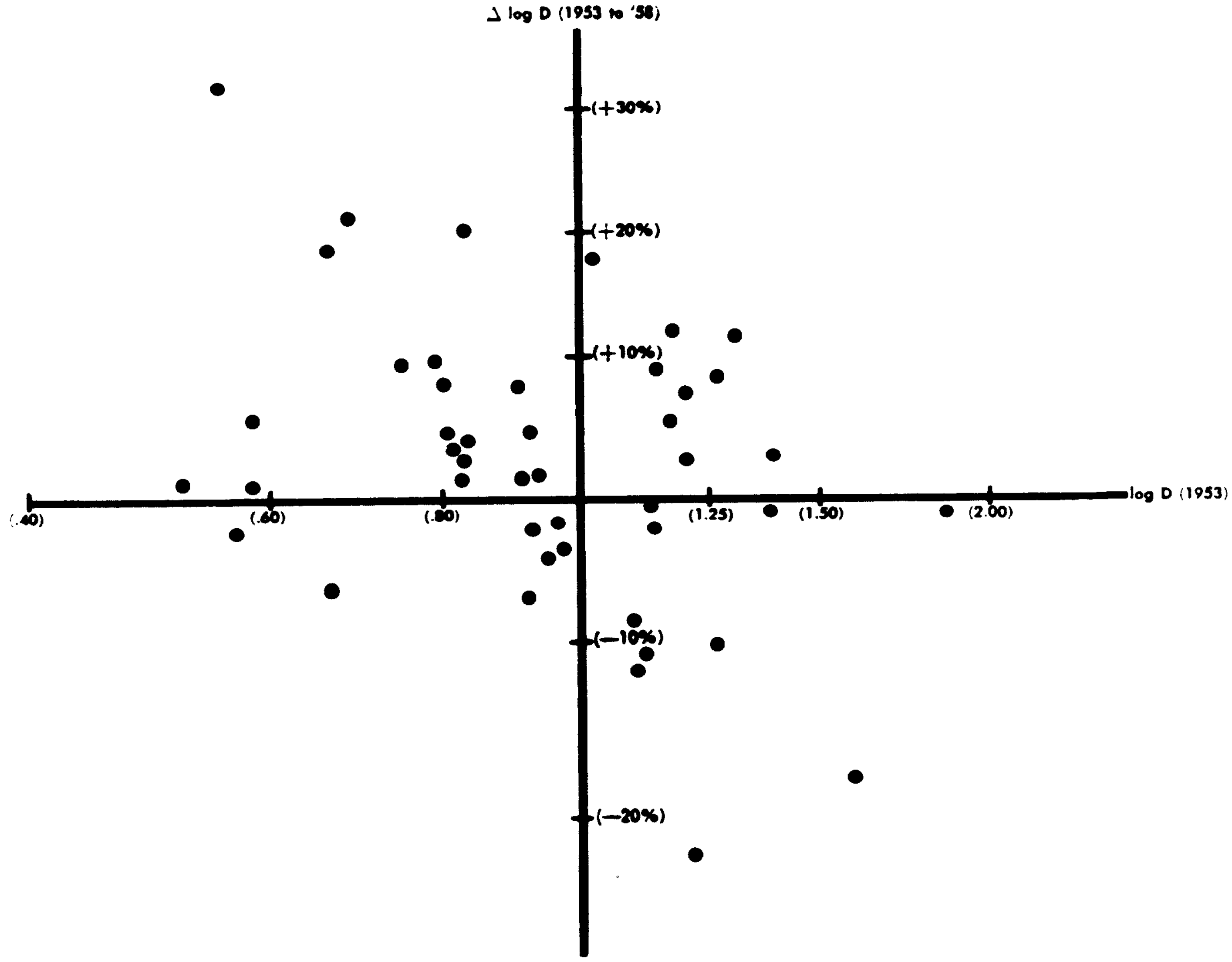
[54] See table 1 in the text and table I.5 in appendix I.B; the difference between the two V_0 equations is:

$$\log\left(\frac{\dot{V}_{0L}}{\dot{V}_0}\right) = 1.178 - .500 \log y - .005 \log P.$$

Chart 6

Changes in relative degree of industrialization: 1953 position *versus* its change from 1953 to 1958

Numbers in parentheses on the abscissa mark the 1953 value of D, those on the ordinate mark the percentage increase in D from 1953 to 1958. See Chart 5.



V. USE OF RESULTS

A. Introduction

In this part of the study, some suggestions are made with respect to the use of the equations for determining the "normal" level and pattern of a country's manufacturing industry in analysis and projection. As was noted earlier, this term "normal" is an empirical concept derived from a systematic investigation of observed facts, and thus has no intrinsic normative value; it refers to what could be anticipated on the average on the basis of the available information. By the same token, the model based on the standard equations is not intended to be used as a coin-in-the-slot machine which would turn out projected output levels by mechanical computation. To make a justified estimate of these levels in a given country, it is necessary to take into account all the information available on the country's specific economic, institutional and other pertinent characteristics, which are only partly reflected in the explanatory variables of the equations. Even less could the model be used as a substitute for planning, since, in addition to the pertinent characteristics referred to above, activity of the public sector and government intervention provided for in the plan may significantly influence the pace and pattern of development — which is exactly the objective of development planning.

In the following some technical problems will be discussed which are to be encountered in the practical application of the standard equations, including certain adjustment procedures involved in the computation of a "normal" pattern and its application for projections. An attempt is also made to compare the projections derived from the standard equations with those based on other methods, especially the input-output approach.

B. Computation of the "normal" pattern

The computation of the "normal" pattern of industrial output on the basis of the standard equations involves various steps and adjustments.

In applying the standard equations of table 1, care will be taken to express the variables in the appropriate units which are indicated in the footnote of the table: per capita income is to be expressed in 1953 US dollars and population to be measured in millions; the equations will then yield value added in millions of 1953 US dollars. The choice of the appropriate exchange rate for the conversion of national value units of a given year into US dollars is a vital factor in the calculation; the choice of the exchange rate will affect not only the absolute levels of value added obtained in applying the equations, but also the corresponding percentage composition of manufacturing industry.

The following calculations are carried out on the basis of the data on Peru given in an ECLA study.[55] The general data and the value added figures by sectors are presented at the top and in column (1) of table 8, respectively. The "normal" level of value added proves, as indicated in table 8, to be \$295.5 million. Since the observed level of value added is \$377.4 million, the relative degree of industrialization equals 1.277. The "normal" value added by sectors is obtained in two consecutive steps: first, an unadjusted set of value added figures, $\overset{*}{V}_i$, is calculated by applying the standard sector equations of table 1 to the same given levels of per capita income and population and the value of D obtained in the previous step; the results are presented in column (2) of table 8. These figures have to be adjusted to satisfy the adding-up condition; that is, the sum of the "normal" value-added levels by sectors should equal the observed value added V_0 of total manufacturing.

Two alternative methods may be proposed for this adjustment. The simplest method — designated as the k-method in table 8 — is to use one and the same adjustment factor, which is equal to the ratio of the observed level of total manufacturing output $(V_0 = \dot{V}_0 D)$ to the sum of computed sector outputs $(\sum_{i=1}^{13} \dot{V}_i)$.[56] In the other method — which is designated as D-method — the gap "k" is reintroduced in the sector equations as if it were an additional value of D. As seen in the example presented in table 8 (column 4), this procedure results in a considerable narrowing down, although not an elimination of the gap in its first application; by reiterating the procedure a few times in (practice at most twice) a quite satisfactory approximation of the identity is obtained.[57] In a sense, this D-method can be said to take advantage of the conceptual complexity of the D variable discussed earlier, and to tend to reduce the magnitude of the residuals from "normal" for those sectors with regression coefficients on log D significantly different from unity.[58]

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[55] *Analysis and Projections of Economic Development VI. The Industrial Development of Peru* (United Nations publication, Sales No.: 59.II.G.2).

[56] See III.A, footnote 34.

[57] For the particular example shown in table 8, the proportionality factor (*k*) equals 1.2237, which is, of course, equal to the first round value of D' in the D'-method. The differences between the two alternative "normal" levels of sector outputs are not very serious; the sector residuals remain with the same signs in almost all cases no matter which "normal" levels may be taken, and the difference in the over-sector sums of these residuals is only about 2% of the total output. The over-sector sum of residuals is presented here separately for positive and negative residuals; numerically, this sum equals one-half of the sum of absolute values of the same sector residual.

[58] See discussion in III.B, footnote [illegible]

Table 8

EXAMPLE OF COMPUTATION OF NORMAL PATTERN

OVER-ALL DATA (GIVEN) [a]

National income	$ 1,482 million
Population	$ 8,941 thousand
Per capita income	$ 165.7
Total value added by manufacturing	$ 377.4 million

VALUE ADDED BY MANUFACTURING BY SECTOR ($ MILLION):

		Calculation of "normal" pattern [b]					*Residuals*	
				Adjustment by D'-method				
	Actual pattern [a] (1)	*Direct results from équations* (V^*_i) (2)	*Adjustment by k-method* (3)	*First round* (4)	*Second round* (5)	*Final* (6)	*k-method* (1)-(3) (7)	*D'-method* (1)-(6) (8)
Food, beverages and tobacco	150.9	112.8	138.0	134.4	133.4	133.6	+12.9	+17.3
Textiles	57.0	31.1	38.1	37.6	37.4	37.4	+18.9	+19.6
Clothing and footwear	30.9	20.9	25.6	24.8	24.7	24.7	+5.3	+6.2
Wood products	13.6	15.7	19.2	19.2	19.1	19.1	—3.3	—5.5
Paper and products	3.6	5.6	6.9	7.9	7.6	7.7	—3.3	—4.1
Printing and publishing	8.0	9.3	11.4	11.1	11.0	11.0	—3.4	—3.0
Leather and products	5.3	5.9	7.2	7.5	7.3	7.3	—1.9	—2.0
Rubber products	3.8	3.2	3.9	3.4	3.4	3.4	—0.1	+0.4
Chemical and petroleum products	49.1	22.9	28.0	26.4	26.3	26.3	+21.1	+22.8
Non-metallic mineral products	15.9	24.7	30.2	30.8	30.6	30.6	—14.3	—14.7
Basic metals	4.3	8.4	10.3	12.2	11.9	12.0	—6.0	—7.7
Metal products	28.4	43.9	53.7	59.9	59.2	59.3	—25.3	—30.9
Other	6.6	4.0	4.9	5.0	5.0	5.0	+1.7	+1.6
TOTAL, manufacturing	377.4	308.4	377.4	380.2	376.9	377.4	+59.9	+67.9
by V_0 équation :		295.5						
D :		1.277						

N. B. All dollar values are in 1953 prices.

[a] The data correspond to those for the Peruvian economy, 1955, which are presented in United Nations: *Analyses and Projections of Economic Development, VI, op. cit.*; the original data (in Peruvian currency at 1955 prices) are converted into 1953 U.S. dollars by using a unique exchange rate ($7.56 per sol) and a unique price index (implicit price deflator of GDP); relative prices of manufactured goods are thus assumed to be unchanged between 1953 and 1955; "chemicals and petroleum and coal products" excludes "electricity", which is included in the original (ECLA's) data of this sector;

[b] Based on the above data and the standard equations in table 1:
Col. (3): *k* (unique proportionality factor) = 1.2237.
Col. (4): after application of D'_1 = 1.2237.
Col. (5): after application of D'_2 (= 0.9926).
Col. (6): after application of D'_3 (= 1.0012).

C. Projection of the "relative" degree of industrialization

It is clear that for projection purposes a "target" level of "total" manufacturing output (V_0) and hence the value of D implicit in that level should be given before the corresponding "normal" composition of sector outputs can be derived. In this connexion, it will be useful to examine the "intentional" rates of industrialization expressed in various Governments' development plans or the rates derived from *ad hoc* country studies, in order to have an idea about the range of variation of the projected increases in the value of D. Table 9 presents the results of such illustrative study of 18 cases, which were selected arbitrarily. As explained in the footnote on the table, $\mathring{R}_D$ denotes the percentage rate of change in D over the period considered which is implicit in each autonomous projection. Since the degree of realism and precision, as well as the time periods, of these projections vary to a considerable extent from case to case, the comparisons made in the following are not intended to lead to any generalizations or to any critical appraisal of these projections.

In 10 out of the 18 cases, the implicit changes in D are almost negligible, hardly exceeding one percentage point per annum. Most of these cases concern not "intentional" data, but are based on country projections, which have been carried out independently of the present study. The "intentional" rates of industrialization involved in governments' planning data are generally high relative to the normal ($\mathring{R}_{V_0}$), especially in countries which showed very low values of D in 1958 (countries I, J, and X). In one case (country P) the declining D

Table 9

IMPLICIT CHANGES IN D IN "OFFICIAL" PROJECTIONS OF TOTAL MANUFACTURING OUTPUT (ILLUSTRATIONS)

Country	Period for projection (Number of years)		"Official" projection R_Y (1) %	R_y (2) %	R_{V_e} (3) %	$\dot{R}_{V_e}$ (4) %	By equation $\dot{R}_D$ (5) %	Approx. annual ΔD in percentage points (6)	Approximate value of D, 1958 (7)
A	1955—1967	(12)	77	40	107	107	0		1.30
B	1955—1967	(12)	*a* 60	28	86	80	8	.6	.85
			b 70	36	122	96	26	1.8	
C	1954—1962	(8)	42	17	58	54	3	.5	1.20
D	1953—1965	(12)	*a* 120	68	213	175	14	1.0	.85
			b 81	38	146	110	17	1.2	
E	1961—1970	(9)	61	29	76	82	(–)3	(–).2	.85
F	1955—1965	(10)	80	36	101	109	(–)4	(–).4	1.00
G	1955—1965	(10)	71	33	97	95	1	.1	1.25
H	1960—1966	(5)	20	10	38	26	10	1.8	.90
I	1957—1968	(11)	90	43	239	122	53	1.3	.35
J	1960—1965	(5)	20	9	45	26	16	2.5	.75
K	1960—1965	(5)	40	26	87	54	21	2.6	.60
L	1954—1961	(7)	24	11	60	30	23	1.1	.35
M	1959—1965	(6)	41	25	66	55	7	1.1	.90
N	1958—1963	(5)	34	28	54	48	4	1.1	1.40
O	1956/58—1970	(13)	167	138	352	282	18	1.8	1.30
P	1960—1965	(5)	71	61	83	105	(–)11	(–)3.1	1.50

Col. (1) to (5): percentage increase over base-year level;

Col. (4): derived from the V_e equation in table 1, applying the "official" rates of increase in total income and in per capita income shown in cols. (1) and (2): i. e.;

$$1 + \dot{R}_{V_e} = (1 + R_Y)^{\gamma_e} (1 + R_y)^{\beta_e - \gamma_e}$$

Col. (5): derived as:

$$1 + \dot{R}_D = (1 + R_{V_e})/(1 + \dot{R}_{V_e});$$

Col. (6): increment of D per annum (expressed in percentage points), approximately calculated using the level indicated in col. (7):

Col. (7): values of D based on the data used for regressions.

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P. Yugoslavia; Secretariat for Information of the Federal Executive Council, *The Five-Year Plan of Economic Development of Yugoslavia*, 1961-1965.

may be considered as a *prima facie* case of declining income elasticity associated with a high degree of industrialization; it reflects a certain slow-down in the rate of increase in the share of manufacturing in total national product which was exceptionally high in preceding years.[60]

The value of $\dot{R}_D$ derived from an "intentional" rate of industrialization provides a quick check of a country's plan in terms of inter-country comparison. If the target rate happens to be set on the basis of some arbitrary assumptions without a sufficient realistic background, $\dot{R}_D$ provides a useful indication of the effort which would be required to achieve the set targets, against which some other, perhaps more realistic, alternatives may be explored.

[60] The share of manufacturing product in total national product in Yugoslavia is nearly 43 per cent in 1958; by using a somewhat lower exchange rate for dollar conversion the value of D goes up as high as 2.00, which might be a more plausible estimate for this country than the one shown in table 9. Apart from this case, a short-period plan with declining D might sometimes be reasonable, especially in case there is an acute need of structural readjustments ensuing after highly concentrative efforts of fostering manufacturing industries.

Table 10

EXAMPLE OF PROJECTION

OVER-ALL DATA[a]

National income	$ 2,527 million
Population	$ 11,464 thousand
Per capita income	$ 220.4
Total value added by manufacturing :	$ 750.8 million

TARGET YEAR BENCHMARKS FOR MANUFACTURING VALUE ADDED BY SECTOR ($ MILLION) :

	"Normal" levels	Adjusted level					
		Variant IA		Variant IB		Variant II	
		Value added	(residuals)	Value added	(residuals)	Value added	(residuals)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Food, beverages and tobacco	221.6	238.9	(+17.3)	256.0	(+34.4)	257.1	(+35.5)
Textiles	74.3	93.9	(+19.6)	113.3	(+39.0)	116.6	(+42.3)
Clothing and footwear	46.9	53.1	(+6.2)	59.2	(+12.3)	60.1	(+13.2)
Wood products	38.7	33.2	(—5.5)	27.8	(—10.9)	28.5	(—10.2)
Paper and products	18.9	14.8	(—4.1)	10.7	(—8.2)	9.3	(—9.6)
Printing and publishing	23.6	20.6	(—3.0)	17.6	(—6.0)	17.7	(—5.9)
Leather and products	12.2	10.2	(—2.0)	8.2	(—4.0)	8.9	(—3.3)
Rubber products	7.2	7.6	(+0.4)	8.0	(+0.8)	8.2	(+1.0)
Chemicals and petroleum products	58.3	81.1	(+22.8)	103.7	(+45.4)	111.4	(+53.1)
Non-metallic mineral products	55.7	41.0	(—14.7)	26.5	(—29.2)	29.9	(—25.8)
Basic metals	33.1	25.4	(—7.7)	17.8	(—15.3)	12.3	(—20.8)
Metal products	148.5	117.6	(—30.9)	87.0	(—61.5)	74.3	(—74.2)
Other	11.8	13.4	(+1.6)	15.0	(+3.2)	16.5	(+4.7)
TOTAL, manufacturing	750.8	750.8	(±67.9)	750.8	(±135.1)	750.8	(±149.8)
by V_e equation :	577.5						
D :	1.300						

N.B. All dollar values are in 1953 prices.

[a] Over-all data correspond to the data for the Peruvian economy, 1965, projected by ECLA in United Nations: ***Analyses and Projections, etc.***: ECLA's own projections of manufacturing output by sector are shown in table 11.

Col. (1): computed by D'-method on the basis of the above data;

Col. (2): assumes the same values and distribution of sector residuals (as shown in col. (3)) as in 1955 (see table 9, col. (8));

Col. (4): assumes that all sector residuals grow (with unchanged signs) at the same rate as total manufacturing output grows;

Col. (6): assumes that sector outputs grow at respective "normal rates" derived directly from the standard equations; the results involve the adjustment to additivity by D'- method.

D. Projections of sectoral pattern and their comparison with the results derived from other methods

Given an independent projection of "total" manufacturing output, it is easy to compute the corresponding "normal" levels of sector outputs, thus providing a set of benchmarks for sectoral planning. As has been repeatedly emphasized in this study, the "normal" pattern as such may or may not be construed as a "target" pattern. Even at this stage of computation, it is desirable at least to take into account the pattern of deviations from "normal" in the base year, since sectors which have shown significant deviations in the base year are likely to maintain to some extent their leads or lags relative to normal in the projection period. In the following, some of the procedures of adjusting the "normal" pattern for the base year position are illustrated. There are several variants to be considered: variant IA assumes that the *absolute* value of each sector residual remains unchanged, so that the residual declines in relation to the level of output as the latter increases (see column (3) in table 10); variant IB assumes that all the sector residuals increase — with their signs unchanged — at the same rate as that of ***total*** manufacturing output; the sum of sector residuals in relation to total manufacturing output, as well as their distribution over sectors, remains in this case unchanged (see column (5) in table 10); variant II assumes that the residuals grow at the same rate as the output in the respective sectors, so that not only the pattern of the residuals change, but also the over-all deviations from the normal pattern tend to increase with an increasing rate of industrialization (see column (7) in table 10).

Of course, the choice of the most appropriate assumption for carrying out the residual adjustments will have to be made in each case in the light of particular circumstances. Available information would, however, seem to provide some evidence, though not quite general,

Table 11

COMPARISON WITH ECLA PROJECTIONS

	ECLA projections		Deviations from the ECLA [illegible]			
	Value added 1965	(Index 1950 = 100)	From 1965 "Normal"	From Variant IV	Variant III	Variant II
	(1)	(2)	(3)	(4)	(5)	(6)
Food, beverages and tobacco	245.1	(162.4)	23.5	6.2	10.9	12.0
Textiles	110.6	(194.0)	36.3	16.7	2.7	6.0
Clothing and footwear	65.9	(213.3)	19.0	12.8	6.7	5.8
Wood products	26.3	(193.4)	12.4	6.9	1.5	2.2
Paper and products	9.8	(272.2)	9.1	5.0	0.9	0.5
Printing and publishing	15.7	(196.3)	7.9	4.9	1.9	2.0
Leather and products	11.1	(209.4)	1.1	0.9	2.9	2.2
Rubber products	10.8	(284.2)	3.6	3.2	2.8	2.6
Chemical and petroleum products	99.8	(203.2)	41.5	18.7	3.9	11.6
Non-metallic mineral products	36.8	(231.4)	18.9	-4.2	10.3	6.9
Basic metals	15.7	(365.1)	17.4	9.7	2.1	3.4
Metal products	91.7	(322.9)	-56.8	-25.9	4.7	17.4
Other	11.5	(174.2)	−0.3	−1.9	3.5	5.0
TOTAL, manufacturing	750.8	(198.9)	123.9	58.5	27.4	38.8

N.B. Numbers in all columns except col. (2) are in millions of 1953 US dollars.

Cols. (1) and (2): derived from United Nations: *Analyses and Projections, etc.*; 1955 levels are shown in table 9;

Col. (3): the 1965 "normal" levels are shown in table 10, col. (1);

Cols. (4), (5) and (6): see table 10, cols. (2), (4) and (6)

Table 12

INCREASES IN MANUFACTURING VALUE ADDED BY CAUSES (ECLA PROJECTIONS)

	Total increments 1955 to 1965	Due to increase in final demand				Due to increase in intermediate use			Due to import substitutions		
		Total	Exports	Consumption	Investment	Total	For manufacturing industries	For non-manufacturing industries	Total	In final demand	Intermediate production
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Food, beverages and tobacco	94.2	83.3	10.0	73.2		10.9	10.7	0.2	(—)10.8	(—)12.8	1.4
Textiles	53.6	37.4	3.1	34.4	—	16.2	14.5	1.7	9.5	9.4	0.1
Clothing and footwear	35.0	33.5	—	33.5	—	1.5	1.5		3.2	2.9	0.3
Wood products	12.7	7.6	0.3	5.5	1.8	5.1	5.0	0.1	1.6	1.5	0.1
Paper and products	6.3	1.2	—	1.2	—	5.1	4.9	0.2	2.7	0.9	1.8
Printing and publishing	7.7	4.7	—	4.6	0.1	3.0	2.8	0.2	0.4		0.4
Leather and products	5.8	0.2	—	0.2		5.6	5.6				
Rubber products	7.0	5.5	—	0.2	5.3	1.5	1.4	0.1	0.6	0.5	0.1
Chemical and petroleum products	50.7	18.6	(—)10.2	28.7	0.1	32.1	25.5	6.6	18.8	0.6	8.2
Non-metallic mineral products	20.9	15.8	(—) 0.1	2.7	13.1	5.1	4.3	0.8	4.0	3.0	1.0
Basic metals	11.4	9.2	8.5	—	0.7	2.2	2.2	—	1.3	0.7	0.6
Metal products	63.3	55.3	—	15.0	40.3	8.0	7.0	1.0	32.8	28.0	4.8
Other	4.9	4.4	—	4.4	—	0.5	0.5				
TOTAL, manufacturing	373.4	276.6	11.6	203.6	61.4	96.8	85.9	10.9	74.1	45.3	28.8

N.B. All values in millions of 1953 US $.

Derived from the input-output tables for Peru, 1955 and 1965; see United Nations: *Analyses and Projections.*

Col. (1) = Cols. (2) + (6);

Col. (2) = Cols. (3) + (4) + (5); value-added components of the increments of final bills of goods (domestically produced);

Col. (6) = Cols. (7) + (8); value-added components of the increases in indirect production requirements; col. (8) is derived from the increase in production requirements of manufacturing industries for non-manufacturing production;

Col. (9) = Cols. (10) + (11); col. (10) is derived from the increase in the domestic production of goods for final use over and above the increase proportional total final demand for products of each of the thirteen sectors; col. (11) is derived from the increase in indirect production requirements (with the increases in final demand given in col. (2)) due to the changes in input coefficients during the period. (See footnote to text on the minor under-estimation involved in the above estimate of total import substitution effect.)

that when a country deviates considerably from the "normal" output pattern, lagging sectors are likely to grow faster and leading sectors more slowly than "normal", so that the general industrial output pattern tends relatively to approach "normal".[60] This would provide some indication in favour of variant IA (which assumes a relative over-all approach to "normal") as against variant IB or II — where the relative significance of the deviations from normal remains constant or tends to increase. It should be noted, however, that the variants presented above are only a few arbitrary examples among a variety of methods for carrying out such adjustments.

For illustrative purposes, the 1965 projections for the Peruvian economy presented in table 10, which were carried out which the standard equations of the present study, are compared with ECLA's own projections. The ECLA projections of sector outputs are given in the document on the Peruvian economy referred to earlier. They are presented in column (1) of table 11 and the deviations from the "normal" pattern — in the sense defined above — in column (3).

A comparison between these deviations for the target year and those in column (8) in table 8 representing the deviations from "normal" in the base year implies that in almost all sectors ECLA has assumed the deviations from "normal" to persist in the same direction and to increase, not only in absolute terms, but even more or less proportionate to the projected increases in output.[61] Indeed, "food, beverages and tobacco" (with an actual level substantially higher than "normal") and "non-metallic mineral products" (which is substantially below "normal") show in the ECLA projections a relative decrease — and yet an increase in absolute terms — over the ten-year period in the deviation from "normal". But in most of the lagging producer-oriented industries, such as "paper and products", "basic metals" and "metal products", ECLA turns out to foresee even a persistent widening of the gap.[62]

The deviations from the ECLA projections of the benchmarks derived by the equations are presented in columns (4) - (6) of table 11. As could be expected under the circumstances referred to above, the pattern adjusted in accordance with variant IB appears on the whole to be closest to the ECLA projections while the one based on variant IA differs most from the ECLA figures.

It will be noted that the differences between the equation projections, especially those adjusted according to variant IB, and the ECLA projections are very small: the sector sum of the deviations in column (5) of table 11 amounts to less than 4% of the projected total manufacturing output given in column (1).

As a further step in the comparative analysis, it is useful to break down the increases in sector outputs by sources of origins. In terms of input-output analysis, which is the basic tool in the ECLA projection,[63] the increase in each sector's output can be attributed to: (1) projected increase in final bill of goods, and (2) projected increase in the intermediate use of the products produced by this sector. Table 12 presents the results of breaking down the total increment of output (value added) in each sector according to these two main categories. The first category is further subdivided into three types of demand: consumption, investment, and exports. The increase in intermediate requirements stems not only from the final demand for manufactured goods, but also from non-manufacturing production requirements, which, in turn, are related to both final demand for non-manufactured products and non-manufacturing production induced by manufacturing; the increase in the intermediate use of manufactured products is thus subdivided into intermediate use in manufacturing industries[64] and that in non-manufacturing industries. This analysis indicates that a greater part of the intermediate demand for manufactured products arises from the manufacturing industries themselves.

Among the thirteen sectors, those which devote an extremely high proportion of their products to intermediate use in other industries are: "paper and products", "leather and products", "chemicals and petroleum products"; then follow "wood products", "printing and publishing" and "textile"; "basic metals" is no exception, but because of the very large exports of this sector — primarily in the form of non-ferrous metals — the deliveries to other domestic industries appear relatively small to total output.

In ECLA's projection, the input-output coefficients are assumed to change only slightly over the period considered. The result of the change in these coefficients,

[60] Such a tendency will be especially observed at earlier stages of industrialization when high deviations from "normal" reflect quite frequently a structural imbalance of the economy owing to its immaturity.

[61] It should be noted that this is at variance with the conjectural hypothesis of a gradual approach to "normal" referred to above. It is then open to question whether the deviations from "normal" in ECLA's projections should be the kind that could be related to intrinsic factors in the Peruvian economy rather than to random developments. An investigation along this line is beyond the scope of the present study.

[62] According to ECLA's projection, the supply of the products of those sectors in the target year is assumed to be still highly dependent on imports from abroad: for example, the percentage of imports in total supply is 36% in "paper and products", 68% in "metal products" and 44% in "iron and steel"; even in "chemicals and petroleum products", "chemicals" alone (excluding "petroleum and coal products") considerably depend on imports (34% of total supply in 1965); "iron and steel", which is a new industry and almost non-existent in the base year in this country, weighs only 8% or so in the total production of "basic metals" even in the target year, the rest of the latter being composed of non-ferrous metal industries (mainly copper), as much as 85% of which is exported abroad.

[63] The Peruvian input-output table considered here should, as indicated in the ECLA study referred to earlier, be regarded as only of a very preliminary nature. The basic data were supplied mainly by a sample survey of manufacturing enterprises and not by an industrial census of the whole economy. Also, the inter-industry relationships covered by the matrix are restricted to manufacturing industries, other important sectors of the economy not being fully covered. The matrix consisted of seventeen manufacturing sectors, but only three non-manufacturing sectors — "agricultural activities", "extractive industries" and "services"; "services" is especially poor, its explicit transactions being restricted to sales to other sectors with no purchases by this sector from other sectors.

[64] This obtains by assuming that any increase in the demand for non-manufacturing products over the base year level was met by imports from abroad with no increase in domestic production.

which can be considered in this particular case primarily due to import substitutions in the sector of intermediate products, is an extra increase in manufacturing value added of $28.8 million; this stems, as will be noted in column (11) of table 12, mostly from the development of new chemical industries and metal-working industries.

Inter-sectoral consistency is again an important factor in the projection for sectors such as "non-metallic mineral products", "metal products" and "rubber products"; the projections for their sectors depend on the projections of demand for investment goods, which in turn depend on the projection of the industrialization pattern as a whole. Import substitution in the area of final bills of goods may be defined quantitatively as an increase in domestic production of goods for final use which is more than proportionate to the increase of total final demand. Applying this definition to each sector's projection, levels of import substitution in final demand are obtained as indicated in column (10) of table 12 of a total of 45.3 million. It is especially in "metal products" and "textiles" that a significant contribution of this type is foreseen. Total import substitution by sectors, comprising both categories considered above, is obtained as the sum of columns (10) and (11) in table 12; the corresponding figures are given in column (9);[65] they amount to $74.1 million which represents about 20% of the total projected increase in output.

E. Final remarks

It is clear that a systematic analysis of the differences between ECLA projections of sector outputs and the projections based on the standard equations would greatly contribute to improving the insight into the former in the light of the particular circumstances and historical conditions of the Peruvian economy; in such an analysis a breakdown by origin of the discrepancies along the lines of the presentation in table 12 would provide a useful starting point. It is beyond the scope of the present study to analyse the discrepancies themselves in this particular example. An extension of the above type of comparative analysis to a number of other cases would also be highly useful to clarify the merits and demerits of the present study in relation to its practical applications.

Indeed, the projection technique using the standard equations is quite simple; the only variables that have to be estimated independently are national income, population and total manufacturing output. It goes without saying, however, that the "normal-pattern" approach of this particular type does not provide complete insight into the mechanism of industrialization. For example, the analysis of the "normal" pattern of industrial growth in output should be accompanied by that of the corresponding "normal" pattern of import substitution and of foreign trade in general which is contained in the present model only in implicit form.[66] On the other hand, a reformulation of normal-pattern approach in terms of the input-output concepts, which is certainly a desirable work-programme for the future, would require a considerable amount of work in obtaining the relevant data on internationally comparable basis. Apart from such new lines of work, it should be remembered that the present study is susceptible of further refinement within its own analytical framework; in particular, it would be desirable to engage in a more extensive analysis of over-time variations. This may be feasible in the future as comparable times-series data become available for a sufficiently large number of countries and over a reasonably long period of time.

It is, however, believed that even with these shortcomings the present study, limited to the cross-section regressions, will be useful in providing a first approach to the study of the structure of manufacturing industry in developing countries and a means of projection of the general trends in this sector of the economy. As far as the former is concerned, the "normal" pattern derived from the equations constitutes a convenient set of benchmarks against which the existing pattern can be measured and analysed; for projection purposes, the present method provides a tentative sectoral pattern that could serve as a starting point for a more detailed analysis taking into account to the fullest possible extent the characteristics of the particular economy under consideration.

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[65] Column (10) does not include the value added component of indirect production requirements that are induced by the import substitution in the final bills of goods; since column (11) includes only that part of the increases in indirect production requirements that are caused by the changes in input coefficients, the indirect requirements induced by import substitution in final demand *without the changes in input coefficients* do not appear in any of the columns. A rough computation would show, however, that the under-estimation of the effect of import substitution due to this factor hardly exceeds 15% of the total of column (10).

[66] Although it is believed that the degree of interdependence among industries tends to increase in the course of industrialization, it remains to be investigated whether it is possible to establish any systematic or "normal" pattern of changes in interindustry relations, expressed in terms of an input-coefficient matrix of a standardized form. A study in this direction has already been advanced to a considerable extent, especially by H. B. Chenery & T. Watanabe: see "International Comparisons of the Structure of Production", *Econometrica*, October 1958; and also some of their later works carried out in connexion with Stanford Project for Quantitative Research in Economic Development in Stanford University, California, such as "An Interindustry Analysis of Growth Patterns" (1960, mimeographed). Because of the scarcity and inadequacy of relevant data, these studies are still in a preliminary stage both in the quality of standardization of input-output tables involved and in the number of countries covered in comparative analysis. Recommendations for speeding up the compilation of interindustry tables in under-developed countries have been made on many occasion: see, for example, Report of the Second Group of Experts on Programming Techniques for the first session of the Conference of Asian Economic Planners, September-October 1961, New Delhi, India.

Appendix I. Methods of statistical analysis

A. Test of significance of various candidate variables

(1) The candidate variables which were chosen to explain manufacturing value added by sector (V_i's, $i = 0, 1, ..., 13$; in millions of 1953 US dollars) are:

- y: per capita national income in 1953 US $;
- P: size of population in *thousands;*
- K/L: capacity of installed power-equipment per employee in horsepower;
- r: annual average rate of growth (in percentage) in per capita national income at constant prices during the period 1950-57;
- I/Y: percentage share of gross domestic capital formation in gross domestic product;
- G/Y: percentage share of government (consumption) expenditure in gross domestic product;
- (X + M)/Y: ratio (in percentage) of exports plus imports of goods and services to gross domestic product;
- X_p/X: percentage share of primary exports in total exports.

All variables relate to 1953. The variables in absolute value (V_i's, P, y, and K/L) were introduced in the form of their logarithms;[a] those in the form of ratios (r, I/Y, G/Y, (X + M)/Y and X_p/X) in natural values.

The relative significance of those candidate explanatory variables was tested mainly by an iterative procedure of linear multiple regressions based on cross-section data for a considerable number of countries (see footnotes on tables I-1 and 2). Owing to the heteroskedasticity involved in the cross-country data and the variation of the sample size for different sectors, the observations for each country were weighted in proportion to its relative level of per capita income (see appendix I.B for the significance of the weighting system employed in this analysis).

(2) Table are shows the list of the variables whose regression coefficients significantly differed from zero when all the eight explanatory variables were included in the multi-linear relationships. The multi-collinearity is tolerably low in general, though not quite negligible in some cases. Table I-2 gives the matrix of simple correlation coefficients for the eight variables considered. For the fifty-four country sample as a whole, there appears to be an appreciable degree of intercorrelation among y, G/Y and K/L, and also between P and X_p/X and between P and (X + M)/Y.

There are a great number of possible combinations of variables for each of the thirteen sectors. For the sake of convenience, table I-1 was used to get the initially significant subset of explanatory variables, and trials and errors tests were then conducted by making all possible combinations of this subset with the rest of the variables. Only a few variables were found in the end statistically significant and, when so, for only a few sectors. Table I-3 presents the regression equations with the best selected variables for the respective sectors.

(3) The size factor, P, showed an explanatory significance for most of the heavy industrial sectors when other subsidiary variables were left out. The growth rate (r) appeared to be significant (at more than 95% confidence level) only in two sectors ("chemicals and petroleum products" and "non-metallic mineral products"). The investment ratio (I/Y) was not quite significant in three out of the five cases where this variable has been retained; the other two cases where its coefficients appeared to be significant are "wood products" and "printing and publishing"; the economic interpretation of this is not clear, however. It is interesting to note that the variable representative of the relative importance of primary exports (X_p/X) turned out to be significant, with negative coefficients, in the case of "textiles" and "basic metals". On the other hand, the significance of foreign trade in the national economy represented by (X + M)/Y appeared to be high for only "printing and publishing" which is again difficult to interpret in economic terms. The variable measuring capital intensity (K/L) remained only in "leather and products" though at a low level of statistical significance.

(4) Although the method used for the choice of variables is by no means an ideal one, one might suspect that the rejected variables which were measured in more or less conventional ways did not represent very accurately the underlying theoretical concepts. Table I-4 indicates that the set of only two explanatory variables, y and P, yields almost as good an explanation as larger sets of variables. For the analysis of some particular sectors, it is possible that an improvement in the quantitative measurement of some of the rejected variables would yield a more satisfactory compromise between statistical significance and economic meaningfulness. For the analysis of the industrialization pattern in general, which is the object of the present study, a further exploration was made to obtain a less onerous and cumbersome way which would take into account the effects of variables other than income and population. The concept of "relative degree of industrialization" (D) was introduced for this purpose. The statistical characteristics of this third variable are examined in more detail in appendix I.C.

B. Heteroskedasticity and weighting of regressions

(1) The results of the regression have been found to vary significantly for various subsets of data. Table I-5 presents one of such examples. The total sample was divided into a "high-income group" and a "low-income group", using the median per capita income $200 as in 1953 as the dividing line. The same form of equation sets resulted for the two groups in significant differences in the regression coefficients as well as in the goodness of "fit".

The random term in all-country regression equations should thus be somewhat heteroskedastic: in other words, it can not be considered as being constant, but as varying rather systematically with the magnitude of per capita income or some other related variables. Especially since the sample size varies for different sectors, it is preferable to transform the raw data so as to keep the resulting regression estimates free from sampling biases, stable and comparable, without an unnecessary loss in degree of freedom.

(2) The appropriate regression weights should be proportional to the relative reliability of the observed data for various countries: in other words, inversely proportional to the variance of the expected value of the variables considered. There are not enough data, however, to estimate the variance for each country. Intuitively, the variability of observed variables seems to be higher for less developed (lower-income) countries, or for smaller-sized countries—especially when the variables are considered in their logarithmic values. In the present study, all the regression estimates have thus been derived from observations weighted according to each country's relative level of per capita income as of 1953. The effects of such weighting are illustrated in relation to the "total manufacturing" equation in table I-6.

[a] Natural logarithms. The constant terms in the regression equations presented in this appendix are all in natural logarithms.

Table 1-1

The variables appearing statistically significant in the multi-linear regressions in 9 variables

	$\log y$	$\log p$	r	$\frac{I}{Y}$	$\frac{G}{Y}$	$\frac{X_p}{X}$	$\frac{X+M}{Y}$	$\log\left(\frac{K}{L}\right)$
0 Total manufacturing	***		*	***				
1 Food, beverages and tobacco	***		*			*	*	
2 Textiles	***					(−)**		
3 Clothing and footwear	***			***	**			***
4 Wood products	***		***	***		*		
5 Paper and products	***		***	***				
6 Printing and publishing	***			(−)**			**	
7 Leather products	***			*				(−)***
8 Rubber products	***	(−)***	**	***	***			(−)***
9 Chemicals and petroleum products	***	***		***			***	
10 Non-metallic	***							
11 Basic metals	***	***	(−)**			(−)***		
12 Metal products	***			***				(−)*
13 Others	***		*					

*** coefficient significant at higher than 95 % confidence level.
** coefficient significant at 95-90 % confidence level.
* coefficient significant at 90-80 % confidence level.
(−) coefficient negative signed.

In the above, the "t" test was applied to the difference of each regression coefficient from zero value in all cases except for the coefficient on log P, in which case the critical value is set at unity since the dependent variables are all expressed in aggregate terms and not in per capita terms.

The multi-linear regression equations are:

$$\log V_i = b_{0i} + b_{1i} \log y + b_{2i} \log p + b_{3i} r + b_{4i} \frac{I}{Y} + b_{5i} \frac{G}{Y} + b_{6i} \frac{X+M}{Y} + b_{7i} \frac{X_p}{X} + b_i \log\left(\frac{K}{L}\right) + u_i \; (i = 0, 1, \ldots, 13)$$

Regression samples:

The above preliminary tests include the following thirty-nine countries: United States, Canada, Argentina, Brazil,* Chile, Colombia,* Costa Rica, Dominican Republic,* Ecuador,* Guatemala,* Honduras,* Mexico, Peru,* UAR,* Turkey, Australia, New Zealand, Japan,* Korea (Rep. of),* China (Taiwan),* Ceylon,* Pakistan,* Philippines,* United Kingdom, Austria, Belgium, Denmark, Finland, France, Germany (Fed. Rep. of), Italy, Norway, Sweden, Switzerland, Greece,* Ireland, Portugal,* Netherlands, and South Africa.

Later the following fifteen countries are added: Rhodesia and Nyasaland,* Kenya,* Algeria,* Morocco,* Iraq,* Israel, Yugoslavia,* Spain, Puerto Rico, Venezuela, Paraguay,* Burma,* India,* Indonesia,* and Thailand.* (The asterisked countries are referred to as "low income" countries in tables 1-2 and 1-5.)

Table 1-2

Simple correlation co-efficients among independent variables

(i) All-country cross section (1953)

	y	r	P	I/Y	G/Y	$(X+M)/Y$	X_p/X	K/L
y	1.00	−.33	.22	.37	.64	.01	.05	.82
r		1.00	.11	−.11	.02	.01	.29	.21
P			1.00	−.20	.48	.62	.51	.20
I/Y				1.00	.18	.44	.11	.36
G/Y					1.00	.06	.54	.61
(X + M)/Y						1.00	.12	.08
X_p/X							1.00	−.43
K/L								1.00

(ii) Low-income countries cross section (1953)

	y	r	P	I/Y	G/Y	$(X+M)/Y$	X_p/X	K/L
y	1.00	.21	—.18	.38	.21	.16	.24	0.4
r		1.00	.14	.07	−.03	.12	.42	0.2
P			1.00	−.004	.02	.34	.37	.45
I/Y				1.00	.42	.73	.32	.22
G/Y					1.00	.42	.22	.09
(X + M)/Y						1.00	.10	.44
X_p/X							1.00	.16
K/L								1.00

(iii) High-income countries cross-section (1953)

	y	r	P	I/Y	G/Y	$(X+M)/Y$	X_P/X	K/L
y	1.00	.36	.37	.09	.55	.23	—.34	.76
r		1.00	.11	—.09	.12	.08	—.39	—.14
P			1.00	—.32	.67	.69	—.56	.20
I/Y				1.00	—.22	.31	.14	.32
G/Y					1.00	—.32	—.61	.56
(X + M)/Y						1.00	.20	.04
X_P/X							1.00	—.32
K/L								1.00

The dividing line between "low income" and "high income" groups is $200 per capita income as in 1953, which splits the total sample into the two equal-sized sub-samples, each consisting of twenty-seven countries. See the footnote in table 1-1.

Table 1-3

REGRESSION EQUATIONS WITH THE BEST SELECTED VARIABLES

Equation	Standard errors	
log V_0^{a} = 10.51 + 1.34 log y + 1.10 log P + 0.14 I/Y	(.071) (.069) (.040) (.0097)	[$\bar{R}^2$ = .9731 ; d. f. = 43]
log V_1 = -9.38 + 1.08 log y + .90 log P	(.079) (.070) (.043)	[$\bar{R}^2$ = .9414 ; d. f. = 51]
log $V_2^{a,b,e}$ = -8.68 + .77 log y + 1.032 log P — .0122 X_p/X	(.30) (.14) (.085) (.0035)	[$\bar{R}^2$ = .9235 ; d. f. = 35]
log $V_3^{a,b}$ = 10.87 + 1.42 log y + .972 log P	(.145) (.114) (.067)	[$\bar{R}^2$ = .9051 ; d. f. = 39]
log V_4^{a} = —-13.98 + 1.42 log y + .969 log P + 032 I/Y	(.112) (.108) (.063) (.025)	[$\bar{R}^2$ = .9295 ; d. f. = 43]
log $V_5^{a,d}$ = 19.775 + 1.92 log y + 1.12 log P + .047 I/Y	(.195) (.180) (.104) (.025)	[$\bar{R}^2$ = .8834 ; d. f. = 38]
log V_6^{a} = 16.66 + 1.35 log y + 1.21 log P + 0.043 I/Y + .0066 (X + M)/Y	(.127) (.124) (.092) (.018) (.0015)	[$\bar{R}^2$ = .9214 ; d. f. = 42]
log V_7^{a} = 15.06 + 1.42 log y + 1.02 log P — .52 log K/L	(.123) (.19) (.065) (0.30)	[$\bar{R}^2$ = .9019 ; d. f. = 45]
log V_8^{a} = — 6.5 + 1.55 log y + 1.17 log P	(.124) (.110) (.067)	[$\bar{R}^2$ = .9298 ; d. f. = 46]
log V_9 = 15.54 + 1.46 log y + .095 γ + 1.19 log P	(.097) (.094) (.029) (.054)	[$\bar{R}^2$ = .9377 ; d. f. = 50]
log V_{10} = -13.66 + 1.36 log y + .064 γ + .999 log P	(0.94) (.090) (.028) (.052)	[$\bar{R}^2$ = .9379 ; d. f. = 50]
log V_{11}^{f} = 12.65 + 1.04 log y — .16 γ + 1.31 log P — .026 X_p/X	(.246) (.287) (.081) (.148) (.0073)	[$\bar{R}^2$ = .8510 ; d. f. = 38]
log V_{12}^{a} = —-18.04 + 1.86 log y + 1.23 log P + .036 I/Y	(.148) (.14) (.083) (.020)	[$\bar{R}^2$ = .9268 ; d. f. = 43]
log V_{13}^{g} = —19.12 + 1.77 log y + 0.64 γ + 1.23 log P	(.140) (.131) (.043) (.077)	[$\bar{R}^2$ = .9184 ; d. f. = 49]

Numbers in parentheses below regression coefficients indicate their standard errors.

$\bar{R}^2$: coefficient of determination adjusted for the degree of freedom used up in the estimation of regression coefficients:

$$\bar{R}^2 = 1 - (1 - R^2)\frac{N - 1}{d.f.}$$

Regression samples: total 54 countries (including USA): see the footnote in table 1-1.

[a] Excluding Paraguay, India, Indonesia, Pakistan, Thailand, Yugoslavia and Kenya.
[b] Excluding Rhodesia and Nyasaland, Spain, Algeria, Morocco, and Iraq.
[c] Excluding Puerto Rico, Venezuela and Israel.
[d] Excluding Guatemala, Honduras, Paraguay, Ceylon and Portugal.
[e] Excluding Honduras, Pakistan, Austria, Ireland, and Morocco.
[f] Excluding Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Paraguay, Ceylon, Philippines, Indonesia, Ireland and Kenya.
[g] Excluding Dominican Republic and Austria.

Table 1-4

1953 CROSS-SECTION REGRESSIONS WITH THE TWO EXPLANATORY VARIABLES

Manuf. sector	*Regression equations*				R^2	[illegible]
0	log V_0	11.23	1.373 log y (.059)	1.077 log P (.036)	.971	51
1	log V_1	9.39	1.075 log y (.069)	.898 log P (.042)	.942	51
2	log V_2	12.97	1.070 log y (.123)	1.187 log P (.075)	.883	51
3	log V_3	13.34	1.419 log y (.103)	.970 log P (.063)	.911	51
4	log V_4	13.25	1.417 log y (.095)	.945 log P (.058)	.921	51
5 [a]	log V_5	18.71	1.990 log y (.181)	1.060 log P (.103)	.803	39
6	log V_6	13.96	1.296 log y (.122)	1.088 log P (.075)	.884	51
7	log V_7	13.50	1.070 log y (.119)	1.020 log P (.073)	.865	51
8	log V_8	17.58	1.550 log y (.107)	1.171 log P (.066)	.932	46
9 [b]	log V_9	15.01	1.350 log y (.094)	1.226 log P (.058)	.939	51
10	log V_{10}	−13.19	1.282 log y (.088)	1.021 log P (.054)	.931	51
11 [c]	log V_{11}	−20.52	1.622 log y (.247)	1.550 log P (.146)	.806	40
12	log V_{12}	−17.33	1.911 log y (.122)	1.196 log P (.075)	.923	51
13 [d]	log V_{13}	18.71	1.699 log y (.124)	1.249 log P (.076)	.917	49

Regression sample: total fifty-four countries (including USA): see the footnote in table 1-1.

[a] Excluding India, Indonesia, Pakistan, Thailand, Yugoslavia, Kenya, Guatemala, Honduras, Paraguay, Ceylon and Portugal;

[b] Excluding Honduras, Pakistan, Austria, Ireland and Morocco;

[c] Excluding Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Paraguay, Ceylon, Philippines, Indonesia, Ireland and Kenya;

[d] Excluding Dominican Republic and Austria.

The adopted weights may not be the ideal ones, since they tend to over-correct the heteroskedasticity in the raw data. However, the difference in the weighted variance of the residuals between the two income groups becomes somewhat less significant than the difference in the unweighted variance.[b]

With this type of weight, the stability of the regression coefficients seems to be increased significantly, since most of the missing countries — in the samples for certain sectors and also in the 1958 samples — happen to be low-income countries. The same weights were also applied to the regressions on the 1958 cross section and the 1950-57 combined time series data, too.

(3) The exclusion of USA may be justified by the fact that the country, with its total manufacturing output occupying a little more than a half of the world total (excluding the "centrally planned" economies) is big enough to deserve special treatment. It is also known from the study of Gilbert and Kravis that the ordinary dollar-conversion rates tend to over-estimate the real income of USA relative to those of other countries.[c] The exclusion of USA does not affect very much the regression coefficients for "total manufacturing", but results in higher coefficients for some sectors rather significantly, especially in "textiles", "wood products", "printing and publishing", "chemicals and petroleum products", and in lower coefficients for "food, beverage, and tobacco" and "leather products" in particular. This can be seen by comparing table 1-4 and table 1-8.

(4) The stability of the "weighted" estimates of the regression parameters is illustrated with the few varying samples for "total manufacturing" in table 1-7. In all-country regressions, the exclusion of almost a dozen of countries did not significantly affect the results, for the excluded countries happen to be relatively low-weight countries. Similar stability is observed even with the regressions for low-income countries alone. However, the difference of the low-income equation from the all-country equation appears to be somewhat significant as regards income coefficients.

[b] Values of F at the .05 and .01 points of F distribution for n_1 = 24, and n_2 = 24 are 1.984 and 2.659, respectively. Hence the difference in the residuals between the two groups is significant when unweighted and not significant when weighted at the 95% confidence level. Similar effects of weighting appear to be even more pronounced when the United States is excluded from the high income group.

[c] See, e.g., M. Gilbert & I. Kravis, *An International Comparison of National Product and the Purchasing of Currencies*, O.E.E.C., Paris, 1954. The same reasoning may lead to the exclusion of Canada as well. In the present study, however, the final results of the regressions are presented for the sample excluding USA only.

Tables I-5

SUB-SAMPLE ESTIMATES OF THE PARAMETERS OF THE REGRESSION EQUATIONS IN TABLE I-4 : LOW-INCOME GROUP (L) AND HIGH-INCOME GROUP (H) : 1953

Sector (i)	*Constant (natural log)*		*Income coefficient*		*Population coefficient*		$\bar{R}^2$ *d. f*	
	L	*H*	*L*	*H*	*L*	*H*	*L*	*H*
0	−14.28	−10.75	1.89	1.30	1.13	1.08	.904 (24)	.972 (24)
			(.25)	(.12)	(.07)	(.05)		
1	−12.18	−8.94	1.72	.97	.86	(.93)	.758 (24)	.953 (24)
			(.33)	(.13)	(.10)	(.05)		
2	−21.28	−10.80	2.12	.75	1.51	1.19	.737 (24)	.910 (24)
			(.58)	(.22)	(.18)	(0.9)		
3	−16.31	−12.37	1.95	1.25	1.00	.99	.525 (24)	.948 (24)
			(.63)	(.16)	(.20)	(.06)		
4	−16.56	−13.37	1.71	1.51	1.16	.90	.713 (24)	.933 (24)
			(.47)	(.18)	(.15)	(.07)		
5 [a]	−27.24	−17.48	2.36	1.86	1.78	1.02	.799 (13)	.852 (24)
			(.66)	(.31)	(.21)	(.12)		
6	−16.17	−15.69	1.24	1.64	1.14	1.03	.543 (24)	.923 (24)
			(.65)	(.21)	(.20)	(.09)		
7	−17.89	−12.82	2.01	.91	.99	1.06	.420 (24)	.941 (24)
			(.77)	(.16)	(.24)	(.06)		
8 [b]	−21.30	−16.87	1.94	1.46	1.37	1.16	.749 (21)	.939 (22)
			(.54)	(.20)	(.17)	(.08)		
9	−17.26	−13.72	1.80	1.12	1.22	1.26	.792 (24)	.945 (24)
			(.41)	(.19)	(.13)	(.08)		
10	−20.37	−12.24	2.37	1.14	1.21	1.02	.836 (24)	.938 (24)
			(.36)	(.17)	(.11)	(.07)		
11 [c]	−29.14	−17.98	2.98	1.16	1.70	1.61	.513 (15)	.821 (22)
			(1.06)	(.45)	(.43)	(.18)		
12	−20.42	−16.86	2.23	1.87	1.36	1.18	.793 (24)	.908 (24)
			(.46)	(.27)	(.14)	(.11)		
13 [d]	−21.97	−19.35	2.05	1.85	1.38	1.21	.888 (23)	.899 (23)
			(.32)	(.29)	(.10)	(.12)		

Regression sample: see the footnote on table I-1.

[a] L: excluding Paraguay, India, Indonesia, Pakistan, Thailand, Yugoslavia, Kenya, Guatemala, Honduras, Ceylon, and Portugal.

[b] L: excluding Honduras, Pakistan and Morocco.
H: excluding Ireland and Austria.

[c] L: excluding Dominican Republic, Ecuador, Guatemala, Honduras, Paraguay, Ceylon, Philippines, Indonesia and Kenya.
H: excluding Costa Rica and Ireland.

[d] L: excluding Dominican Republic.
H: excluding Austria.

For the low-income group regressions with the D variable, see footnote [10] in appendix I.C.

Table I-6

EFFECTS OF PER CAPITA INCOME WEIGHTS

	Low-income group : with less than $ 200 per capita income	*High-income group : with over $ 200 per capita income*	*High-income group : excluding USA*
Number of countries	27	27	(26)
Sum of weights	18.9325	93.9051	(83.9313)
Unweighted variance of residuals [a]	1.2021	.4714	(.4428)
Weighted variance of residuals [a]	.7380	1.2334	(1.0229)

[a] Country residuals are calculated from the 1953 all-country cross-section regression equation (unweighted) for "total manufacturing":

$$\log \hat{V}_{oj} = -11.7369 + 1.467 \log_e y_j + 1.075 \log_e P_j \quad (j = 1, \ldots 54) .$$

Table I-7

CROSS-SECTION REGRESSIONS FOR "TOTAL MANUFACTURING": WITH VARYING SAMPLES, 1953

Sample	Constant term	Income coefficient	Population coefficient	R^2
A. *All countries*				
1. 53 countries	11.6863	1.3946	1.1204	(.9682)
2. 48 countries	11.6176	1.3849	1.1185	(.9705)
3. 47 countries	−11.5229	1.3850	1.1096	(.9690)
4. 42 countries	−11.4360	1.3657	1.1142	(.9659)
B. *Low-income countries*				
1. 27 countries	−14.2814	1.8943	1.1292	(.9109)
2. 24 countries	−13.9585	1.9121	1.0890	(.9056)
3. 18 countries	−13.7705	1.8200	1.1188	(.8780)

Sample countries

A-1: see the note on table I-8;
A-2: countries in the sample for V_8 equation in table I-8;
A-3: countries in the sample for V_5 equation in table I-8;
A-4: countries in the sample for V_{11} equation in table I-8;
B-1: see the note on table I-1;
B-2: countries in the low-income sample for V_8 equations in table I-5;
B-3: countries in the low-income sample for V_{11} equation in table I-5.

C. Some statistical properties of "D"

(1) The basic feature of the regression equations in the present study is that a set of "aggregative" variables has been chosen to explain the behaviour of less aggregative variables, and also that, for the purpose of general analysis, the same form of equation is applied to both "total manufacturing" and its 13 constituent sectors. The trial-and-error tests of various candidate variables, as discussed in appendix I.A, have not produced an appropriate method of isolating the effects of possibly important factors other than y and P. It has been found, however, that there are some significant correlations between the residuals from the regression equation for "total manufacturing" and those from the sectoral regression equations, both equations having the same set of explanatory variables, y and P (see table I-4). Since the actual level of value added by "total manufacturing" is known for each of the sample countries, its difference from the estimated level (in logarithmic form), log D, can be introduced as a new additional variable in the sector equations; namely,

$$\log V_i = \alpha_i + \beta_i \log y + \gamma_i \log P + \delta_i \log D + u_i, \quad (i = 1, \ldots, 13)$$

where, for each j-country,

$$\log D_j = \log V_{0j} - \log \dot{V}_{0j} = \log V_{0j} - (\dot{\alpha}_0 + \dot{\beta}_0 \log y_j + \dot{\gamma}_0 \log P_j)^d$$

(2) D is thus a statistically specified variable, though it is not quite specifiable in economic terms, except that it may be regarded as measuring the "relative degree of industrialization", the causal determinants of which themselves are complex and unspecified. The non-linearity in the observed relationship of "total manufacturing" which is mentioned in the preceding section is, however, an important element of this complexity, especially for countries with very low, or very high, per capita incomes. On the other hand, for D to be a meaningful economic variable, relatable as such, not to the pure concept of random error, but to the process of economic development where essential changes refer to long-run variables, a test should be made as regards the short-run stability in the value of D for a given country. A discussion of those conceptual properties of D is given in the text.[e]

(3) One peculiar statistical characteristic of D should be noted; namely, that the introduction of this additional variable does not affect the estimated regression coefficients on other variables (y and P) nor the constant terms if a proper adjustment is made for the difference of the sample size among sectors. This property derives from the fact that the variable D is defined as the residual from the V_0 equation: the sample estimates of the parameters in this equation have such characteristics as for the mean values of the variables,

$$\text{av.}(\log V_0) = \dot{\alpha}_0 + \dot{\beta}_0 \,\text{av.}(\log y) + \dot{\gamma}_0 \,\text{av.}(\log P),$$

and hence the mean value of log D equals zero whether it is normally distributed or not.

In practice, some countries are missing from the samples for certain sectors. The above-mentioned property of D can thus be utilized only if some of the samples for the sector equations are extrapolated so that the observations for all the countries which

[d] As shown in table I-3, I/Y appears significant in V_0 equation. But this does not have to be included in determining D_j, since the same variable does not commonly appear significant in sector equations and also because D_j can, in its nature, represent the complex of whatever other unspecified variables.

[e] See discussions in part II and part IV.

[f] The introduction of log D in the regression equation for each sector requires the computation of additional moments M_{yD}, M_{PD}, M_{DD}, and M_{V_iD} (where y, P, D, and V_i stand for the logarithmic values of the respective variables); the first two moments turn out, however, to be always equal to zero, provided that the same countries are involved in all the samples for the sector regressions. Thus, the regression coefficients on log D can be derived without affecting $\dot{\beta}_i$ and $\dot{\gamma}_i$, simply as the ratios of M_{V_iD} to M_{DD}. Furthermore, since average (log D) is zero, the constant terms are also unaffected by the introduction of log D

Table I-8

1953 CROSS-SECTION REGRESSIONS

Manuf. sector	Number of observations	$\dot{\alpha}_i$	$\dot{\beta}_i$	$\dot{\gamma}_i$	$\dot{\delta}_i$	$\bar{R}^2$ [$\bar{R}^2$]	Without D $\bar{R}^2$ [$\bar{R}^2$]
0	53	11.6863	1.3946 (.0542)	1.1204 (.0413)			.9669 [.9320]
1	53	8.3995	0.9977 (.0564)	0.8531 (.0429)	0.8676 (.1514)	.9392 [.8782]	.8927 [.7974]
2	53	-15.9948	1.2941 (.0983)	1.3735 (0.748)	1.0339 (.2639)	.9162 [.8139]	.8905 [.7570]
3	53	13.4509	1.4200 (.0809)	0.9859 (.0616)	0.9165 (.2173)	.9238 [.8684]	.8965 [.8213]
4	53	14.9226	1.5634 (.0888)	1.0351 (.0675)	0.9266 (.2383)	.9210 [.8758]	.8972 [.8289]
5	47[a]	20.5303	2.1164 (.1207)	1.1907 (.0919)	1.8171 (.3241)	.9105 [.8852]	.8413 [.7964]
6	53	-16.4646	1.7250 (.0660)	1.0562 (.0503)	0.7940 (.1773)	.9598 [.9387]	.9434 [.9084]
7	52[b]	12.7388	1.0137 (.0981)	0.9826 (0.747)	1.2346 (.2635)	.8620 [.7192]	.8002 [.5934]
8	48[c]	18.4189	1.6041 (.1022)	1.2352 (.0778)	0.4328 (.2748)	.9118 [.8392]	.9101 [.8358]
9	53	-17.3069	1.5433 (.0831)	1.3564 (.0633)	0.7017 (.2231)	.9444 [.8939]	.9339 [.8670]
10	53	--12.9349	1.2423 (.0781)	1.0294 (.0567)	1.1694 (.1998)	.9305 [.8712]	.8814 [.7678]
11	42[d]	-24.6444	1.9258 (.1992)	1.7983 (.1527)	2.1579 (.5351)	.8278 [.7188]	.7491 [.5902]
12	53	--19.0922	2.0177 (.0757)	1.3311 (.0576)	1.4977 (.2033)	.9644 [.9457]	.9241 [.8774]
13	51[e]	-20.3910	1.8587 (.1195)	1.3238 (.0910)	0.9756 (.3211)	.9057 [.8437]	.8905 [.8188]

The fifty-three countries are: Burma, Ceylon, China (Taiwan), India, Indonesia, Japan, Korea (Rep. of), Pakistan, Philippines, Thailand, Rhodesia and Nyasaland, South Africa, UAR, Algeria, Kenya, Morocco, Israel, Iraq, Turkey, Portugal, Greece, Spain, Argentina, Brazil, Chile, Colombia, Mexico, Peru, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Paraguay, Puerto Rico, Venezuela, Austria, Belgium, Denmark, Finland, France, Germany (Fed. Rep. of), Ireland, Italy, Netherlands, Norway, Sweden, Switzerland, United Kingdom, Australia, New Zealand, Canada, Yugoslavia.

The estimate of regression coefficients involve the theoretical estimates of V_i's based on the first-round regression equations for the missing countries, which are:

[a] Ceylon, Portugal, Costa Rica, Guatemala, Honduras, Paraguay.

[b] Rhodesia and Nyasaland.

[c] Pakistan, Morocco, Honduras, Austria, Ireland.

[d] Ceylon, Indonesia, Philippines, Kenya, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Paraguay, Ireland.

[e] Dominican Republic, Austria.

make up the sample of "total manufacturing" are available for all the regressions.[g]

(4) The extrapolation of the sample requires iterative regressions. First, D_i is re-defined by re-estimating the V_0 equation with a given reduced sample, from which the countries not represented in the particular sectoral sample have been eliminated, and a first-round estimation of the V_i equation (with the three explanatory variables) is run on this reduced sample. A second-round regression is then run on a complete sample in which the theoretical estimates of $\dot{V}_i$ derived from the first-round regression equation have been introduced for the missing countries.

The coefficients (and constants) shown in tables I-8, I-9 and I-10 were obtained in the second-round regressions where the sector sample size is smaller than that for "total manufacturing". However, the $\bar{R}$'s (adjusted to the degree of freedom for respective samples) were assumed to be identical with those obtained in the first-round regression equations, since the inclusion of the theoretical estimates in the enlarged samples makes the regression "fit" illusively high. This assumption necessitates a corresponding adjustment in the computation of the standard errors of regression coefficients.

(5) The last two columns in tables I-8 and I-9 show the gain in the coefficients of determination ($\bar{R}^2$) arising from the inclusion of the additional variable (D). The bracketed coefficients of determination [$\bar{R}^2$] represent a further adjustment to the critical value of

[g] The procedure, though not quite necessary, is justified in view of the principle that the influence of the sampling variation is negligible enough to maintain the estimates for different sectors comparable to one another; in fact, the weighting of the regressions helped to satisfy this principle, as shown in appendix I.B. In any case, once the sample extrapolation is done, the computation of the regression coefficients on log D can be done easily without actually computing the values of D_i's as explained in the preceding footnote.

population coefficients which is equal to unity at zero "size effect": these are the coefficients that would obtain if the dependent variables were expressed in per capita terms which would result in a corresponding change of the population coefficients to $\gamma_i - 1$, the other regression coefficients and their standard errors being unaffected. An analysis of variance indicates that the gain in the explained variance due to the introduction of the third explanatory variable D was significant using both 1953 and 1958 all-country data. The "rubber products" sector appears to be the only exception with a regression coefficient on D not significantly different from zero.

When a similar analysis is undertaken with the sample of "low-income" countries (1953) (measuring D, from this group's own V_0-equation), the regression coefficients on D turn out to be insignificant in the case of two more sectors: "printing and publishing" (sector 6) and "other manufacturing" (sector 13), in addition to "rubber products" (sector 8).[h]

D. Test of differences between two cross-section regressions, 1953 and 1958

(1) The significance of the difference between the regression equations for the two separate years, 1953 and 1958 (see tables I-8 and I-9) has been tested by means of analysis of variance. The test involves the estimation of "combined" regression equations. The procedure involves the assumption that the same set of coefficients (elasticities) are applicable for both years, although the constant terms may vary between the years. The test consists in examining whether this assumption of "parallelism" is valid or not.[i] In this test, the "first-round" regression equations (with no sample extrapolations) are used. The over-all differences between the regression coefficients of the two samples have been found to be statistically insignificant in all the cases, and hence the assumption of parallelism in the combined regression equations is justifiable. A more detailed test for the regression coefficient on each explanatory variable has confirmed this assumption, except in the case of the population coefficient in "leather products".[j]

(2) Table I-10 shows the full results of the "combined" cross-section regressions, which are now based on the enlarged samples as indicated in tables I-8 and I-9. As mentioned above, the combined regressions involve two sets of constant terms which apply to the 1953 and 1958 data separately. However, those differences in the constant terms appear to be statistically insignificant. Indeed, the difference between the constant terms might be interpreted as being due to (*a*) the effects of the "time" factor, which is independent of all the other specified explanatory variables, and (*b*) the fact that the two samples, for 1953 and 1958, do not comprise exactly the same countries. In other words it would reflect the "over-time" variations as well as the sampling bias. Moreover, the over-time variations during a short time-period of only five years must be considered far too small, relative to the cross-country variations, to generate differences in the regression positions of a statistically significant order.[k]

Since the differences between the two sample estimates have thus proved to be generally insignificant, a standard set of equations can now be derived, preferably from a newly defined set of over-all regressions, in which the observations for the two years are combined into a single "cross-section" sample. The standard set of equations, thus obtained, is presented in table I-11. The regression coefficients in this over-all cross section are generally higher than those in the combined cross-section when the constant terms in the latter increase as between 1953 and 1958, and vice versa, though the changes are rather of negligible magnitude either way. The coefficients of determination ($\bar{R}^2$) and standard errors are almost the same as those in the combined cross-section shown in table I-10.

E. Analysis of time-series data

(1) As mentioned in the text (III), there are a number of reasons why it is difficult to expect a straightforward agreement between the cross-section and the time-series approaches. The difficulties can easily be illustrated by the results of the first trial on the comparative study of "between country" variation and "within country" variation, which was carried out according to the following formulas.[l]

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[h] The introduction of the D variable in the 1953 Low income Group regression equations (in table I-5) gave the following values of coefficients on D and corresponding gains in the coefficients of determination.

Manufacturing sector	*Number of observations*	*Coefficient on D (Standard error)*		R^2 *with D*	$[\bar{R}^2]$	*without D*	
1	27	.7920	(.2278)	.8350	[.6827]	.7588	[.5239]
2	27	1.2886	(.4125)	.8074	[.5462]	.7370	[.3804]
3	27	1.3620	(.4552)	.6440	[.4211]	.5246	[.2292]
4	27	1.3423	(.2913)	.8507	[.6185]	.7128	[.2965]
5	27	.5085	(.4990)*	.5841	[.0842]	.5432	[.0827]
6	27	1.7708	(.5361)	.5886	[.4075]	.4200	[.1634]
7	24	.3742	(.4430)*	.7461	[.2796]	.7485	[.2923]
8	27	.7641	(.3062)	.8289	[.5173]	.7916	[.4122]
9	27	.9718	(.2341)	.9024	[.7661]	.8360	[.6077]
10	18	.22743	(.7520)	.6844	[.5340]	.5132	[.2948]
11	27	.9732	(.3306)	.8434	[.6077]	.7928	[.4825]
12	26	.5614	(.2375)	.9084	[.7066]	.8879	[.6501]

*... coefficients not significantly different from zero at the 95% confidence level. Coefficients on y and P and constants same as shown in table I-5. Sector 5 (paper and products) is omitted because of the low degrees of freedom.

[i] The "combined" regression estimates are derived by adding the product moments (taken as deviations from the mean for each sample) for the two samples together; such a regression is similar to what is termed the "cell-mean corrected" regression in the analysis of covariance.

To test the significance of the difference of regressions, the analysis of variance takes the following form:

Sum of squares	D.f.
(I) Combined regression; The variation explained by combined regression	n_1 (equal to number of explanatory variables)
(II) Difference of regressions: The sum of the variations explained by two separate regressions (1953 and 1958) *minus* the sum of squares of (I)	$(2 - 1)n_1 = n_1$
(III) Combined residuals: The sum of the variations not explained by the two separate regressions (1953 and 1958).	$n_2 = (N - 2n_1 - 2)$
Total within samples: The sum of the total variations in the two separate samples (1953 and 1958).	$N - 2$ (where N is the total number of observations)

[j] In terms of F test, which compares, for each explanatory variable, the sum of squares of the deviations of the coefficients from their weighted mean with the combined residuals, the weights are the reciprocals of the standard errors (in square) of the regression coefficients considered.

[k] Although the differences are not sufficiently large to be statistically significant, their pattern as such looks rather interesting if they are interpretable as reflecting the "time" effects. It will be noted that the constant terms are larger in 1958 than in 1953 for "total manufacturing" and for the eight sectors and smaller in the remaining sectors.

[l] i designates manufacturing sector ($i = 0, 1, \ldots, 13$), j country ($j = 1, \ldots, 42$ (maximum)) and t year (1950 to 1957). Variables capped with bars stand for their geometric means over time for each country when suffixed with j, and the grand means over time and over country when not suffixed with j. The two regression equations are developed by decomposing the total variation in such way that

$$\log V_{ijt} - \log \bar{V}_{i} = (\log \bar{V}_{ij} - \log \bar{V}_{i}) + (\log V_{ijt} - \log \bar{V}_{ij})$$

Table I-9

1958 CROSS-SECTION REGRESSIONS

Manufacturing sector	Number of observations	α_i^*	β_i^*	γ_i^*	δ_i^*	$\bar{R}^2$ [R^{2}]	Without D R^2 [$\bar{R}^2$]
0	42	—11.2287	1.3256	1.1239	—	—	.9652
			(.0613)	(.0461)			[.9268]
1	42	—8.1754	0.94620	0.86915	0.91157	.9268	.8813
			(.0693)	(.0522)	(.1885)	[.8492]	[.7554]
2	42	—13.9340	1.10172	1.27614	0.88123	.9004	.8789
			(.1097)	(.0825)	(.2983)	[.7734]	[.7029]
3	36[a]	—12.1823	1.29078	0.93282	0.83603	.9386	.9167
			(.0750)	(.0564)	(.2039)	[.8859]	[.8454]
4	40[b]	—14.4337	1.4960	1.0242	1.1456	.9324	.8986
			(.0896)	(.0674)	(.2436)	[.8852]	[.8278]
5	38[c]	—17.1361	1.8845	1.0052	1.4643	.8672	.7950
			(.1455)	(.1095)	(.3958)	[.8408]	[.7326]
6	34[d]	—15.7333	1.6870	1.0148	0.9565	.9727	.9557
			(.0592)	(.0445)	(.1608)	[.9534]	[.9248]
7	39[e]	—8.6262	0.7488	0.7058	1.2817	.6849	.6098
			(.1388)	(.1045)	(.3733)	[.4881]	[.3659]
8	37[f]	—17.0299	1.5291	1.1488	0.0288	.8971	.9001
			(.1155)	(.0869)	(.3141)	[.8214]	[.8267]
9	42	—17.8427	1.5323	1.4332	0.7062	.9460	.9362
			(.0947)	(.0712)	(.2575)	[.8964]	[.8678]
10	42	—10.9807	1.0229	0.9823	0.9769	.9110	.8698
			(.0854)	(.0643)	(.2323)	[.8206]	[.7168]
11	34[g]	—21.4693	1.9959	1.4429	1.5707	.6712	.5928
			(.2919)	(.2195)	(.7939)	[.5083]	[.4398]
12	38[h]	—18.0031	1.9267	1.2825	1.6658	.9724	.9391
			(.0719)	(.0541)	(.1955)	[.9522]	[.8838]
13	30[i]	—20.5609	1.8441	1.3465	1.2094	.9188	.9006
			(.1255)	(.0944)	(.3412)	[.87182]	[.8431]

The forty-two countries are: Burma, Ceylon, China (Taiwan), India, Japan, Korea (Rep. of), Philippines, South Africa, UAR, Algeria, Kenya, Morocco, Israel, Portugal, Greece, Spain, Argentina, Brazil, Chile, Colombia, Mexico, Peru, Ecuador, Guatemala, Venezuela, Austria, Belgium, Denmark, Finland, France, Germany (Fed. Rep. of) Ireland, Italy, Netherlands, Norway, Sweden, Switzerland, United Kingdom, Australia, New Zealand, Canada, Yugoslavia.

The estimates of regression coefficients involve the theoretical estimates based on the first-round regression equations for the missing countries, which are:

[a] Burma, Portugal, Greece, Austria, Belgium, Italy;
[b] Austria, Belgium;
[c] Ceylon, Portugal, Guatemala, Burma;
[d] Burma, Ceylon, Portugal, Greece, Austria, Belgium, Italy, Norway;
[e] Burma, Denmark, Norway;
[f] UAR, Morocco, Austria, Ireland, Norway;
[g] Burma, Ceylon, Philippines, Kenya, Ecuador, Guatemala, Ireland, New Zealand;
[h] Burma, Ceylon, UAR, Portugal;
[i] Burma, Portugal, Greece, Spain, Austria, Belgium, Finland, France, Ireland, Italy, Netherlands, New Zealand.

Table 1-10

1953-58 COMBINED CROSS-SECTION REGRESSIONS

Manu-facturing sector	*Number of observations*	$\overset{*}{\alpha}_i$ *(1953)*	$\overset{*}{\alpha}_i$ *(1958)*	* [illegible]	* [illegible]	*	*R* [illegible]
0	95	−11.5321	−11.4749	1.3639 (.0400)	1.1224 (.0303)		.9659 [.9374]
1	95	−8.3206	−8.2855	0.9758 (.0459)	0.8607 (.0348)	0.8869 (.1240)	.9350 [.8715]
2	95	−15.0880	−15.1208	1.2096 (.0722)	1.3307 (.0547)	0.9668 (.1952)	.9091 [.7980]
3	89	12.8917	−12.9167	1.3631 (.0551)	0.9628 (.0417)	0.8812 (.1488)	.9296 [.8752]
4	93	−14.6986	−14.7314	1.5335 (.0618)	1.0306 (.0468)	1.0228 (.1668)	.9272 [.8775]
5	85	−19.1645	−18.9148	2.0151 (.0919)	1.1085 (.0696)	1.6621 (.2482)	.8932 [.8621]
6	87	−16.1974	−16.0812	1.7086 (.0432)	1.0378 (.0327)	0.8654 (.1167)	.9671 [.9431]
7	91	−10.9175	−10.9888	0.8988 (.0826)	0.8593 (.0626)	1.2553 (.2234)	.7900 [.6077]
8	85	−17.8717	−17.7403	1.5717 (.0746)	1.1967 (.0566)	0.2553 (.2017)	.9074 [.8337]
9	95	−17.6061	−17.4905	1.5377 (.0609)	1.3911 (.0462)	0.7037 (.1645)	.9460 [.8941]
10	95	−12.1572	−12.0078	1.1452 (.0559)	1.0095 (.0424)	1.0848 (.1512)	.9206 [.8469]
11	76	−23.4075	−23.0334	1.9610 (.1720)	1.6375 (.1303)	1.8999 (.4648)	.7497 [.6201]
12	91	−18.6540	−18.5777	1.9778 (.0518)	1.3097 (.0392)	1.5716 (.1399)	.9680 [.9468]
13	81	−20.4440	−20.4976	1.8521 (.0850)	1.3341 (.0644)	1.0784 (.2295)	.9122 [.8574]

N.B. See tables 1-8 and 1-9 for sample countries.

(*a*) Combined time-series:

$$\log V_{ijt} = a_{ij} + b_i \log y_{jt} + c_i \log P_{jt} + u_{ijt},$$

where

$$a_{ij} = \log V_{ij} - b_i \log \bar{y}_j - c_i \log \bar{P}_j,$$

and

(*b*) Cross-section of period averages:

$$\log \bar{V}_{ij} = a_i + b_i' \log \bar{y}_j + c_i' \log \bar{P}_j + u_{ij}',$$

where

$$a_i = \log \bar{V}_i - b_i' \log \bar{y} - c_i' \log \bar{P}.$$

The cross-section of the period averages is an entirely different concept from the "over-all regression" in table 1-11, which involved both cross-country and over-time variations. The new cross-section is simply based on the average values of the observed variables for the time period considered. In the combined time-series equations, b_i and c_i are common to all countries, whereas a_{ij} varies from country to country; so the parallelism among various countries' time-series regression planes are already assumed, while different countries are assigned different intercepts in accordance with the over-time means of their own value added, per capita income and population. The third explanatory variable, D, is not included here, for simplicity's sake. The results are shown in table 1-12.

The pattern of response of manufacturing output to changing income and population appears to be appreciably different between the two types of regression. It will be observed that in general the response to variation in income is lower and the response to variation in population significantly higher in the results obtained by the combined time-series analysis, as compared with those obtained in the cross-section analysis.

Such differences could to some extent be expected on *a priori* considerations: for example, in the between-country response pattern, the income elasticities will reflect, among other factors, the differences in comparative production advantage. In the over-time variations, all countries tend to increase their per capita incomes, though at varying rates; owing to this simultaneous upward movement of the per capita income, the differences in comparative production advantage between countries can be expected to remain relatively stable.

There are also statistical considerations that may account for the differences between the results obtained in the two regressions. For the over-time variation the explanatory variables tend to move in the same direction, and hence their time-series behaviours tend to be inter-correlated which is not the case in the cross-country analysis; this makes it difficult to separate the true income effects from the seeming population effects. Moreover, while the annual growth in population is usually of a steady magnitude, the inter-dependence between annual changes in national income and annual changes in manufacturing output should involve some time-lag

Table I-11

OVER-ALL CROSS-SECTION REGRESSIONS: WITH 1953 AND 1958 COMBINED SAMPLE

Manufacturing sector	α_i^*	β_i^*	γ_i^*	δ_i^*
0	11.5327	1.3685	1.1241	
1	8.3308	.9784	.8618	.8836
2	15.0498	1.2049	1.3292	.9638
3	12.8827	1.3608	.9620	.8767
4	14.6868	1.5306	1.0296	1.0076
5	19.2401	2.0352	1.1162	1.6991
6	16.2319	1.7178	1.0414	.8730
7	10.8947	.8928	.8572	1.2511
8	17.9114	1.5822	1.2008	.2806
9	17.6408	1.5468	1.3948	.7123
10	12.2027	1.1571	1.0142	1.1160
11	23.5222	1.9911	1.6492	1.9145
12	18.6759	1.9837	1.3121	1.5665
13	20.4255	1.8474	1.3325	1.0528

Estimates are based on the same as that are involved in the estimates in table I-11, except that D_j's are measured from the over-all regression normal of V_{oj}'s instead of each of the 1953 and the 1958 regression equations.

The same table is reproduced in the text as table 1, in which constant terms (α_i^*) are expressed in common-logarithmic values, instead of natural logarithmic, and also adjusted for the unit of measurement of population which is changed to *millions* in the text instead of *thousands*.

complications, which are beyond the scope of the present study.[m]

Secondly, there is the difference in the degree of variation of per capita income and population between the two sets of data. Whereas the between-country variance of the *size* of population is significantly greater than the between-country variance in the level of per capita income, the reverse is true with respect to the *growth rates* of these variables. Since in this type of regression analysis a greater stability of one variable — as compared with another one — tends to entail higher values of the regression coefficients corresponding to the former, this factor may contribute to explain in part the differences in question.

Finally, the "combined" time-series equations assumed a parallelism among its regression surfaces of various countries; the validity of such assumption has yet to be examined. The regression coefficients in the new cross-section as defined above are generally very low compared with those derived from the cross-section data for a given year (for example, those shown in table I-4). This is most likely due to the nature of the sample — especially the arithmetic feature of the "geometric means" of annual data on which the former analysis was based.

(2) To avoid the pitfalls in multiple regressions, it was decided not to introduce the third variable, D, into the time-series equations.[n] Instead, further simplifying assumptions were introduced in favour of a tentative analysis based on simple regressions. Namely, it was assumed that there should be no appreciable "size" effect on the year-to-year variation of industrial output, and also that the effect of "time" factor or "autonomous trend", if any, should be negligible or not isolated as such from the income effect. Thus, the simple regression equations:

$$\log V_{ijt} = a''_{ij} + b''_{ij} \log y_{jt} + u''_{ijt}, \quad \begin{cases} i = 0, 1, \ldots, 13 \\ j: \text{country} \end{cases}$$

were estimated from the time-series data for each country. The resulting estimates of income coefficients for individual countries are shown in table I-13. Figures in brackets indicate the coefficients of determination ($\bar{R}^2$).

The goodness of fit widely varies among different countries. Generally speaking, the fit is tolerably good in those cases where the regression coefficients appear to be more or less of a magnitude comparable with those obtained in the cross-section analysis; an extremely poor fit appears mostly when these coefficients turn out to be very small or even negative. A cross-country comparison would indicate that the regression coefficients are fairly stable, as among higher-income countries; the coefficients appear quite erratic and almost meaningless in countries with less than $100 per capita income (as in 1953) and also in those where per capita incomes (at constant prices) tended to decline during the period observed.

(3) Excluding those countries, a test of the differences of regression coefficients is applied to the two groups separately: high-income group and low-income group, the dividing line being $300 per capita income (in 1953).

The results are presented in the columns for the analysis of variance in table I-14. The differences of regressions are on the whole much larger among low-income countries than among high-income countries, and they are quite significant in both cases. The combined time-series equations are thus not strictly meaningful as such.

The income elasticities in the combined time-series equations (table I-14) bear, nevertheless, a rather striking resemblance to those obtained from the cross-section data. The high elasticities for low-income groups relative to those for high income groups conform, in general, to similar findings from the cross-section regressions (see table I-5). Of course, the time series coefficients, thus obtained, are not directly comparable with the cross-section coefficients, for the former should reflect not only income effects, but what could be isolable as population effects, if any, and other unspecified factors which could be treated as variables over time, but are constant in terms of cross-section.

[m] The disturbing effect of these annual fluctuations in the explanatory variables (which are in themselves only of secondary importance in the over-time analysis) could be avoided by carrying out, instead of the combined time-series analysis described in this section, a cross-section analysis in which the between-country variation of the *trend rates of increase* in industrial output are studied in contrast to the between-country variations of the *trend rates of increase* in per capita income and population.

[n] Because "D" is, by definition, a long-run variable that changes only slowly over time, it should not be introduced as an annual variate in the time-series analysis.

Table 1-12

PERIOD-AVERAGE CROSS-SECTION AND COMBINED TIME SERIES (1950-57)

	Cross-section				Combined time series		
Manufacturing sector	*Const.*	*Regr. coeff. on log y (stand. error)*	*Regr. coeff. on log P (stand. error)*	*Coeff. of deter. (d.f.)*	*Regr. coeff. on log y (stand. error)*	*Regr. coeff. on log P (stand. error)*	*Degrees of freedom*
0	−9.07	1.22 (.133)	.95 (.076)	.888 (38)	1.03 (.050)	1.71 (.106)	(242)
1	−7.67	.97 (.132)	.79 (.075)	.884 (38)	.74 (.049)	1.27 (.104)	(242)
2	−9.12	.77 (.169)	.99 (.099)	.784 (38)	.72 (.099)	.40 (.209)	(245)
3	−11.78	1.34 (.248)	.85 (.116)	.833 (23)	.84 (.198)	1.23 (.374)	(154)
4	−10.19	1.18 (.175)	.81 (.089)	.852 (27)	.75 (.082)	.92 (.173)	(180)
5	−13.90	1.66 (.248)	.80 (.130)	.755 (31)	1.03 (.128)	3.22 (.278)	(203)
6	−10.27	1.47 (.227)	.82 (.106)	.854 (21)	.89 (.099)	2.11 (.199)	(142)
7	−13.87	.92 (.173)	.91 (.097)	.828 (29)	.72 (.111)	.35 (.242)	(191)
8	−15.43	1.20 (.178)	.95 (.098)	.854 (26)	1.31 (.107)	1.69 (.222)	(172)
9	−9.94	1.19 (.166)	1.05 (.095)	.856 (36)	1.06 (.087)	2.92 (.188)	(231)
10	−12.66	1.08 (.144)	.86 (.084)	.842 (37)	.83 (.089)	2.22 (.190)	(238)
11	−14.07	1.41 (.270)	1.05 (.160)	.752 (29)	1.24 (.193)	2.13 (.427)	(189)
12	−10.14	1.49 (.248)	.98 (.117)	.830 (26)	1.41 (.088)	2.22 (.198)	(175)
13	−15.04	1.58 (.571)	.95 (.219)	.748 (11)	1.36 (.141)	.95 (.262)	(87)

Sample countries are those shown in table 1-14, so the USA is included.

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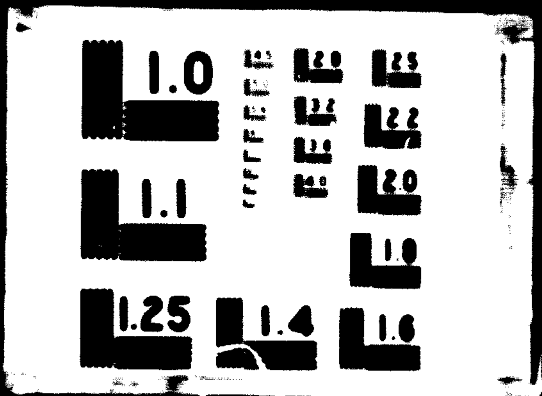

Table

1950-57 TIME-SERIES SIMPLE REGRESSIONS: INCOME

	Sweden 8	United Kingdom 8	New Zealand 7	South Africa 7	Spain 3	Switzerland 4	Canada 8	U.S.A. 8	Argentina 7
Total manufacturing	.968 (.902)	1.539 (.977)	3.152 (.687)	1.385 (.930)	2.393 (.339)	.757 (.959)	1.881 (.797)	2.000 (.962)	1.535 (.217)
Food, beverages and tobacco	.808 (.935)	.958 (.951)	1.660 (.632)	.701 (.790)	1.020 (.633)	.606 (.943)	1.632 (.614)	.672 (.847)	.141 (n.s.)
Textiles	.008 (n.s.)	.033 (n.s.)	2.244 (.554)	1.608 (.888)	1.361 (.313)	—.103 (.697)	.043 (n.s.)	—.390 (n.s.)	2.117 (.587)
Clothing and footwear	.129 (n.s.)	.615 (.557)	.506 (.107)	.580 (.650)	1.170 (.549)	.410 (.991)	1.122 (.783)	.558 (.405)	1.480 (.508)
Wood products	.576 (.585)	1.222 (.676)	.999 (.665)	.595 (.903)	2.960 (.435)	.367 (.989)	1.302 (.564)	.621 (.383)	1.273 (.341)
Paper and products	1.826 (.864)	2.034 (.817)	12.149 (.598)	1.734 (.956)	4.270 (.593)	1.075 (.971)	1.283 (.515)	2.459 (.793)	3.510 (.075)
Printing and publishing	.867 (.853)	2.033 (.817)	4.271 (.552)	.603 (.825)	4.110 (.474)	1.112 (.945)	1.797 (.554)	1.698 (.734)	4.718 (.452)
Leather products	—.503 (.478)	—.301 (n.s.)	—1.982 (.292)	.392 (.711)	2.079 (.406)	.751 (.925)	.999 (.336)	.082 (n.s.)	1.377 (.181)
Rubber products	2.166 (.940)	— —	7.682 (.951)	1.255 (.928)	5.744 (.505)	.771 (.961)	1.695 (.646)	1.451 (.602)	1.369 (n.s.)
Chemicals	1.695 (.934)	2.698 (.988)	3.554 (.741)	1.604 (.929)	1.417 (.470)	.846 (.954)	2.876 (.594)	2.753 (.901)	1.474 (n.s.)
Non-metallic mineral products	.837 (.796)	.749 (.776)	3.267 (.581)	.859 (.910)	4.466 (.399)	.613 (.952)	3.268 (.582)	2.218 (.842)	1.864 (.068)
Basic metals	2.558 (.866)	1.464 (.904)	— —	1.993 (.926)	3.636 (.442)	1.083 (.978)	2.069 (.778)	1.628 (.536)	4.264 (.274)
Metal products	.760 (.723)	1.914 (.958)	5.009 (.672)	1.985 (.934)	3.281 (.544)	1.073 (.969)	2.197 (.922)	3.164 (.909)	1.534 (.086)
Others	.475 (.358)	2.125 (.872)	— —	— —	— —	.109 (.505)	2.049 (.653)	2.118 (.901)	.178 (n.s.)

N.B. n.s., negligibly small.
The numbers in the column heads indicate the numbers of observations.

I 13

COEFFICIENT AND R^2 (i) High-income group.

Cl[illegible]	Venez[illegible]	[illegible]	[illegible]mark	Belgium	Finland	France	Germany Fed. Rep. of	[illegible]	[illegible]	N[illegible]	[illegible]
8	7	8	8	8	8	8	8	8	8	8	8
.238	1.678	1.253	1.517	1.619	1.976	1.666	1.535	1.164	1.623	1.345	2.632
(n.s.)	(.864)	(.989)	(.796)	(.861)	(.995)	(.972)	(.996)	(.731)	(.992)	(.994)	(.973)
.279	1.226	.737	1.130	1.001	2.044	.659	1.362	.361	.923	.829	1.615
(n.s.)	(.849)	(.909)	(.636)	(.976)	(.736)	(.736)	(.984)	(.102)	(.939)	(.976)	(.904)
.310	1.570	.731	−.630	.849	1.897	.598	1.093	3.273	.283	1.066	.244
(n.s.)	(.930)	(.851)	(.001)	(.293)	(.952)	(.517)	(.958)	(.602)	(n.s.)	(.935)	(n.s.)
.789	2.594	—	.186		2.178	.438	1.606	—.130		.924	2.668
(n.s.)	(.648)	—	(n.s.)		(.896)	(.352)	(.994)	(n.s.)		(.818)	(.903)
—	1.276	—	1.182	—	.357	1.180	.862	1.463	.988	1.569	2.391
	(.694)	—	(.787)	—	(n.s.)	(.984)	(.898)	(.463)	(.761)	(.949)	(.866)
.432	3.179	1.462	2.050	1.371	2.769	1.924	1.261	3.631	1.465	1.489	2.413
(n.s.)	(.743)	(.930)	(.731)	(.340)	(.944)	(.848)	(.961)	(.734)	(.981)	(.932)	(.896)
	1.945	—	2.050	—	1.710	2.406	1.270	2.046		1.199	
	(.791)	—	(.728)	—	(.939)	(.961)	(.963)	(.745)		(.975)	
—	1.914	−.142	—	—.812	.824	.506	1.157	1.379	.424	1.200	
	(.898)	(n.s.)	—	(.260)	(.492)	(.683)	(.978)	(.494)	(.444)	(.947)	
—	2.656	—	1.307	3.092	1.568	1.788	1.609	—	1.087	1.207	
—	(.806)	—	(.591)	(.795)	(.860)	(.968)	(.970)		(.786)	(.946)	
.151	1.744	1.009	1.331	1.890	3.016	2.520	1.595	2.728	2.688	1.789	2.998
(n.s.)	(.898)	(.886)	(.592)	(.816)	(.937)	(.984)	(.987)	(.757)	(.960)	(.962)	(.921)
.748	1.665	.988	—.000	1.534	1.502	1.703	1.296	2.354	2.201	.834	2.813
(.137)	(.868)	(.832)	(n.s.)	(.641)	(.873)	(.938)	(.989)	(.592)	(.992)	(.847)	(.945)
.662	—	2.048	2.760	1.968	2.629	1.813	1.404	—	2.589	2.075	4.521
(n.s.)	—	(.963)	(.768)	(.753)	(.858)	(.896)	(.965)	—	(.953)	(.981)	(.913)
—	2.623	1.378	2.750	1.960	2.049	2.334	1.934	1.646	1.707	2.072	3.176
—	(.870)	(.909)	(.771)	(.857)	(.968)	(.982)	(.989)	(.182)	(.984)	(.981)	(.930)
—	—	—	.205	—	1.455	—	2.211	—			2.164
—	—	—	(n.s.)	—	(.871)	—	(.871)				(.924)

Table 1-13

(ii) Low-

	Yugoslavia	*Congo Leopoldville*	*Columbia*	*Costa Rica*	*Ecuador*	*Burma*	*Ceylon*	*Portugal*
	5	6	7	5	7	8	7	6
Total manufacturing	1.709 [.787]	4.551 [.868]	1.322 [.956]	1.859 [.560]	2.407 [.782]	.565 [.948]	−1.342 [.136]	.634 [.890]
Food, beverages and tobacco	1.576 [.809]	4.516 [.765]	1.188 [.950]	1.848 [.672]	1.859 [.796]	−.051 [.104]	−.086 [n.s.]	1.206 [.963]
Textiles	1.762 [.840]	4.933 [.790]	.636 [.899]	—	2.898 [.757]	3.491 [.944]	.500 [n.s.]	.759 [.919]
Clothing and footwear	1.177 [.985]		.881 [.765]	—			−3.694 [n.s.]	
Wood products	.962 [.764]		1.341 [.960]		—	.748 [.959]		.414 [.911]
Paper and products	2.242 [.508]		4.203 [.950]		—		—	
Printing and publishing	1.785 [.595]	—	1.131 [.954]	—	—		—	—
Leather products	1.498 [.663]	5.567 [.801]	1.836 [.875]	—	—	—	.052 [n.s.]	1.500 [.796]
Rubber probucts	1.886 [.784]		3.250 [.957]	—	—	1.807 [.372]	—	1.561 [.912]
Chemicals and petroleum products	2.511 [.701]	7.876 [.910]	1.655 [.946]	—	3.024 [.737]	4.544 [.944]	−2.159 [.129]	1.269 [.990]
Non-metallic mineral products	1.415 [.829]	2.826 [.758]	1.598 [.920]	—	4.893 [.830]	—6.916 [.584]	−4.384 [.109]	1.818 [.984]
Basic metals	2.615 [.764]	1.290 [n.s.]	10.011 [.797]	—	—	—	—	1.769 [.915]
Metal products	1.711 [.785]	—	—	—	—	—	—	—
Other manufacturing	.577 [.130]	—	—	—	—	—	—	—

N.B. n.s.: negligibly small.
The numbers in the column heads indicate the numbers of observations.

(continued)

income group

Turkey	Algeria	Egypt	Brazil	Guatemala	Mexico	Peru	China Taiwan	[illegible]	[illegible]	[illegible]	[illegible]
8	6	4	8	7	6	7	7	[illegible]	1	[illegible]	[illegible]
	.911	.684	2.567	1.182	1.846	.550	2.678	2.391	5.275	2.865	[illegible]
	[.720]	[.717]	[.961]	[.661]	[.908]	[n.s.]	[.992]	[.975]	[.591]	[.993]	[.974]
	1.300	.280	2.328	.852	1.593	.022	2.883	2.139	5.970	2.353	1.096
	[.779]	[n.s.]	[.94[illegible]]	[.591]	[.859]	[n.s.]	[.908]	[.920]	[.476]	[.973]	[.901]
1.070	−3.639	.733	2.048	1.010	1.316	−.330	3.452	2.523	5.159	.542	.710
[.453]	[.415]	[.869]	[.725]	[.156]	[.962]	[n.s.]	[.880]	[.972]	[.690]	[n.s.]	[.787]
				2.120		−.548			4.419	1.100	
				[.474]		[n.s.]			[.659]	[.036]	
				4.521		−.280	1.244	.939	.491	5.544	1.537
				[.759]		[n.s.]	[.924]	[.674]	[n.s.]	[.919]	[.869]
	1.378	1.588	2.880		1.714	1.197	2.980	2.570	.022	2.944	1.676
	[.340]	[.778]	[.850]		[.554]	[n.s.]	[.909]	[.968]	[n.s.]	[.690]	[.978]
	.482	1.427	3.731			−.960		2.584			
	[.166]	[.980]	[.951]			[n.s.]		[.873]			
		.652	.838	−.546		−.847	.748	2.796		9.169	1.037
		[.382]	[.496]	[.158]	—	[.089]	[.187]	[.840]		[.955]	[.812]
		—	3.650	—	1.521	.626	1.555	1.870	1.652	1.905	1.669
	—	—	[.941]	—	[.953]	[n.s.]	[.860]	[.870]	[n.s.]	[.385]	[.845]
—	1.358	.457	—	1.066	2.127	−.680	2.057	2.688	.929	3.010	1.649
—	[.626]	[.257]	—	[.240]	[.933]	[n.s.]	[.938]	[.967]	[n.s.]	[.950]	[.844]
—	.949	1.244	3.403	2.258	2.316	−1.890	1.725	1.834	.928	1.333	2.691
—	[.736]	[.648]	[.917]	[.548]	[.881]	[n.s.]	[.925]	[.958]	[n.s.]	[.738]	[.920]
	−.196	2.339	3.276	—	1.420	−.065	5.121	1.943	.644		1.715
—	[n.s.]	[.989]	[.922]		[.816]	[n.s.]	[.948]	[.983]	[n.s.]		[.577]
—	.095	—	—	—	—	—	4.524	3.019	.658	5.274	2.057
—	[n.s.]	—	—	—	—	—	[.966]	[.953]	[n.s.]	[.990]	[.902]
—	—	—	—	—	—	—	.131	2.973			
—	—	—	—	—	—	—	[n.s.]	[.926]			

Table I-14

Time series : combined simple regressions and the test of parallelism

Manufacturing sector	Number of countries	Income coefficient in combined time series	R	Analysis of variance: Mean sum of squares of: Difference of regressions	(d.f.)	Combined residuals	(d.f.)
			(i) Low-income group				
0	13	1.6944	.7960	.00271	(12)	.000270	(65)
1	13	1.5427	.7862	.00187	(12)	.000330	(65)
2	12	1.0175	.2100	.01223	(11)	.000651	(61)
3	4	1.1781	.4200	.00086	(3)	.001216	(17)
4	7	1.4726	.4525	.01390	(6)	.000988	(33)
5	9	2.2305	.7229	.00561	(8)	.001770	(40)
6	6	1.9337	.6506	.00849	(5)	.001282	(26)
7	9	2.0058	.4242	.02542	(8)	.001318	(41)
8	8	1.9893	.7832	.00317	(7)	.000993	(38)
9	11	2.0110	.7722	.00322	(10)	.000902	(48)
10	12	2.0079	.7760	.00394	(11)	.000623	(54)
11	9	2.3794	.3020	.05410	(8)	.004440	(40)
12	5	2.2358	.6900	.02051	(4)	.001062	(23)
(13)	(2)	(2.4083)	(.7360)	(.02938)	(1)	(.001905)	(9)
			(ii) High-income group				
0	20	1.5656	.8704	.00260	(19)	.000753	(107)
1	20	1.0702	.7374	.00292	(19)	.000802	(107)
2	20	.8637	.3641	.00928	(19)	.001923	(107)
3	17	1.3493	.4862	.01459	(16)	.002795	(89)
4	18	1.0532	.6200	.00376	(17)	.001358	(95)
5	20	1.9947	.4533	.03311	(19)	.006726	(107)
6	16	1.6183	.6721	.00790	(15)	.002505	(33)
7	18	.6934	.2132	.01622	(17)	.001588	(95)
8	16	1.8953	.6665	.01728	(15)	.002917	(83)
9	20	1.9405	.7789	.00811	(19)	.001977	(107)
10	20	1.4838	.6435	.00869	(19)	.002308	(107)
11	17	2.0062	.7728	.00842	(16)	.002215	(96)
12	20	2.0521	.7985	.00895	(19)	.001900	(107)
13	11	1.7516	.6958	.01004	(10)	.001849	(60)
			(iii) Combined high- and low-income groups				
0	33	1.5470	.8293	.00358	(32)	.000370	(172)
1	33	1.1476	.7301	.00292	(32)	.000623	(172)
2	33	.8882	.3209	.00975	(32)	.001461	(168)
3	21	1.3407	.4816	.01182	(20)	.002542	(106)
4	25	1.1151	.5584	.00653	(24)	.001260	(128)
5	29	2.0309	.5139	.02420	(28)	.005378	(147)
6	22	1.6595	.6647	.00787	(21)	.002289	(109)
7	27	.8809	.2053	.02227	(26)	.001507	(136)
8	24	1.9105	.6840	.01226	(23)	.002313	(121)
9	31	1.9716	.7769	.00649	(30)	.001644	(155)
10	32	1.5692	.5603	.00733	(31)	.001743	(161)
11	26	2.0723	.5990	.02305	(25)	.002869	(136)
12	25	2.0751	.7808	.01058	(24)	.001752	(130)
13	13	1.8359	.6940	.01080	(12)	.001856	(69)

N.B. Sample countries: See table I-13. **Congo** (Leopoldville), Burma, Ceylon, Peru, China (Taiwan), Korea (Republic of) and Chile are altogether excluded.

Mean sum of squares in the analysis **of variance involves the** country weights applied in the combined regressions. The differences of regressions relative **to the** combined residuals are significant at the 95% confidence level in all cases except in textiles for low income group.

Appendix II

Statistical data

The following notes on the statistical sources deal only with predominantly free-enterprise economies (which were used in the regression analysis).[a]

A. Value added

The value added in manufacturing censuses is computed as value of gross production *minus* raw materials and contract work; it includes depreciation and rental costs (rent, patent fees, licences, etc.). In most cases, value added is evaluated at market prices (including indirect taxes). It thus is not always comparable to the concept of "gross domestic product originating in manufacturing industry" in *National Account Statistics* (United Nations).

1. 1953 VALUE ADDED

The data used in the 1953 cross-section analysis were derived from national manufacturing censuses of similar inquiries, compiled and adjusted to international comparability by the United Nations Statistical Office. For a detailed discussion of the methods used in making these adjustments, see *Patterns of Industrial Growth, 1938-1958*, appendix III.[b] The most important adjustments are as follows.

(*a*) National raw data were adjusted, if necessary, for the International Standard Industrial Classification (ISIC)[c] codes. Since it did not prove practical to establish comparability for each of the twenty major (2-digit) groups of manufacturing (ISIC 20 to 39), some of the major groups were combined. The regrouping resulted in the thirteen "sectors", as shown in table 1 in the text. For a number of countries, regrouping frequently involved shifts between ISIC 23 and 24, 24 and 29, or 34 and 35-38; total value of manufacturing was rarely affected except in the few cases where national raw data did not separate certain mining activities from processing: e.g., stone quarrying (ISIC 14) from non-metallic minerals processing (ISIC 33) and coal mining (ISIC 11) from coal processing (ISIC 32).

(*b*) Certain censuses or related inquiries do not provide value added data, but only the value of gross production (Thailand, Republic of Korea, Dominican Republic) or quantity of physical output (Indonesia); in such cases, the value added had to be approximated by certain reasonable methods.

(*c*) The insufficiencies in the coverage of censuses and related inquiries had to be filled by various methods of approximation. The coverage of raw data widely varies among countries, especially with regard to small-scale industries, including handicrafts and repairing services which, by the ISIC standards, are considered as manufacturing.[d] The size criterion which is most commonly used is the number of persons employed: for example, establishments employing less than twenty persons and using no power, or less than ten persons even when using power, are excluded in the Indian inquiry; for Pakistan, the cut-off point is twenty persons and no power; for other countries it is four, five or six persons employed (Kenya, Rhodesia and Nyasaland, Philippines, Ceylon, Brazil, etc.). As a result, the estimates of value added compiled from those raw data tend to fall short of those compiled for the purpose of national accounts statistics: census value added as per cent of GDP originating in manufacturing was less than 50 per cent for Burma, less than 40 per cent for India, less than 30 per cent for Pakistan; in Latin America, the coverage was in general more satisfactory — about 90 per cent in Brazil, and less than 70 per cent in Mexico and Peru, though less than 50 per cent in Guatemala and Ecuador. The under-coverage was most frequently observed in the following sections: ISIC 20-22 (Brazil, Ecuador, Mexico, Burma, Philippines, Turkey and India); ISIC 25-26 (Egypt, Brazil, Ecuador, Burma, and, in particular, Pakistan and India); ISIC 29 (Guatemala, India); ISIC 35-38 (UAR, Ecuador, Guatemala, Mexico, Peru, Ceylon, Pakistan, Greece). The data for the coverage adjustment were mostly supplied by the United Nations Statistical Office.

In a number of cases, important industries had been altogether omitted from the raw data — for example, petroleum refining (Iraq, Venezuela, Peru, Mexico), copper refining (Congo-Leopoldville, Rhodesia and Nyasaland, Chile), tobacco manufacture (Japan, Republic of Korea, Peru, etc.).

(*d*) Where a national census or similar inquiry did not relate to 1953, extrapolations had to be made, either forward or backward (Mexico from 1950, Peru from 1954, Paraguay from 1955, Costa Rica from 1951, Burma from 1952, Philippines from 1956, UAR from 1950, Federal Republic of Germany from 1950).

Some countries offered the value added evaluated only at factor cost (i.e., excluding indirect taxes and subsidies). The differences between factor-cost estimates and market-price estimates are especially important in the case of ISIC 20-22, which include tobacco and liquor. Adjustments for changes in inventories of semi-finished goods are another important source of difficulties (for example, the 1953 censuses for Canada and the United States were not adjusted for other inventory changes). Moreover the raw data for some countries happened to include part of the trade income — i.e., income accrued from "goods sold in the same condition as purchased". Those types of conceptual gap are rather difficult to be discerned as such. As a rule, no adjustment was applied to them. Thus, the adjustments made by the United Nations Statistical Office were, in most cases, to raise the level of value added by manufacturing and to correct the structure of industries.[e] For most countries, total value added was raised to agree with the level of GDP originating in manufacturing (for details, see table II-1). The corrected structure can be seen in the country weights used by the United Nations Statistical Office for the computation of the world production indices.[f]

2. EXTRAPOLATIONS OF VALUE ADDED

The 1953 value added was extrapolated for a number of purposes. In the time-series analysis 1950 to 1957 covering forty-one countries

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[a] The data on centrally planned economies used in the analysis of residuals (part III, section 3, of the text of the present study) were taken from the source which had been prepared on other occasions.

[b] United Nations publication, Sales No.: 59.XVIII.6.

[c] United Nations, *International Standard Industrial Classification*, Sales No.: 58.XVII.2.

[d] For inclusion of manufacturing units, see *International Standards Industrial Classification*.

[e] Original uncorrected data are given in *Pattern of Industrial Growth, 1938-1958*, part II.

[f] See the table on percentage distribution of value added in 1953 by country and region for mining and manufacturing industries in *Supplement to the Monthly Bulletin of Statistics. Definitions and Explanatory Notes*, fourth issue, 1960 (United Nations publication). This table does not include data for Algeria, Iraq, Israel, Kenya and Morocco

(see table I-14 in appendix I.E.), for the 1958 cross-section analysis covering forty-two countries (see appendix I.D.) and for the analysis of long-term variations covering seventeen, mostly advanced, countries (see text: IV 3). These extrapolations were carried out by applying to the 1953 data the sectoral indices of industrial production compiled by the United Nations Statistical Office.

B. National income

1. 1953 data

The reference period of the national income data for the 1953 cross-section analysis is the average for the period 1952 to 1954. Data in local currency of current prices were derived from *Yearbooks of National Accounts Statistics*.[g]

2. Extrapolations

For backward extrapolations to 1938, the index numbers of per capita product at constant prices, as available in the United Nations publications,[h] were used. Where such indicators were not available, the estimates of national income at current prices were deflated to 1953 price levels by appropriate price indices especially prepared for the purpose.

[g] United Nations publications, Sales Nos.: 58.XVII.3., 59.XVII.3., 60.XVII.3. and 61.XVII.4.

[h] United Nations, *Statistical Yearbook*, 1958, especially tables 161, 160 and 158.

C. Conversion rates

The conversions of value added and national income data from local currencies to US dollars were made at 1953 purchasing power parity rates. The rates and method of estimation were taken from *Patterns of Industrial Growth*, 1938-1958,[i] except for the countries listed below. Taking into account the OEEC study on Comparative National Products,[j] ECLA publications,[k] as well as official exchange rates, it was found preferable to substitute the UN *Pattern* rates in a certain number of cases. Table II-2 indicates the rates usual in these cases.

D. Population

Population data used in the present study are mid-year estimates, currently published by the United Nations.

E. Other variables

The data for the other variables that were tested but later excluded from the 1953 regression analysis (see appendix I.A), were compiled from various United Nations publications.

[i] *Op. cit.*, p. 444.

[j] Milton Gilbert and Associates, *Comparative National Products and Price Levels*, Paris, 1958.

[k] *Economic Survey of Latin America*, 1951-1952, E/CN.12/292, Rev. 2, p. 33.

Table II-1

CHARACTERISTICS OF THE DATA ON 1953 VALUE ADDED BY TOTAL MANUFACTURING, BY COUNTRY

1. Total value added by manufacturing was not adjusted and is similar to original census or related inquiry for the following countries:

Africa	*Asia*	*Europe*
Algeria	China (Taiwan)	Austria
Kenya	Japan	France
South Africa	Israel (1956 data)	Italy
		Netherlands
		United Kingdom
		Yugoslavia

Latin America	*North America*	*Oceania*
Argentina	Canada	Australia
Colombia	United States	
Honduras		
Paraguay		
Puerto Rico		

2. Total value added by manufacturing from the census or related inquiries was adjusted to agree with national accounts data on GDP originating in manufacturing for the following countries:

Africa

Morocco

UAR (NDP at factor cost; census at market price extrapolated from 1950).

Asia	*Europe*	*Latin America*
Burma	Belgium	Costa Rica
Ceylon	Denmark	Ecuador
India	Finland	Peru
Korea (Rep. of)	Germany (Fed. Rep. of)	Venezuela
Pakistan	Ireland	
Philippines	Portugal	
	Spain	
	Turkey	

3. Value added by manufacturing from the census or related inquiries was adjusted to agree with the coverage of ISIC codes for the following countries; but the result does not agree with national accounts data on GPD originating in manufacturing, because the latter involve no such adjustments, or involve different adjustments:

Chile	Copper-refining classified with mining in national censuses and GDP data
Rhodesia and Nyasaland	
Brazil	Food-processing in rural areas classified into "agriculture" in national census and GDP data
Norway	Fish-processing classified with "agriculture" in national census and GDP data.
Greece	GDP originating in manufacturing may be understated

4. Value added by manufacturing from the census or related inquiries cannot be checked against national accounts data, because the latter are not broken down by industrial origin for the following countries: Dominican Republic, Guatemala, Indonesia, Iraq, Mexico, Thailand, Sweden and Switzerland.

Table II-2

1953 PURCHASING POWER PARITY RATES USED IN THE PRESENT STUDY

(THOSE DIFFERENT FROM THE UNITED NATIONS *Pattern* RATES ONLY)[a]

Country	*U.S. cents per unit of local currency*	*Country*	*U.S. cents per unit of local currency*
United Kingdom	321.78	Argentina	9.9
Ireland	280.00	Brazil	2.92
South Africa	325.50	Paragua	3.15
Rhodesia and Nyasaland	327.71	Philippines	12.80
Australia	223.61	Algeria	0.286
New Zealand	284.80	Morocco	0.29
Belgium	2.00	Kenya	280.00
Italy	0.16	Iraq	280.00
Norway	15.20	Israel	55.56

[a] For the conversion factors used for countries not mentioned above, see *Patterns of Industrial Growth* 1938–1958, p. [illegible]

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