A MATHEMATICAL ANALYSIS OF GROWTH PATTERNS IN THE MINERAL INDUSTRIES OF UNDERDEVELOPED COUNTRIES

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ABSTRACT

Production curves for mineral industries in underdeveloped countries were constructed. Thirty-six different countries and twelve mineral products were included in the study. These were divided into three subgroups consisting of country-mineral combinations in which 1) the country was a colony and was considered during a period just before independence (there were 67 such cases), 2) the country was newly independent (54 such cases), 3) the country had been long independent and its recent production situation was under consideration (80 such cases).

Measures of the growth rate of the mineral industries, of their size, and of their stability were taken from these curves and these were normalized in various manners. The normalization was meant to remove, as far as possible, the effect of the particular mineral, and to make the final measure a function of only the country portion of the country-mineral combination. Then various variables relating to the countries involved were compiled; they measure G.N.P. per capita, internal transportation situation, literacy, newspaper circulation, infant mortality rate, foreign aid, population, presence of a geological survey and size of the mineral industry for each country.

Nonlinear, though nearly linear, functional models were established which were to explain the corrected growth rates, stabilities and sizes of the selected mineral industries by relating them to the economic and social measures noted above. The mathematical method employed was nonlinear estimation, a least squares multiple regression method and the problem was run on an I.B.M. 7094 computer. Parameters measuring the amount of dependence of the corrected growth rates etc. on each of the economic and social variables were obtained but such high deviations were associated with the results that no patterns could be described and future growth rates etc. could not be predicted within practical limits.

The sources of the high deviations are probably 1) a lack of precision of the published data relating to the social and economic variables, 2) the use of non-ideal functional models (no previous work was available to suggest alternate models), 3) the use of nonlinear estimation when another technique (possibly linear programming) may have been more suitable, and 4) the use of the variables in an improper manner, in particular by not including their time rates of change. This last source of trouble, a serious one, was recognized long in advance but the data necessary to obtain the time rates of change of the variables was simply not available in published sources. It is suggested that a government agency might have access to such information and be able to rerun the problem with somewhat different functional subroutines, thus obtaining parameters which would predict the mineral situation within a more narrow range.

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TABLE OF CONTENTS

PAGE

A. Outline of the Problem and the Method of Solution Employed

The goal of this investigation is to obtain a better understanding of the pattern of development of the mineral industries of underdeveloped countries. The rates of production, amounts of production, and stability of production for such industries are measured and an attempt is made to understand the values of these measured quantities. This is done by setting them equal to a function of several independent variables which are characteristic of the countries and/or minerals investigated. Then a nonlinear regression analysis is made which, given the dependent variable (production rate, etc.), the independent variables, and the functional model, will give least squares estimates for a set of parameters. The parameters will then measure the degree of dependence of the production rate, etc. on each of the independent variables. Twelve different analyses are made for different dependent variables and for different groups of countries. Error analyses are performed on the residuals between the observed data and the least squares fits. The purpose of the error analyses is to show the make-up of the groups of data for which the analysis is good, fair, poor and inadequate.

The steps in the study are: 1) defining the dependent variables to be explained, 2) obtaining numerical values for these variables, 3) selecting the independent variables on which the dependent variables are thought to depend, 4) obtaining numerical values for the independent variables, 5) constructing a functional model to express the expected relationship between the dependent and independent variables, 6) performing a nonlinear regression analysis with the above material to obtain a quantitative measure of the degree of the dependences, and 7) performing an error analysis on the results.

The basic item in this study is a set of production curves for mineral production in underdeveloped countries. A measure of the rate of growth of these curves is taken as a dependent variable in the analysis and the above procedure is followed for three sets of country-mineral combinations. The sets are characterized by combinations in which the countries are:

1. Underdeveloped countries which have been self-governing for a considerable length of time, the "South American" group. This group is examined during recent years. An example of a member of this group is Venezuela-Gold, 1957-62.

2. Underdeveloped countries which have recently become self-governing. The production curves for the first years of self-government are considered in this group. Ghana-Aluminum, 1957-62 is a typical member of this group.

3. Underdeveloped countries as colonies, during the final years before self-government was granted. Typical of this group is Ghana-Gold, 1944-57.

The same mineral industries are considered in each of the three groups.

The results of the mathematical analyses of these three sets are compared and discussed. In addition two other dependent variables are considered for each of the three groups of countries. These two variables are measures of the magnitude of mineral production and of stability of production during the periods under consideration.. They are treated in essentially the same way as the growth rate variables.

As stated above, the basic item examined is a set of production curves for various groups of country-mineral combinations. The analysis of these items is started by setting up an equation:

$$y = f\ (x_1, x_2, x_3, x_4, x_5, x_6, x_8)$$

wherein:

y is the uncorrected growth index for each production curve. Numerically, it is the doubling period in years divided into 100. The symbols y_f and y_g, used in the final analysis are two modifications on the numerical values of y. These modifications make the growth rates more dependent on the specific independent variables (x's) for which data were found to be available. The symbol y with alphabetical subscripts other than f and g refers to intermediate quantities calculated in the process of arriving at y_f and y_g.

And:

x_1 measures the road and railroad mileage and internal waterways within each country,

x_2 measures the literary and newspaper circulation,

x_3 measures the effect of a geological survey,

x_4 measures the infant mortality rate,

x_5 measures the G.N.P. per capita,

x_6 measures the foreign aid and long term investment,

x_7 measures the size of the population,

x_8 measures the volume of mineral production.

The data were obtained in the following form:

y_1	x_{11}	x_{21}	x_{31}	.	.	.	x_{81}
y_2	x_{12}	x_{22}	x_{32}	.	.	.	x_{82}
'	'	'	'	'	'	'	'
'	'	'	'	'	'	'	'
y_m	x_{1m}	x_{2m}	x_{3m}	.	.	.	x_{8m}

Note: In this paper when any y has a numerical subscript such as y_1, or any x has a double numerical subscript such as x_{21} (x-two, observation number one) the additional number in the subscript refers to a particular observation in a set of similar observations.

The numerical values of all y's and x's are obtained from the production curves and literature with suitable adjustment to facilitate mathematical handling. Neither data nor precision was lost in making these adjustments. Because of the inexact and sometimes hardly comparable values that were obtainable for the independent variables it was felt that the function should, wherever possible, be linear with respect to each x_1, x_2 ... x_n. Once higher powers of the independent variables are introduced the inherent lack of precision would be magnified. This would be equally true whether the higher powers were introduced in the forms x_1^2, x_4^2, x_6^3 etc. or in the forms x_1x_4, $x_2^2x_3$, $x_2x_3x_5x_6$ etc. In actuality, in order to express a reasonable relationship a higher power of one of the independent variables had to be introduced and the functional model for the growth rates took the form:

$$y_f \text{ or } y_g = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4/x_4 + a_5x_5 + a_6x_6 + a_7(x_8 - a_8)^2$$

The set of parameters a_o, a_1, - - - a_n measures the degree and nature of dependence of the corrected growth rate on each of the independent variables.

The mathematical procedure followed is to consider several functional models and to select one that seemed logically reasonable and that minimized the use of high powers of the independent variables. For this model a least squares estimate of the parameters a_o, a_1, - - - a_n, is obtained and an assesment of the worth of these estimates is made. The assessment of the worth of the estimates of the parameter values includes the following information:

1. a discussion of the magnitude of the parameters and the indicated degree of dependence of the corrected growth rates on each independent variable.

2. the actual value of the minimum sum of squares for the least squares estimates of the parameters,

3. the root mean square deviation on the calculated values of the dependent variable, indicating how closely a new set of independent variables would be able to predict a new dependent variable,

4. a display of the observations grouped by the amount of percent deviation. This is to give an indication of which country-mineral pairs are most subject and least subject to this type of analysis.

B. Nature of the Input Data

I. Dependent Variables

a. Uncorrected growth index, y

There are a large number of combinations of underdeveloped countries plus mineral products, and in order to obtain a set of data that could be handled in a statistical manner it was necessary to exclude those country-mineral combinations in which a) the mineral considered was one produced by only a few underdeveloped countries, b) the amount of production was so small that it was affected by extremely local conditions, and c) the data for either the dependent or the independent variables was not available. Case a) above was used to exclude combinations such as Colombia-emeralds because the shape of the production curve might be largely dependent on the "emerald" portion of the combination and statistical methods could never hope to bring this out without a fair number of other emerald production curves with which to make comparisons. Case b) was employed in the elimination of such combinations as Pacific Islands-phosphate, Central American countries-precious metals, etc. Wherever the production curves for an entire country could be viewed as likely to be dependent on the whim or finances of one individual they were eliminated. If, however, the production was very small but believed to be composed of several producers it was retained; that is, if a number of producers in a country perished, flourished or held their own it was felt that this would be indicated by the values of one or more of the independent variables. Some country-mineral combinations which were retained at this stage were subsequently dropped because other data required for the analysis was unavailable or unreliable.

At the data collecting stage the following countries were under consideration:

I

Ghana
Congo (Leopoldville)
Nigeria
Burma
India
Indonesia
Malaya
Philippines
Guinea
Senegal
French West Africa
(as a group, before independence)
Morocco
Sierra Leone
Jamaica
Trinidad
Israel
Algeria
Egypt (post-Farouk)
Syria
x Malagasy Republic
Angola
Mozambique
British Guiana
x Northern Rhodesia
x Papua and Australian New Guinea, or the Island of New Guinea
Liberia
Surinam
Jordan

II

Bolivia
Brazil
Colombia
Cuba (pre-Castro)
Chile
x Iran
Peru
Thailand
Turkey
Venezuela
x Newfoundland
Iraq
Mexico

III

x Bulgaria
x Albania
x Rumania (see text)
x Cuba (Castro)

The first list includes countries that have a period in their recent history which could be termed "shortly before independence" or a period that could be termed "shortly after independence" or both such periods. The second list is of countries that have no such periods in their recent histories and the third list is of underdeveloped countries with centrally planned economies. Those countries marked with an x were subsequently dropped from the statistical analysis because of a lack of data available in a usable form. This does not include Rumania which was dropped when it became clear that the data for Bulgaria, Albania and Castro Cuba would not be available. An attempt was also made to obtain data on the Central Asian republics of the U.S.S.R. but such data was usually available for only a portion of Central Asia or it was based on undefined indices or given only as a percent increase over the previous year.

A tabulation of minerals produced in each of the countries listed above was made and the following group of mineral products was selected as common to a minimum of ten of the countries.

Bauxite

Diamonds

Petroleum

Gold

Manganese

Tin

Copper

Silver

Iron

Energy

Cement

Fertilizer materials

Production curves were then plotted for all those country-mineral combinations for which there was significant production. The plot was semi-logarithmic (time on the linear scale, amount of production on the semi-logarithmic scale) so the units of measurement used were of no importance as long as the same units were employed throughout the production interval on each plot.

Energy was measured by a United Nations unit defined as:

"The gross inland consumption of commercial fuels and water power expressed in terms of coal equivalent. Fuelwood and other vegetal fuels and peat have been omitted. These are believed to provide a major share of energy supply in all but a few countries... Coke, manufactured gas, and electricity are considered consumed by importing country. Bunkers supplied to foreign going ships are excluded."[1.] Energy consumption rather than production was measured for two reasons. First of all, the consumption figures were more complete and appeared to be more reliable and secondly, a measurement of energy production would have produced some degree of duplication of the petroleum production data.

The production of fertilizer materials was plotted in separate production curves of time vs. the N, P_2O_5 or K_2O content of the materials produced. Nitrogen content of manufactured nitrates was included in the nitrogen plots.

1. United Nations Statistical Yearbook, 1959

Production data was usually plotted from the first year of production or from the year 1913. Two exceptions to this are cement, for which production data was rarely available before the early 1930's, and energy consumption for which data was available for 1929, 1937 and 1949 onwards.

In total 221 semi-logarithmic production curves were constructed. During the construction of these curves it became clear that portions of most of the curves could be well approximated by a straight line. Each curve was then examined and straight lines were fitted by eye to all portions which appeared approximately linear on the semi-logarithmic plot. Rather than attempt to make least squares fits, the following procedure was followed. Linear portions of the curves were marked off and recorded on a tracing paper overlay. After an interval of several days (to erase specific memory of the first set of results) the process was repeated on the graphs themselves. The two sets of straight lines were then compared and those that did not agree within five degrees and within ± 3 years on the end points were discarded. About a dozen lines were retained even though they did not meet the above criteria. These lines were usually in intervals that were approximated by one line segment in one attempt and by two line segments of slightly different slopes and end points in the other. After this process 307 straight lines on 194 country-mineral curves were retained.

The above procedure guaranteed the correctness of the fit; the goodness of the fit is another matter. In some curves the portions approximated as linear were virtually just that and a least squares sum would be close to zero; in others the fit, although repeatable, was poor. This was a difficulty inherent to the production data and nothing could be done about it. An argument could be put forth that certain lines should be dropped from the analysis but the criterion that they be seen as straight lines (plus or minus five degrees) on two occasions was considered adequate. If a least squares fit had been made on each "linear" section then the sum of the squares could have been used as a measure of the goodness of fit. The sum of squares chosen, above which lines would be discarded, would, however, have been as arbitrary as the criterion that the lines be seen as linear in two independent attempts, though a certain useless quantitativeness would have been obtained.

After the 307 lines were selected according to the above selection procedure their doubling periods or halving periods were taken from the semi-logarithmic plots. A dependent variable based on a doubling or halving period was necessary to make all the linear growth periods comparable to one another. Any sort of non-logarithmic measure would have run into one or more of the difficulties listed below.

1) Dependence on the size of production.[2.]

2) Dependence on the units in which the product was measured.

3) Impossibility of comparison of one mineral product to another.

2. This was accounted for by one of the independent variables, x_8.

4) Absence of any theoretical backing. Growth curves and decay curves are assumed to be related to exponentials unless there is a reason for thinking otherwise. The S-shaped production curve is not really an issue here inasmuch as it may be approximated by two exponential functions. The analysis is not aimed at answering the theoretical "On what part of an S-curve should a certain country-mineral production be found?" Indeed, an S-curve is not specifically assumed. The more practical "What should be the slope of the (logarithmic) production curve of a certain country-mineral?" is asked.

Reciprocals were taken of the doubling and halving times. This was done to obtain a dependent variable that would increase with an increasing growth rate and would not have a discontinuity at the zero point. The figure then obtained was given a plus sign to indicate growth or a minus sign to indicate decay and was multiplied by one hundred to obtain a handier figure. Examples:

a) Rapid growth, doubling period 2.0 years:

$$y = + \frac{1}{2.0} \times 100 = + 50.$$

b) Slight decay, halving period 12.5 years:

$$y = - \frac{1}{12.5} \times 100 = - 8.0.$$

This variable, y, was termed the uncorrected growth index. It is not directly useful for analysis because different lines give values of y which are not comparable until various corrections are applied to the sets of y values.

It was stated above that the maximum error in measurement of the doubling period was plus or minus five degrees. This five degrees is transferred to the uncorrected growth index, y, as an error of ± 2.2 for values of the index of + 10 to - 10 and as an error of ± 9.0 on values of the index of 40 to 50 (or - 40 to - 50). In point of fact, however, the error in measurement for the numerically higher growth indices was usually considerably less than the allowable five degrees. This was because rapid growth or decay usually were observed over relatively short time intervals and the measurement problem was considerably easier. A second reason, which came with familiarity with the growth curves, is the belief that all-out growth or decay over a period of about two to six years is, except in case of the advent of war, constrained by "inertia" to a linear (semi-logarithmic) maximum. A value of ± 5 should thus describe the measurement error in virtually all the uncorrected growth indices and this same probable error may be applied to all the corrected growth indices described later.

One class of data which may contain a greater error is the set of data for initial growth of a mineral industry within a country. The problem in this case was not in the measurement of the slope but in choosing the end "point" where the slope became more moderate. Sometimes this "point" was a period of three to seven years and the choice of just which year to select as the end point determined the slope of the period within a limit that exceeded five degrees.

b. The three sets of country-mineral data

After obtaining uncorrected growth indices for 307 linear portions of the growth curves it was noted that they could be placed in the following ten categories:

1. Indices for colonies just prior to independence.

2. Indices for countries just after independence.

3. Recent indices for independent countries.

4. Indices of initial growth in colonies just prior to independence.

5. Indices of initial growth in colonies well before independence.

6. Indices of initial growth in countries just after independence.

7. Recent indices of initial growth in independent countries.

8. Non-recent indices of initial growth in independent countries.

9. Indices for countries with centrally planned economies.

10. Indices for countries through periods which included the date of the country's independence.

Of the above, the first three sets of data were chosen for analysis. The fourth set could be included in the first with proper corrections though the fifth and eighth sets had to be dropped from the analysis; there simply were not enough data (only 13 indices in the fifth set and 7 in the eighth set) to allow these sets to be subject to statistical analysis. Groups six and seven were, with proper corrections, placed in sets two and three respectively. The data of set nine were, as noted before, dropped because of the unavailability of data for the corresponding independent variables. Each member of the tenth set was broken up into periods of before and after independence. Slight improvements were then often made on the uncorrected growth indices of the two portions and the two portions were then assigned to sets one and two. Some of the broken up portions of the tenth set were, however, not assigned to sets one or two because they covered a very short time period or would not be able to meet the standards of linearity by themselves.

Eventually 201 indices were selected and they were distributed in the following manner:

1. Indices for colonies just prior to independence - 67.

2. Indices for countries just after independence - 54.

3. Recent indices for independent countries - 80.

c. Corrected growth indices used in the mathematical analysis

In the equation:

$$y = f(x_1, x_2, \dots x_n)$$

the dependent variable y must have two essential properties. First of all there must be a completeness of the equation so that y will not be markedly dependent on factors other than $x_1 \dots x_n$. If additional independent variables can not be obtained and yet it is believed that the dependent variable is not wholly explained by the existing relationship, then some modification must be made on the dependent variable so that it becomes a variable essentially explainable by the function. Then, secondly, each of the three sets of observations

$$y, x_1, x_2, x_3 \cdots x_n$$

must be examined with care to be certain that within each set the values of the parameters should be the same. For example, in a set of production data for mature mineral industries some normalizing process would be necessary before data for a new mineral industry of a country could be included. The functional model and the independent variables would be the same in both cases but inasmuch as the dependent variables would be measuring somewhat different things, the correct parameter values would be different and the grouping of both these types of observations for one least squares fit would be improper. A normalizing process would serve to have the dependent variable always (within a given set) measure the same thing.

One of the factors that doubtless has an effect on the rate of mineral production is the particular mineral which is produced. The exact nature of each of the minerals selected for study was something that could not be assigned a numerical value as an independent variable. Since most of the available independent variables measure factors which are essentially functions of the country portion of the country-mineral pair the significance of the growth index was brought into line with this and the index was modified by making it essentially independent of the particular mineral under consideration.

This was done in the following manner. Values of the uncorrected growth index were grouped by the mineral of the country-mineral pair, with no reference to the country. Then each of these groupings was averaged and so was the entire set of uncorrected growth indices. Growth indices for some country-mineral pairs subsequently dropped from the analysis were included in the averaging process and so the total number of indices is 249, not 201. This is legitimate because these 48 indices were dropped for the variety of reasons already discussed and not because of lack of reliability. In fact the addition of these data adds to the reliability of the averaging process. Some of the minerals, such as petroleum, showed average growth rates higher than the overall average and so for such groups this difference in averages was subtracted from the index of each member of the group. Likewise the remainder of the mineral groups showed averages lower than the overall average of uncorrected growth indices. Silver and gold are examples of minerals in this category. To each member of mineral groups in this category the difference between the group average and the overall average was made up by addition. The numerical values used in this normalizing are tabulated below.

Note: Sample calculations of the type described on the following pages may be found with the data print out on page 76.

Mineral Product	Sum of indices	No. of growth periods	Average uncorrected index	Normalizing procedure
All	4692.3	250	18.769	--
Petroleum	1211.3	29	41.77	subtract 23.0
Diamonds	425.1	11	38.65	subtract 19.9
Fertilizers	723.2	22	32.87	subtract 14.1
Aluminum	426.8	17	25.11	subtract 6.3
Iron	529.8	26	20.38	subtract 1.8
Copper	283.7	14	20.26	subtract 1.5
Cement	683.1	38	17.97	add 0.8
Energy	463.8	38	12.21	add 6.6
Tin	120.1	10	12.01	add 6.8
Gold	13.8	13	1.06	add 17.7
Manganese	9.1	15	0.61	add 18.2
Silver	- 195.7	17	- 11.62	add 30.4

The effect of this normalizing procedure was to bring the average of each mineral group up or down to the overall average of 18.77, but to maintain the spacing between members within each group. At first it would seem as though the normalizing should have been performed by multiplication, multiplying the petroleum average by 0.499 to bring it down to 18.77, and multiplying the silver average by - 1.61 to bring it up to 18.77, etc. But this would have been mathematically improper because of the logarithmic nature of the growth index. This must be kept in mind when performing any operation which adjusts the magnitudes of one group of the growth indices in relation to another.

The growth indices normalized in the above manner were tabulated and termed y_a.

An additional correction was then made on certain of the terms of y_a. These terms were those that were for periods of initial growth of a mineral industry within a particular underdeveloped country.

Period	Sum of uncorrected indices	No. of growth periods	Average uncorrected index	Normalizing procedure
Initial growth in dependent territories	1494.2	29	51.52	subtract 32.8
Initial growth in independent countries	1474.6	27	54.61	subtract 35.8

The values of y_a adjusted in this manner were termed y_f and, along with y_g (to be defined below), were used as the dependent variable in the final mathematical analysis.

The problem of choosing a dependent variable was one of choosing a variable that would be predictable or explainable by the independent variables whose values were available and by using a logical and uncomplex functional model. These restrictions do not completely bound the choice of the dependent variable and at least one other besides y_f appeared to have considerable merit.

Starting again with the uncorrected growth index y, we now make a comparison, not with the same industry in other underdeveloped countries, but with world production of the specific mineral in question. A world growth curve for each of the mineral products considered was constructed on semi-logarithmic graph paper of the same scale as that which had been used for the individual country-mineral plots. The dates for each period in which a country-mineral index had been obtained were noted. A world-mineral growth index was readily obtained for the corresponding mineral and years for each of the 201 uncorrected growth indices under analysis. Then the world index was subtracted from uncorrected growth index. Thus, if a country-mineral curve was doubling every eight years ($y = + 12.5$) and the world production curve for the mineral during the same time interval was halving every fifty years ($y = - 2.0$), then the corrected value, y_b, would be: $y_b = 14.5$. This index, y_b, is a measure of how rapid the growth of a mineral industry in a country is when compared with the world growth of the same mineral industry. A positive sign before a value of y_b does not necessarily indicate that the industry is increasing in production but that it was increasing its share of the world production during the period under consideration. Not only is the interpretation of y_b different from y_a, but the value of y_b could never have been derived from y by the methods used to obtain y_a. For example, the average uncorrected indices for silver production for the underdeveloped countries under analysis showed a decline, with a value of - 11.62 but the world-silver index for most of the time interval in which these indices are found exhibits a growth index of about zero. This shows that the two normalizing procodures are different and, as is obvious, that for mineral production, the underdeveloped nations do not give a good sampling of the world situation.

There is a very small mathematical imperfection in the process of defining y_b and this is carried over into the definition of y_g. It is introduced by correcting y with the entire world curve. Theoretically the correction should be made for each mineral with the world curve minus the particular country-mineral curve. The error introduced in this manner is certainly small enough to be neglected.

To account for initial production data in the sets of values of y_b, those values which were for initial production were normalized in the same manner as had been the y_a values. The resultant variable was termed y_g and was employed in the final mathematical analysis as a dependent variable.

d. Other corrected growth indices

In the course of working on this problem three other corrections on the growth index were considered and calculated but were found to be incompatible with the independent variables, functional model, and/or mathematical methods employed. Nevertheless, they are discussed below partly because they throw an additional light on the problem and partly because they may be of use in some future analysis that employs other independent variables or another functional model.

The three additional sets of corrected values of the growth index were all obtained by the same operations. They differ from one another in their starting points; one starts with y_a, one with y and one with y_b. The new sets are designated respectively y_c, y_d and y_e. They were obtained by a normalization procedure similar to the one of those used to normalize the effect of the particular mineral (the procedure used to obtain y_a from y). In this case it was the colonial background of the country-mineral pair, not the mineral's market that was normalized. Country-mineral growth indices were placed in fourteen groups. There was a great deal of overlap, many pairs being placed in more than one group, so the total number of observations adds up to much more than 249. Averages were taken of each group and appropriate additions or subtractions were made on y_a, y and y_b, with more than one correction being made to many of the indices.

Status of country	Sum of indices	No. of growth periods	Average uncorrected index	Normalizing procedure
All countries	4692.3	250	18.769	--
Portuguese colonies	199.4	9	22.16	subtract 3.4
British colonies before independence	1054.3	43	24.52	subtract 5.8
Ex-British colonies (includes Jordan, excludes Egypt and Israel)	434.7	29	14.99	add 3.8
U.S. colonies before independence	187.3	5	37.46	subtract 18.7
Ex-U.S. colonies (includes Liberia from 1949)	290.4	12	24.20	subtract 5.4
French colonies before independence	522.6	16	32.67	subtract 13.9
Ex-French colonies (includes Syria)	114.1	10	11.41	add 7.4
Netherlands colonies before independence	260.0	8	32.50	subtract 13.7
Netherlands colonies after independence	32.1	9	3.57	add 15.2
Belgian colonies before independence	41.7	7	5.96	add 12.8
Communist nations	73.7	17	4.32	add 14.5
None of the above (includes pre-communist Cuba and Albania; Egypt, Israel and Iraq)	1721.5	85	20.25	subtract 1.5
Initial growth in dependent territories	1494.2	29	51.52	subtract 32.8
Initial growth in independent countries	1474.6	27	54.61	subtract 35.8

In addition to the groupings above, a grouping of sixty growth periods of independent countries with "strong man" governments was made. These sixty totalled 1142.3, for an average of 19.04, just barely above the overall average. Because of this proximity to the overall average and because of some difficulty in deciding just what countries to include in the "strong man" group, this grouping was omitted from further calculations.

The purpose of correcting the growth indices by using the figures from the above table was to obtain a set of growth indices independent of country, or more precisely, of colonial background. This was done in a straightforward manner though there is reason to question the statistical validity of operating with the averages of some of the small groupings. When the results were obtained, however, it was realized that there was no use for them in this analysis. Consider the equation: $y_{c, d \text{ or } e} = f(x_1, x_2 \ldots.)$, remembering that y_c, y_d and y_e are theoretically independent of colonial background. But what about x_1, x_2 ....? They measure a variety of things about the country from infant mortality to literacy and newspaper circulation. And these quantities are, to one degree or another, certainly dependent on colonial background. The equation then, even in its most general form, is seen to be invalid if y_c, y_d or y_e are on the left hand side because then the left hand side is independent of an apparently important variable on which some of the terms of the right hand side are certainly dependent.

The sets of y_c and y_e have been normalized to account for both the nature of the mineral and the colonial background of the country. If the growth index depended on only these two factors then the numerical values of all y_c and of all y_e would be the same for all country-mineral pairs. Although the values of y_c and of y_e are in fact much more densely distributed than those of y, y_a, y_b, y_f or y_g, they are not all the same. Perhaps a careful analysis of the residuals would shed some light on the "personalities" of the individual countries considered and/or the mineral deposits within each country. This investigator sees no way of attacking such a problem and, in addition, feels that various errors in data gathering (estimated at $\pm$ 5), and assumptions made in the normalizing processes would throw such delicate statistical work awry.

The remaining dependent variable, y_d, is an interesting one. It is much like y_a or y_b (that is, ready for analysis when the values which need it are normalized for initial production). Let us speak of a set of y_h which will be y_d normalized in such a manner. Then we could say:

$$y_h = g\ (v_1, v_2, v_3 \cdots v_n)$$

where $v_1, v_2, v_3 \cdots v_n$ would be independent variables that are related to the specific mineral deposits of the country and/or variables related to the country but not to its colonial background.

This sort of model should be valid and the values of y_h should be adequate and without overly large probable errors. The difficulty is in choosing the dependent variables, $v_1, v_2, \cdots v_n$. One of the simplest such variables, average grade of ore (of the given mineral) in the country, requires hardly justifiable assumptions to be made before a numerical value can be assigned. It is possible, though doubtful, that a proper choice of variables and of assumptions, might enable a future investigator at least to start an investigation along these lines.

e. Other independent variables used in the analysis

In the course of this project it became apparent that the data that was collected and the method of analysis employed might be used to obtain additional information about the mineral production of underdeveloped countries. Two quantities, in addition to growth rate, that might be subject to analysis are volume of mineral production and stability of production. A new functional model was proposed,

$$z = h\ (x_1, x_2, x_3 \ldots x_n)$$

where z was a measure of the volume of mineral production (z_b) or of the stability of production (z_a) and

where the independent variables were essentially the same as in the analysis of the growth indices.

The measure of the volume of mineral production, z_b, was taken from the analysis of the growth indices where it is tabulated as x_8. For all cases $z_b = x_8$ identically. The dual nomenclature is employed so that it will be clear whether the data is being used as a dependent variable or as an independent variable. In practice, of course, all the independent variables in an analysis of this sort should be independent of one another. The number of vehicles in a city is dependent on the number of miles of streets. It may also be properly viewed as dependent on the number of miles of sidewalk but it should not be viewed as dependent on both of these because of the high correlation between miles of street and miles of sidewalk in a given city. Likewise in this analysis use of two variables that were highly correlatable was avoided (literacy and % of population with six years of schooling, for example) but this is a case of multivariate analysis and it is quite impossible to say surely beforehand that:

$$x_1 \neq f\,(x_2, x_3, x_4 \ldots)$$
$$x_2 \neq f\,(x_1, x_3, x_4 \ldots)$$
$$x_3 \neq f\,(x_1, x_2, x_4 \ldots)$$
etc.

The investigator suspected that one of the x's, x_8, might be a function of the others, with one more independent variable (population) added in the new functional model.

Definition of z_b (or x_8):

This measure of the volume of mineral production was constrained by three factors. 1) Measurements of different minerals had to be comparable. 2) Measurements should express the volume of mineral production for a period (the period for which the doubling period was taken as linear on the semi-logarithmic plot), not for just one year. 3) Different z_b's would be taken in different years and would still have to be comparable. The first and third constraints require that the volume measure be a pure number (neither dollars nor tons nor carats would do). A logical and reasonable such number is per cent of world production. When? The second constraint requires that periods of different lengths had to be considered. The ends of the periods were usually slightly arbitrary and so this was averaged out by choosing the middle. For periods of an even number of years the data a half year past the middle were chosen. Thus the definition of $z_b = x_8$ was: one hundred times the country's percentage of the world production of the mineral at the middle of the particular production period. The factor of one hundred is included to make the data conform to certain format requirements of the computer programs utilized. Sometimes this factor of one hundred is omitted and when it is it is so noted.

There is a slight mathematical incorrectness in this procedure because the world production is itself somewhat dependent on the country's production, but for small values of z_b the error introduced in this manner is minute and for the larger values it is still small enough to be neglected. In theory: $z_b = x_8$ should not equal a percentage of the world production but should equal a percentage of world production minus the particular country-mineral production (for the pertinent date).

Definition of z_a, a measure of stability:

A rather rough and arbitrary measure of the stability of the selected growth periods was made. On the semi-logarithmic plots (Scale 1/4" = 1 year, 3-5/16" = 1 cycle) on which the production curves were plotted a count was made of the number of points (years) at which each production period under consideration took a turn of 120° or more. From this number was subtracted the number of such instances on the world curve for the same interval and the difference was normalized to a ten year period to give the number of 120° fluctuations more or less than normal per decade.

Example: If in a five year period there were two fluctuations of 120° or more on the country's production curve and one fluctuation on the world production curve for the same period then the stability variable would be: $\frac{10}{5}(2-1) = -2.0$, the minus sign indicating that the particular production period was less stable than the world curve.

The measure is rough, giving only one or two significant digits, and also somewhat inexact, the 120° measuring somewhat different changes, depending on the angle of the production line to the semi-logarithmic axis. But it does give a good enough measure of stability to see if the independent variables used in the rest of this analysis and the function used for z_b can be used to predict or explain stability. If so, a subsequent project could establish a better measure of stability and start from there.

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II. Nature of the Independent Variables

A selection of independent variables was made guided by the following constrictions.

1. As a group the independent variables must contain as much information as possible on which the dependent variables might depend. There is no way of assuring this; the actual amount of dependence is the final goal of the analysis. The relative dependence of the corrected growth indices on several independent variables might be deduced properly in an analysis but be of little interest unless the total of these dependences accounted for a considerable fraction of the corrected growth index.

2. This first constraint is balanced by the fact that the number of independent variables selected must be as small as possible in order to increase the significance of the final results. If we consider the set of data for periods just after independence in which there were fifty-four observations, we could get a perfect fit with a function in the form:

$$y_f \text{ or } y_g = f\ (x_1, x_2 \ldots x_{54})$$

but the function would be of no use because a fifty-fifth observation would have no particular likelihood of being anywhere near the function. A near-minimum number of variables which contains a near-maximum amount of information must be selected.

3. An outgrowth of the first two constrictions which is also desirable because of the mathematical requirements of the analysis

employed is that the independent variables be as close to mutually independent as possible.

4. The data must be as reliable as possible. A balance must be reached when choosing between reliable sets of figures on which the corrected growth index is thought to depend moderately, and less reliably known independent variables on which the growth index would seem to depend heavily.

5. A fifth, and very important restriction, is that the data must be obtainable. Ideally most of the independent variables should have been measures of rates of change - rate of road building, decrease in infant mortality, increase in literacy, etc. However, such information was not available and not enough older statistics were available to derive them. Information of a static nature had to be employed to explain a dynamic characteristic, the corrected growth index. This is probably the weakest step in the entire analysis but there is no avoiding it. For all the variables but one (foreign aid) non-time-modified data (usually the most recent available) was employed to explain growth indices for all growth periods under consideration. Thus 1960 infant mortality statistics for India would be used to explain the growth rates of India's mineral industries for periods, some of which started as far back as 1913. This shortcoming is not as critical as it would appear at first. 6. To begin with, this reality required that for each independent variable the data must be taken at just about the same date. In this manner a parallel process is used for each country and the error involved, if any, may be hoped to be systematic and to be partially accounted for by the a_0 term which is built into the functional model. Then it must be noted that the growth

index has not been viewed as time-dependent, only situation-dependent (British colony, former French colony, etc.). That is to say, that a growing and prospering mineral industry in 1950 would not be expected to have a longer doubling time than an otherwise identical industry in 1960 just because of the ten year difference. The assumption made is that the variables measure the nature of the country and although the variables may change somewhat with time the changes will be worldwide and the spacing between countries (considering all the independent variables at once, within the framework of the functional model) will not change markedly. The set of data for recent growth indices in independent countries essentially avoids the above issues and it will be of interest to compare the results of this set with those of the other two sets.

Throughout this paper the terms "depend", "dependent variable", and "independent variable" have been used in a mathematical sense. The functional model only has an equals sign which says that one side of the equation equals the other. The above terms will be used in the remainder of this paper but it should be noted that the results of the analysis will only show what the "dependent" variables equal. And this is indeed what we are interested in knowing. What in reality actually depends on what is thought provoking but not subject to mathematical analyses. Do a high mineral growth index, high stability, and high production depend on a low infant mortality rate, a high road mileage, a high literacy rate, etc.? Or is it valid to view these characteristics of a country as depending on the existence of a healthy mineral industry? One of the "independent" variables is the amount of foreign aid and musing over the actual direction of the dependence of this variable is very thought provoking. A third and probably most valid view of the issue is that both sides of the equation depend equally on a third set of variables which are not subject to qualification. These would be national pride, national personality, and various cultural and psychological factors.

A discussion follows of the independent variables selected and their definitions, and of some independent variables considered but not selected.

a. The independent variables used in the analysis

Transport factor, x_1

Accessibility is certainly an important determinant of mineral production and mineral production rates. Mining will not take place if the nearest markets are inaccessible from the mineral areas. The interaction among people and dissemination of ideas that lead to industrialization are also tightly bound to the internal transportation situation of a country. In the following definition "roads" refers to anything other than "tracks" or "trails". The definition of roads is chosen in this manner because such a definition includes those ways that may be used for opening up an area for mining, and because there is little standardization of descriptive road nomenclature throughout the world and only an all-inclusive definition can avoid inconsistencies. Double tracked railways are counted doubly in the railroad portion of the variable because that is the form in which the data is available.

In the definition of the transport factor, x_1, the road density, measured in kilometers per hundred square kilometers, is added to a second factor which is ten times the railway density, measured in the same units. This total is then multiplied by unity for most countries but by 1.5 for those countries that make extensive use of domestic waterways. The countries under study to which this waterways factor of 1.5 was applied are Malaya, Turkey, Thailand, Egypt, Burma, Indonesia, the Philippines, the Congo (Leopoldville), British Guiana, Surinam, Liberia and Venezuela.

The information used in compiling this variable was in most cases for the year 1956.

In compiling the data for x_1 it was noted that the ex-British colonies usually ranked somewhat higher than nearby countries with other historical backgrounds.

Literacy and newspaper factor, x_2

Literacy and newspaper circulation in a given country are related to the ability of the people to mobilize themselves for productive purposes. This factor was a bit rougher than many of the others because literacy rates are available only within a five percent range. The criterion for literacy was a "yes" answer to the UNESCO poll which asked "Can you read and write?" By newspaper circulation what was meant was the number of copies per thousand population of publications containing general news which appeared at least four times a week. In many Asian, African and Near Eastern countries it is the custom to have newspapers read aloud to groups of quasi-literates.

The author does not have any familiarity with such a custom in Latin America and wonders if perhaps the Asian, African and Near Eastern countries should have their values for this variable increased somewhat.

Definition: to the figure for daily newspaper circulation per thousand population was added 4.2 times the literacy rate, expressed in twentieths (1 = 0-5% literacy, 20 = 95-100% literacy). The multiplier of 4.2 gave the two portions of the factor equal weights. A minimum value for the probable error in this factor, based on the roughness of the literacy data, would be $\pm 1\frac{1}{4}$ % for each measurement of x_2.

The data for literacy was in most cases for about the year 1950; the information for the newspaper circulation portion of the data is from the period 1957-1961.

No appreciable interdependence is apparent between this factor and x_1.

Logarithmic survey factor, x_3

This is a hybrid factor designed to put the existence of a geological survey in the countries under consideration into the analysis. It is obtained in the following manner. The date of the first publication of a country's geological survey (or bureau of mines or similar organization) is recorded and this date is subtracted from the mid-point of each of that country's production periods. The value of this difference may be positive or negative. A logarithm was then taken of the absolute value of this number and the positive or negative sign was restored. The reason for making the factor logarithmic was to reduce the emphasis of some surveys of former colonies (notably India and Indonesia) that began as far back as the mid-nineteenth century. These early surveys were certainly of value to the countries involved but as far as a production period with a mid-point in 1950 is concerned, they could hardly be considered worth ten times what a survey founded in 1940 was worth. A relative worth of two would be reasonable, however, and this is the value of log 100 years/log 10 years. It is clear that many of the early surveys at their start were less effective and less efficient, and also smaller, than new surveys of the past two or three decades and this is another reason for using a logarithmic factor which discounts the past.

Many of the surveys involved are very different organizations, some of great value to their countries, some of only moderate value. But the value of even the poorest survey is likely to be applied to the mineral production under consideration here inasmuch as the material under analysis is often a highlight of a nation's economy. This is a partial justification for making comparisons between organizations which the author knew to be dissimilar. The remainder of the justification is that the information is relevant and this is the best form into which it could be put.

This logarithmic survey factor is in no apparent way interdependent with the transport or literacy factors and yet there is the hint that there is some connection between them. It is hard to picture a country with a very low literacy rate, almost no newspapers, few roads and no railroads and a long-established geological survey.

Infant mortality factor, x_4

This item in the analysis is the most complete demographic variable for which data could be obtained. It is, nevertheless, the roughest data employed in the analysis, incorporating in its compilation a large number of biases, differences in national statistical services, laws and customs concerning birth and death registrations, etc. In addition error is introduced by the selection in many countries of atypical "areas of registration" from which the data is selected and published as representative of the entire country. The variable is extremely pertinent to the problem at hand and since it was the best choice of several related sets of even poorer data it was selected. The data does have a considerable spread and the existence of a pattern is clear despite the above difficulties. The variable, x_4, is definied as the number of infants per thousand who were born alive but died during their first year. Data is taken, in all but one or two cases, from the United Nations, Demographic Yearbook, 1962 and refers mostly to the years 1960 and 1961.

In discussing a similar variable, infant deaths in the first month of life, Norton Ginsburg in Atlas of Economic Development writes, ". . . skepticism can be expressed for Iraq, which appears in the highest category, and for Jordan, Algeria, and Morocco elsewhere in the Near East, Madagascar and Nigeria in Sub-Saharan Africa, and Paraguay in Latin America. These examples re-emphasize the well-founded doubts concerning the reliability of many of the data employed and suggest what has been implied before, that less is probably known about the demographic characteristics of more people than of any other set of facts about them."[3]

This variable appears to be almost completely independent of the previous independent variables (and also of the ones following) and yet to be closely related to the growth indices. This is its strong point and reason for inclusion in the analysis.

Gross national product per capita, x_5

Gross national product per capita, measured in U.S. dollars, is chosen as the fifth independent variable. It is a variable that is widely recognized at present as being the best single measure of economic development for a particular country. It is a measure of the amount of new wealth available to individuals in each country if all wealth produced in one year were distributed evenly among them. This variable tends to include a systematic error in that it fails to take full account of the wealth produced in areas where barter is common. Because of this G.N.P./capita should not be used when comparing developed countries to underdeveloped countries. But for the purposes of this analysis it is a very satisfactory variable although a few of the more advanced countries (Israel, for example) may have apparently elevated values. It is almost certain that this kind of error would not cause a change in the order of the countries considered in this study.

3. Ginsburg, N., Atlas of Economic Development, The University of Chicago Press, 1961, p. 24.

The data used is from the period 1950-1955, with the vast majority of figures for the year 1955.

There is clearly some interdependence between this variable and all of the preceding variables but the degree of interdependence would appear to be small in all cases and the proven utility of this variable is such that slight interdependence is not justification for omitting it or even modifying it for this analysis.

Foreign aid and long-term investment, x_6

The data for this variable are measured in millions of U.S. dollars per year during the period 1951-1961. Most of the data were United Nations data and conformed to the following definition: "Net international flow of long-term capital and official donations - Flows of long-term capital exclude all transactions of central banks and of private monetary institutions. Data on long-term transactions of private monetary institutions are available only for a small number of countries. The term 'long-term' generally refers to loans and investments for periods exceeding one year. However, in the case of official capital short-term flows are included. These are generally not significant except in the case of the accumulated local currency proceeds from the sale of United States surplus agricultural products."[4.]

4. International Flow of Long-term Capital and Official Donations 1959-1961, United Nations, New York, 1963, p. 6.

The significance of this variable is obvious but its mathematical interdependence with the remainder of the other variables is not at all clear. Perhaps the over-riding factor in the determination of the value of this variable for each country is the country's strategic value in the cold war struggle. If so it would be much less dependent on the other variables than one would at first imagine.

This variable differs from all the others selected because it changes much more rapidly with time and the 1951-1961 values are not properly applied to earlier dates. Average values for the whole decade were taken rather than the higher 1959-1961 values in order to overcome this difficulty for the 1950's. An arbitrary rule of thumb was applied in adapting this data for earlier production periods. The mid-point of each production curve was noted and if this point fell before 1956 (the mid-point of the 1951-1961 period) the number of years before was also noted. Then for each decade before 1956 the value of this variable was halved. Thus, for periods with mid-points after 1946 the full value of the variable was used; for periods with mid-points after 1936 but not after 1946 half the value of the variable was used and so on for each decade.

Population, x_7

The most recent population counts or estimates, measured in millions of persons, is chosen as a variable but not in the main analysis, the analysis of the growth indices. It is employed in the analysis of the volume of mineral production and the stability of mineral production, where it is felt to be a determining factor. It is a variable which is to some degree interdependent with some of the other variables but the degree of interdependence would be extremely difficult to assess.

Volume of production, x_8 (or z_b)

This variable was defined and discussed in the section on dependent variables. Its definition is repeated here: "One hundred times the country's percentage of the world production of the mineral at the middle of the particular production period." The idea was put forth that this variable may be highly dependent on the other seven variables and this idea will be put to a test in the analysis.

b. Other independent variables which were considered for use in this analysis

Population density - This is an available demographic statistic but there is no particular reason to believe it is related in a usable manner to this problem. Extremely low population densities as are found in Mauritania, Libya, Mongolia, Greenland, etc. would probably hinder the development of mineral industries but the same information would also be available through consideration of the transport factor, the survey factor and/or the foreign aid factor. Also as soon as the population density exceeds a certain threshold it no longer appears to bear any relationship to the mineral industries. The presence of Canada and Australia among the least densely populated nations also helped in the decision not to use population density as an independent variable.

Population growth - This is another demographic variable for which reasonable data is available. This information, however, has always been a puzzler to demographers inasmuch as it exhibits a pattern all of its own which is not closely related to other possible determinants of economic development. Another objection to this data is that it falls within a very narrow range with few countries showing growth rates far from the mean of 1.6 percent per year.

Education - Many sets of data concerning educational variables are available but most of them correlate reasonably highly with the literacy rate which was chosen to represent this body of information.

War - The number of wars engaged in, the damage during the war for independence, and so on were considered as possible variables. L. F. Richardson[5.] makes a good case for fatalities being the only good quantitative measure of warfare and he also indicates that the gathering of these statistics is a lifetime's task. His own statistics stop well short of completing the period of interest in this analysis and no attempt was made to complete his task.

Percent of technicians and/or capital left in a former colony by the mother country - This variable would have been included in the analysis of the set of data for ex-colonies but it was not available. The contrast between Guinea and Ghana gave rise to its consideration.

5. Richardson, L. F., Statistics of Deadly Quarrels, The Boxwood Press, Pittsburgh and Quadrangle Books, Chicago, 1960.

Latitude or mean temperature - No meaningful quantitative means of expressing this information was uncovered. Countries have different sizes, shapes and topographies which make a simple variable such as the mean warm season temperature of the capital city meaningless in the mathematical treatment of this problem.

Average grade of ore or total amount of ore in a country - These are unknown until the area involved is mined out and unestimated until almost that time. In addition such estimates are subject to radical revisions with new discoveries and changes in technology.

Average taxes and royalties - Mining laws of all the countries involved in the study are available[6.] but a short investigation shows the impossibility of arriving at a single number to represent the situation in each country. Many of the mining codes simply state that before mining can start an agreement must be reached between the mining concern and the appropriate government official. Even if a single number were found to represent each country it would only measure the statutory requirements, not the actual practices.

6. Ely, N., Summary of Mining and Petroleum Laws of the World, United States Department of the Interior, Bureau of Mines Information Circular 8017, Washington D.C., 1961.

Single crop economies - This variable is too complex to handle. When does one crop dependence help and when does it hinder an economy? Sometimes the one crop is really two crops. Sometimes the one crop constitutes 30% of the nation's exports, and sometimes more than twice that percentage. Sometimes the one "crop" is the mineral under consideration but more often it is not. The difficulties involved of this one variable are worthy of extensive analysis themselves.

Percent of exports which are raw materials - This data is available but most of the countries under analysis show about the same export dependence on raw materials; only five of the selected countries have manufactured exports exceeding 15% of total exports and some of these five show the low raw material dependence only because of peculiarities in the United Nations International Trade Classification which makes an attempt to define what is raw and what is processed. Also there is the real danger of feedback in using this variable. Raw material export data may often be the same as the mineral production data which are to be explained.

Existence of a national image - This is an interesting concept which evades quantification.

Stability or number of changes in government - The actual number of changes in government within an individual country is too small to give a statistically viable variable. There are other objections to the use of this variable. The number of changes in government recorded would be very dependent on the essentially arbitrary period of time selected. And bloodless coups would be counted equally with civil wars.

Smoothness of transition to independence - This variable is much like the war variable and subject to the same objections if numbers of fatalities are to be taken as the measure. Other measures such as lines of print in the New York Times yearly index, amount of foreign military aid, etc. are more apt to reflect the strategic status of the country in the cold war.

Date or rank of independence - The independence dates for the colony-nations are too closely spaced to be very important in the long run if treated by actual number of years and if the treatment is by rank order of independence the data does not seem to fall into a pattern logically or actually relatable to anything else.

Mid-year of production period - This variable, if properly constructed, might account for the business cycle or change of economic conditions with time. Since World War Two the world has experienced an almost unbroken period of good economic conditions and all the production periods of two sets of data and most of the production periods of the third fall into this time interval. Thus they would have almost the same value for such a variable, if one were constructed. The third set, "Just Before Independence", contains a few production periods from times of poor economic conditions. A small error in the y_f calculations of this one set may be introduced on this account though the normalization procedures employed would tend to minimize it. (Minerals more apt to be produced during depression years, precious metals, have lower average growth indices in the data used in this study and these lower figures are then normalized upwards.) The y_g

dependent variable for this set of data would, however, contain no error on this account. In obtaining y_g the mineral growth index for a country and period were compared with the world production for the same period and the economic conditions of the time were on both ends of the comparison.

c. References used in obtaining the independent variables

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III. Data

PERIODS JUST PRIOR TO INDEPENDENCE

COUNTRY-MINERAL DATES Y	Y(A)	Y(B)	Y(C)	Y(D)	Y(E)	Y(F)	Y(G)	Z(A)
INDONESIA-TIN 1945-48								
143.	149.8	119.1	136.1	129.3	105.4	149.8	119.1	-3.3
P.I.-COPPER 1937-41								
83.	81.5	76.1	30.0	31.5	24.6	48.7	43.3	0.
MOROCCO-MANGANESE 1944-52								
50.	68.2	31.4	54.3	36.1	17.5	68.2	31.4	+1.2
NIGERIA-OIL 1958-60								
90.	67.	79.2	28.4	51.4	40.6	34.2	46.4	0.
P.I.-SILVER 1921-41								
28.6	59.	25.6	40.3	9.9	6.9	59.	25.6	-4.0
INDONESIA-MANGANESE 1920-28								
40.	58.2	30.3	11.7	-6.5	-16.2	35.4	-2.5	+1.2
ANGOLA-OIL 1958-62								
67.	44.	57.	7.8	30.8	20.8	11.2	24.2	-2.5
P.I.-GOLD 1921-41								
22.3	40.	15.6	21.3	3.6	-3.1	40.	15.6	-1.0
P.I.-IRON 1935-40								
40.	38.2	27.8	-3.0	-1.2	-13.4	5.4	-5.0	+2.0
CONGO (LEO.)-SILVER 1932-60								
3.6	34.	1.7	46.8	16.4	14.5	34.	1.7	-3.9
MALAYA-IRON 1951-57								
33.3	31.5	26.5	25.7	27.5	20.7	31.5	26.5	+3.3
GUINEA-IRON 1953-57								
33.3	31.5	27.6	-15.2	-13.4	-19.1	-1.3	-5.2	0.
GHANA-SILVER 1938-58								
0.	30.4	0.9	24.6	-5.8	-4.9	30.4	0.9	-5.5
MOROCCO-SILVER 1952-58								
0.	30.4	0.	16.5	-13.9	-13.9	30.4	0.	-3.3
BURMA-SILVER 1930-41								
0.	30.4	-0.1	24.6	-5.8	-5.9	30.4	-0.1	0.
BRITISH GUIANA-DIAMONDS 1958-62								
50.	30.1	39.4	24.3	44.2	33.6	30.1	39.4	-2.5
MOROCCO-CEMENT 1945-55								
25.	25.8	4.7	11.9	11.1	-9.2	25.8	4.7	-1.0

JAMAICA-ENERGY 1949-61	16.7	23.3	9.5	17.5	10.9	3.7	23.3	9.5	-2.5
SENEGAL-CEMENT 1948-60	22.3	23.1	9.8	-23.6	-22.4	-36.9	-9.7	-23.	-4.2
INDIA-CEMENT 1933-42	22.3	23.1	20.5	17.3	16.5	10.	23.1	20.5	0.
JAMAICA-ALUMINUM 1954-62	28.6	22.3	15.8	-16.3	-10.	-22.8	-10.5	-17.	-2.5
GHANA-GOLD 1944-57	4.1	21.8	-0.3	16.	-1.7	-6.1	21.8	-0.3	-1.5
GHANA-MANGANESE 1936-57	3.1	21.3	-3.3	15.5	-2.7	-9.1	21.3	-3.3	-2.4
INDONESIA-CEMENT 1933-39	20.	20.8	8.3	7.1	6.3	-5.4	20.8	8.3	-1.7
BURMA-TIN 1922-39	13.4	20.2	13.3	14.4	7.6	7.5	20.2	13.3	-0.6
BRITISH GUIANA-ENERGY 1949-61	13.3	19.9	6.1	14.1	7.5	0.3	19.9	6.1	-0.8
SIERRA LEONE-ENERGY 1949-61	11.1	17.7	3.9	11.9	5.3	1.9	17.7	3.9	-4.2
MOZAMBIQUE-ENERGY 1949-61	13.4	20.0	6.2	16.6	10.	2.8	20.	6.2	0.
NIGERIA-ENERGY 1949-61	10.	16.6	2.8	10.8	4.2	-3.0	16.6	2.8	-1.7
GHANA-ENERGY 1949-57	10.	16.6	2.8	10.8	4.2	-3.0	16.6	2.8	-6.2
ALGERIA-ENERGY 1949-61	9.5	16.1	2.3	2.2	-4.4	-11.6	16.1	2.3	0.
FRENCH WEST AFRICA GROUP-ENERGY 1951-61	9.1	15.7	1.9	1.8	-4.8	-12.	15.7	1.9	-2.
ALGERIA-CEMENT 1950-61	14.8	15.6	1.8	1.7	0.9	-12.1	15.6	1.8	-0.9
TRINIDAD-ENERGY 1949-61	8.7	15.3	1.5	9.5	2.9	-4.3	15.3	1.5	-1.7
JAMAICA-CEMENT 1952-62	14.3	15.1	1.9	-23.5	-24.3	-36.7	-17.7	-30.9	-1.0
ANGOLA-IRON 1958-62	40.	38.2	29.9	2.	3.8	-6.3	5.4	-2.9	-2.5

EGYPT-NITRATES 1952-54	28.6	14.5	18.6	-24.1	-10.	-20.	-18.3	-14.2	0.
P.I.-CEMENT 1929-39	13.4	14.2	10.1	-4.5	-5.3	-8.6	14.2	10.1	-1.0
MALAYA-ENERGY 1949-57	7.3	13.9	0.5	8.1	1.5	-5.3	13.9	0.5	-2.5
SIERRA LEONE-DIAMONDS 1955-62	33.3	13.4	24.4	7.6	27.5	18.6	13.4	24.4	-4.3
MALAYA-ALUMINUM 1953-57	18.3	12.	6.2	6.2	12.5	0.4	12.	6.2	-2.5
CONGO (LEO.)-MANGANESE 1955-62	-7.1	11.1	-13.	23.9	5.7	-0.2	11.1	-13.0	-2.8
INDIA-IRON 1913-40	11.8	10.	10.8	4.2	6.0	5.0	10.	10.8	-0.4
MOROCCO-IRON 1940-57	11.8	10.	5.7	-3.9	-2.1	-8.2	10.	5.7	-0.4
FRENCH WEST AFRICA GROUP-DIAMONDS 1936-61	28.6	8.7	20.9	-38.	-16.1	-25.8	-24.1	-11.9	-2.4
ISRAEL-CEMENT 1934-49	7.2	8.0	1.5	2.2	1.4	-4.3	8.0	1.5	-4.7
SIERRA LEONE-IRON 1943-62	8.5	6.7	2.1	0.9	2.7	-3.7	6.7	2.1	-1.1
MALAYA-TIN 1949-57	-1.2	5.6	-5.3	0.2	-7.0	-11.1	5.6	-5.3	+1.2
CONGO(LEO.)-COPPER 1933-62	6.7	5.2	-0.7	18.0	19.5	12.1	5.2	-0.7	-0.3
MOROCCO-PHOSPHATE 1946-57	9.5	4.6	-1.3	-9.3	-4.4	-15.2	4.6	-1.3	-1.8
NIGERIA-TIN 1940-62	-2.4	4.4	-0.4	1.4	-8.2	-6.2	4.4	-0.4	+0.5
BRITISH GUIANA-ALUMINUM 1947-62	9.1	2.8	-7.0	-3.0	3.3	-12.8	2.8	-7.0	-4.0
INDIA-ALUMINUM 1918-43	8.0	1.7	-2.4	-4.1	2.2	-8.2	1.7	-2.4	-2.2
GHANA-DIAMONDS 1947-57	20.0	0.1	4.4	-5.7	14.2	-1.4	0.1	4.4	0.
GHANA-ALUMINUM 1942-56	4.4	-1.9	-4.4	-40.5	-34.2	-43.	-34.7	-37.2	-5.0

EGYPT-PHOSPHATE 1946-54	5.2	-8.9	-8.5	-14.7	-0.6	-14.3	-8.9	-8.5	-5.0
TRINIDAD-OIL 1951-62	11.1	-11.9	1.6	-17.7	5.3	-4.2	-11.9	1.6	0.
CONGO (LEO.)-DIAMONDS 1949-59	7.2	-12.7	-2.2	0.1	20.	10.6	-12.7	-2.2	-1.0
INDONESIA-OIL 1907-40	8.0	-15.	-1.0	-28.7	-5.7	-14.7	-15.	-1.0	-1.2
CONGO (LEO.)-TIN 1956-62	-22.3	-15.5	-22.1	-2.7	-9.5	-9.3	-15.5	-22.1	+1.7
GUINEA-ALUMINUM 1954-59	-14.3	-20.6	-25.4	-34.5	-28.2	-39.3	-20.6	-25.4	-2.0
ALGERIA-PHOSPHATE 1953-62	-11.1	-25.2	-21.9	-39.1	-25.0	-35.8	-25.2	-21.9	-1.1
ANGOLA-MANGANESE 1953-62	20.	38.2	13.8	34.8	16.6	10.4	38.2	13.8	-3.3
ANGOLA-ENERGY 1949-61	22.3	28.9	15.1	25.5	18.9	11.7	28.9	15.1	-2.5
ANGOLA-CEMENT 1957-62	0.	0.8	-11.1	-2.6	-3.4	-14.5	0.8	-11.1	0.
ANGOLA-DIAMONDS 1956-62	10.	-9.9	3.8	-13.3	6.6	0.4	-9.9	3.8	0.
SURINAM-ALUMINUM 1952-62	0.	-6.3	-13.7	-20.	-13.7	-27.4	-6.3	-13.7	-2.0

END

PERIODS JUST PRIOR TO INDEPENDENCE

COUNTRY-MINERAL DATES	X(8)	X(1)	X(2)	X(3)	X(4)	X(5)	X(6)	X(7)
INDONESIA-TIN 1945-48	1390.	11.2	24.	1.98	150.	127.	80.	95.9
P.I.-COPPER 1937-41	35.	20.5	74.	1.57	73.1	201.	45.	24.0
MOROCCO-MANGANESE 1944-52	450.	8.3	36.	1.32	71.1	159.	50.	11.6
NIGERIA-OIL 1958-60	5.7	9.8	17.	1.59	62.9	70.	14.	35.3
P.I.-SILVER 1921-41	5.3	20.5	74.	1.46	73.1	201.	22.5	24.0
INDONESIA-MANGANESE 1920-28	39.0	11.2	24.	1.87	150.	127.	10.0	95.9
ANGOLA-OIL 1958-62	0.62	4.1	8.0	0.0	195.	70.	9.8	4.1
P.I.-GOLD 1921-41	78.0	20.5	74.	1.46	73.1	201.	22.5	24.0
P.I.-IRON 1935-40	54.0	20.5	74.	1.55	73.1	201.	45.	24.0
CONGO (LEO.)-SILVER 1932-60	381.	6.3	36.	1.20	144.	98.	20.5	13.7
MALAYA-IRON 1951-57	40.	15.9	84.	1.71	62.1	298.	34.	6.7
GUINEA-IRON 1953-57	18.0	5.5	4.0	1.23	210.	58.	14.	2.7
GHANA-SILVER 1938-58	2.8	11.1	39.	1.54	113.	135.	32.	6.7
MOROCCO-SILVER 1952-58	103.	8.3	36.	1.45	71.1	159.	50.	11.6
BURMA-SILVER 1930-41	263.	10.5	58.	1.87	149.	52.	17.	19.3
BRITISH GUIANA-DIAMONDS 1958-62	38.0	2.1	131.	1.43	51.	311.	7.5	0.6
MOROCCO-CEMENT 1945-55	24.0	8.3	36.	1.36	71.1	159.	50.	11.6

JAMAICA-ENERGY 1949-61

17.0	77.	126.	0.78	48.2	265.	3.5	1.6

SENEGAL-CEMENT 1948-60

3.1	10.9	12.	1.20	92.9	58.	9.1	2.6

INDIA-CEMENT 1933-42

161.	33.0	24.0	1.91	146.	72.	140.	436.4

JAMAICA-ALUMINUM 1954-62

2740.	77.	126.	0.95	48.2	265.	3.5	1.6

GHANA-GOLD 1944-57

207.	11.1	39.	1.57	113.	135.	32.	6.7

GHANA-MANGANESE 1936-57

1240.	11.1	39.	1.53	113.	135.	32.	6.7

INDONESIA-CEMENT 1933-39

15.0	11.2	24.	1.93	150.	127.	20.	95.9

BURMA-TIN 1922-39

170.	10.5	58.	1.87	149.	52.	8.5	19.3

BRITISH GUIANA-ENERGY 1949-61

0.76	2.1	131.	1.34	51.	311.	7.5	0.6

SIERRA LEONE-ENERGY 1949-61

0.24	14.5	11.	1.43	153.	73.	3.6	2.5

MOZAMBIQUE-ENERGY 1949-61

1.6	7.5	6.0	1.26	34.2	70.	12.8	5.1

NIGERIA-ENERGY 1949-61

3.0	9.8	17.	1.43	62.9	70.	14.	35.3

GHANA-ENERGY 1949-57

1.4	11.1	39.	1.60	113.	135.	32.	6.7

ALGERIA-ENERGY 1949-61

6.5	4.0	41.	1.85	118.	176.	21.	10.2

FRENCH WEST AFRICA GROUP-ENERGY 1951-61

1.8	3.9	5.0	1.26	188.	58.	45.7	19.5

ALGERIA-CEMENT 1950-61

30.	4.0	41.	1.85	118.	176.	21.	10.2

TRINIDAD-ENERGY 1949-61

4.0	77.	165.	-1.00	48.5	291.	1.0	6.7

JAMAICA-CEMENT 1952-62

5.8	77.	126.	0.90	48.2	265.	3.5	1.6

ANGOLA-IRON 1958-62

13.0	4.1	8.0	0.0	195.	70.	9.8	4.1

EGYPT-NITRATES 1952-54
35. 10.8 46. 1.72 108. 133. 52. 26.1

P.I.-CEMENT 1929-39
16.0 20.5 74. 1.51 73.1 201. 22.5 24.0

MALAYA-ENERGY 1949-57
63.0 15.9 84. 1.70 62.1 298. 34. 6.7

SIERRA LEONE-DIAMONDS 1955-62
450. 14.5 11. 1.48 153. 76. 3.6 2.5

MALAYA-ALUMINUM 1953-57
14.0 15.9 84. 1.60 62.1 298. 34. 6.7

CONGO (LEO.)-MANGANESE 1955-62
300. 6.3 36. 1.45 144. 98. 41. 13.7

INDIA-IRON 1913-40
106. 33.0 24. 1.85 146. 72. 70. 436.4

MOROCCO-IRON 1940-57
56.0 8.3 36. 1.33 71.1 159. 50. 11.6

FRENCH WEST AFRICA GROUP-DIAMONDS 1936-61
67.0 3.9 5.0 1.02 188. 58. 45.7 19.5

ISRAEL-CEMENT 1934-49
29.0 45.5 275. -0.98 31.4 540. 106. 2.2

SIERRA LEONE-IRON 1943-62
41.0 14.5 11. 1.39 153. 76. 3.6 2.5

MALAYA-TIN 1949-57
3140. 15.9 84. 1.70 62.1 298. 34. 6.7

CONGO(LEO.)-COPPER 1933-62
670. 6.3 36. 1.24 144. 98. 41. 13.7

MOROCCO-PHOSPHATE 1946-57
1540. 8.3 36. 1.39 71.1 159. 50. 11.6

NIGERIA-TIN 1940-62
504. 9.8 17. 1.48 62.9 70. 14. 35.3

BRITISH GUIANA-ALUMINUM 1947-62
1390. 2.1 131. 1.33 51.0 311. 7.5 0.6

INDIA-ALUMINUM 1918-43
41. 33. 24. 1.87 146. 72. 70. 436.4

GHANA-DIAMONDS 1947-57
2170. 11.1 39. 1.59 113. 135. 32. 6.7

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GHANA-ALUMINUM 1942-56
174.     11.1     39.      1.56     113.     135.     32.      6.7

EGYPT-PHOSPHATE 1946-54
174.     10.8     46.      1.70     108.     133.     52.      26.1

TRINIDAD-OIL 1951-62
47.      77.      165.     -0.93    48.5     291.     1.0      6.7

CONGO (LEO.)-DIAMONDS 1949-59
5680.    6.3      36.      1.38     144.     98.      41.      13.7

INDONESIA-OIL 1907-40
202.     11.2     24.      1.87     150.     127.     10.0     95.9

CONGO (LEO.)-TIN 1956-62
640.     6.3      36.      1.46     144.     98.      41.      13.7

GUINEA-ALUMINUM 1954-59
179.     5.5      4.0      1.24     79.4     58.      14.      2.7

ALGERIA-PHOSPHATE 1953-62
160.     4.0      41.      1.86     118.     176.     21.      10.2

ANGOLA-MANGANESE 1953-62
39.      4.1      8.0      -0.40    195.     70.      9.8      4.1

ANGOLA-ENERGY 1949-61
0.55     4.1      8.0      -0.70    195.     70.      9.8      4.1

ANGOLA-CEMENT 1957-62
5.3      4.1      8.0      0.0      195.     70.      9.8      4.1

ANGOLA-DIAMONDS 1956-62
378.     4.1      8.0      0.0      195.     70.      9.8      4.1

SURINAM-ALUMINUM 1952-62
1650.    1.5      88.      0.48     44.      356.     11.      0.3

       END
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PERIODS JUST AFTER INDEPENDENCE

COUNTRY-MINERAL DATES	Y	Y(A)	Y(B)	Y(C)	Y(D)	Y(E)	Y(F)	Y(G)	Z(A)
GUINEA-ALUMINUM 1959-62	125.	118.7	108.6	126.1	132.4	116.	118.7	108.6	-3.3
INDONESIA-MANGANESE 1952-56	83.0	101.2	73.9	80.6	62.4	53.3	65.4	38.1	-2.5
ISRAEL-POTASH 1953-58	100.	85.9	94.8	48.6	62.7	57.5	50.1	59.	-4.0
P.I.-CEMENT 1945-50	67.	67.8	40.3	62.4	61.6	34.9	67.8	40.3	-4.0
P.I.-GOLD 1947-52	50.	67.7	44.7	62.3	44.6	39.3	67.7	44.7	0.
NIGERIA-OIL 1960-62	90.	67.	80.5	35.	58.	48.5	31.2	44.7	0.
INDIA-MANGANESE 1945-53	40.	58.2	25.	62.	43.8	28.8	58.2	25.	0.
BURMA-SILVER 1951-62	25.	55.4	22.2	59.2	28.6	26.	55.4	22.2	-3.3
NIGERIA-CEMENT 1958-62	50.	50.8	41.6	28.8	18.	9.6	15.	5.4	-2.5
ISRAEL-PHOSPHATE 1952-58	62.	47.9	55.2	10.6	24.7	17.9	12.1	19.4	-1.7
ISRAEL-NITRATES 1955/6-61/2	62.	47.9	46.8	10.6	24.7	9.5	12.1	11.	-1.7
P.I.-SILVER 1948-62	12.5	42.9	8.9	37.4	7.1	3.5	42.9	8.9	-3.6
MOROCCO-COPPER 1957-62	33.3	31.8	25.9	39.2	40.7	33.3	31.8	25.9	0.
P.I.-IRON 1949-54	33.3	31.5	24.2	-9.7	-7.9	-17.	-4.3	-11.6	+4.0
MALAYA-IRON 1957-62	33.3	31.5	27.9	35.3	37.1	31.7	31.5	27.9	-4.0
P.I.-COPPER 1946-62	28.6	27.1	20.3	21.7	23.2	14.9	27.1	20.3	-0.6
INDIA-ALUMINUM 1948-62	33.3	27.0	19.0	30.8	37.1	22.8	27.	19.	0.
EGYPT-IRON 1956-62	28.6	26.8	21.3	25.3	27.1	19.8	26.8	21.3	-6.7

INDONESIA-CEMENT 1951-62

25.	25.8	13.9	41.	40.2	29.1	25.8	13.9	-1.1

ISRAEL-ENERGY 1949-61

18.2	24.8	11.	23.3	16.7	9.5	24.8	11.	0.

BURMA-ENERGY 1949-61

18.2	24.8	11.	28.6	22.	14.8	24.8	11.	-0.8

GHANA-GOLD 1957-62

4.1	21.8	15.1	25.6	7.9	18.9	21.8	15.1	0.

INDIA-PHOSPHATE 1948-62

33.3	19.2	23.1	23.	37.1	26.9	19.2	23.1	-4.3

P.I.-ENERGY 1949-61

11.8	18.4	4.6	13.	6.4	-0.8	18.4	4.6	0.

GHANA-SILVER 1958-62

-73.	-42.6	-73.2	-38.8	-69.6	-69.4	-42.6	-73.2	0.0

INDIA-CEMENT 1948-62

16.7	17.5	3.2	21.3	20.5	7.0	17.5	3.2	0.

MOROCCO-ENERGY 1957-61

9.5	16.1	2.3	23.5	16.9	9.7	16.1	2.3	0.

INDONESIA-TIN 1948-54

8.5	15.3	3.5	30.5	23.7	18.7	15.3	3.5	-3.3

INDIA-IRON 1947-62

16.7	14.9	9.0	18.7	20.5	12.8	14.9	9.0	+1.3

EGYPT-NITRATES 1954-61

28.6	14.5	12.7	-22.8	-8.7	-24.6	-21.3	-23.1	-2.9

INDIA-NITRATES 1944/5-60/1

28.6	14.5	10.7	18.3	32.4	14.5	14.5	10.7	-2.5

EGYPT-ENERGY 1955-61

7.3	13.9	0.1	12.5	5.8	-1.4	13.9	0.1	0.0

INDIA-ENERGY 1949-61

7.3	13.9	0.1	17.7	11.1	3.9	13.9	0.1	0.

EGYPT-CEMENT 1952-62

12.5	13.3	0.1	11.8	11.	-1.4	13.3	0.1	0.

ISRAEL-CEMENT 1949-61

11.8	12.6	-1.8	11.1	10.3	-3.3	12.6	-1.8	-1.7

MALAYA-ALUMINUM 1957-62

18.3	12.	4.6	15.8	22.1	8.4	12.	4.6	-4.0

INDIA-GOLD 1952-62

-6.3	11.4	-10.8	15.2	-2.5	-7.0	11.4	-10.8	-2.0

GHANA-MANGANESE 1957-62	-10.	8.2	-12.6	12.	-6.2	-8.8	8.2	-12.6	-6.0
GHANA-ALUMINUM 1957-62	11.8	5.5	-1.9	9.3	15.6	1.9	5.5	-1.9	-8.0
MOROCCO-PHOSPHATE 1957-62	9.5	4.6	-4.9	12.	16.9	2.5	4.6	-4.9	0.
INDIA-COPPER 1948-62	4.2	2.7	-2.7	6.5	8.0	1.1	2.7	-2.7	-0.7
BURMA-OIL 1948-62	25.	2.	15.	5.8	28.8	18.8	2.	15.	-2.1
BURMA-TIN 1947-62	-5.7	1.1	-10.8	4.9	-1.9	-7.	1.1	-10.8	-5.3
MALAYA-ENERGY 1957-61	7.3	0.7	0.1	4.5	11.1	3.9	0.7	0.1	0.
GHANA-ENERGY 1957-61	3.7	-2.9	-3.5	0.9	7.5	0.3	-2.9	-3.5	0.
INDONESIA-OIL 1949-62	14.3	-8.7	3.9	6.5	29.5	19.1	-8.7	3.9	0.
MOROCCO-SILVER 1958-62	-40.	-9.6	4+=6	-2.2	-32.6	-33.2	-9.6	-40.6	0.
EGYPT-PHOSPHATE 1954-62	3.4	-10.7	-6.5	-12.2	1.9	-8.0	-10.7	-6.5	-1.3
GUINEA-IRON 1957-62	-12.5	-14.3	-17.6	-6.9	-5.1	-10.2	-14.3	-17.6	-6.0
MOROCCO-IRON 1957-62	-14.3	-16.1	-19.4	-8.7	-6.9	-12.0	-16.1	-19.4	-4.0
INDIA-OIL 1947-62	5.9	-17.1	-4.3	-13.3	9.7	-0.5	-17.1	-4.3	0.
GHANA-DIAMONDS 1957-62	1.2	-18.7	-5.1	-14.9	5.0	-1.3	-18.7	-5.1	0.
MOROCCO-CEMENT 1956-58	-25.	-24.2	-32.9	-16.8	-17.6	-25.5	-24.2	-32.9	-5.0
INDONESIA-ALUMINUM 1949-53	-50.	-56.3	-69.8	-41.1	-34.8	-54.6	-56.3	-69.8	-7.5

END

PERIODS JUST AFTER INDEPENDENCE

COUNTRY-MINERAL	DATES	X(8)	X(1)	X(2)	X(3)	X(4)	X(5)	X(6)	X(7)
GUINEA-ALUMINUM	1959-62	598.	5.5	4.	1.35	210.	58.	14.	2.7
INDONESIA-MANGANESE	1952-56	21.	11.2	24.	2.02	150.	127.	80.	95.9
ISRAEL-POTASH	1953-58	3.7	45.5	275.	0.65	31.4	540.	212.	2.2
P.I.-CEMENT	1945-50	18.	20.5	74.	1.65	73.1	201.	90.	24.0
P.I.-GOLD	1947-52	99.	20.5	74.	1.68	73.1	201.	90.	24.0
NIGERIA-OIL	1960-62	20.	9.8	17.	1.60	62.9	70.	21.	35.3
INDIA-MANGANESE	1945-53	1350.	33.	24.	1.97	146.	72.	279.	436.4
BURMA-SILVER	1951-62	67.	10.5	58.	2.00	149.	52.	34.	19.3
NIGERIA-CEMENT	1958-62	5.0	9.8	17.	1.36	62.9	70.	21.	35.3
ISRAEL-PHOSPHATE	1952-58	24.	45.5	275.	0.6	31.4	540.	212.	2.2
ISRAEL-NITRATES	1955/6-61/2	15.	45.5	275.	0.84	31.4	540.	212.	2.2
P.I.-SILVER	1948-62	22.	20.5	74.	1.72	73.1	201.	90.	24.0
MOROCCO-COPPER	1957-62	3.6	8.3	36.	1.51	71.1	159.	50.	11.6
P.I.-IRON	1949-54	39.	20.5	74.	1.7	73.1	201.	90.	24.0
MALAYA-IRON	1957-62	110.	15.9	84.	1.75	62.1	298.	34.	6.7
P.I.-COPPER	1946-62	51.	20.5	74.	1.7	73.1	201.	90.	24.0
INDIA-ALUMINUM	1948-62	52.	33.	24.	2.00	146.	72.	279.	436.4

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EGYPT-IRON 1956-62
5.6 10.8 46. 1.77 108. 133. 52. 26.1

INDONESIA-CEMENT 1951-62
62. 11.2 24. 2.03 150. 127. 80. 95.9

ISRAEL-ENERGY 1949-61
6.0 45.5 275. 0.6 31.4 540. 212. 2.2

BURMA-ENERGY 1949-61
2.0 10.5 58. 2.00 149. 52. 34. 19.3

GHANA-GOLD 1957-62
197. 11.1 39. 1.67 113. 135. 32. 6.7

INDIA-PHOSPHATE 1948-62
2.0 33. 24. 1.99 146. 72. 279. 436.4

P.I.-ENERGY 1949-61
8.4 20.5 74. 1.72 73.1 201. 90. 24.0

GHANA-SILVER 1958-62
0.59 11.1 39. 1.67 113. 135. 32. 6.7

INDIA-CEMENT 1948-62
211. 33. 24. 2.00 146. 72. 279. 436.4

MOROCCO-ENERGY 1957-61
3.5 8.3 36. 1.51 71.1 159. 50. 11.6

INDONESIA-TIN 1948-54
1830. 11.2 24. 1.98 150. 127. 80. 95.9

INDIA-IRON 1947-62
31. 33. 24. 1.99 146. 72. 279. 436.4

EGYPT-NITRATES 1954-61
40. 10.8 46. 1.76 108. 133. 52. 26.1

INDIA-NITRATES 1944/5-60/1
159. 33. 24. 1.98 146. 72. 279. 436.4

EGYPT-ENERGY 1955-61
16. 10.8 46. 1.76 108. 133. 52. 26.1

INDIA-ENERGY 1949-61
133. 33. 24. 2.00 146. 72. 279. 436.4

EGYPT-CEMENT 1952-62
60. 10.8 46. 1.76 108. 133. 52. 26.1

ISRAEL-CEMENT 1949-61
31. 45.5 275. 0.6 31.4 540. 212. 2.2

MALAYA-ALUMINUM 1957-62
17. 15.9 84. 1.75 62.1 298. 34. 6.7

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INDIA-GOLD 1952-62
45.       33.       24.       2.00      146.      72.       279.      436.4

GHANA-MANGANESE 1957-62
400.      11.1      39.       1.67      113.      135.      32.       6.7

GHANA-ALUMINUM 1957-62
88.       11.1      39.       1.67      113.      135.      32.       6.7

MOROCCO-PHOSPHATE 1957-62
1830.     8.3       36.       1.51      71.1      159.      50.       11.6

INDIA-COPPER 1948-62
28.       33.       24.       1.99      146.      72.       279.      436.4

BURMA-OIL 1948-62
2.5       10.5      58.       1.99      149.      52.       34.       19.3

BURMA-TIN 1947-62
56.       10.5      58.       1.99      149.      52.       34.       19.3

MALAYA-ENERGY 1957-61
66.       15.9      84.       1.75      62.1      298.      34.       6.7

GHANA-ENERGY 1957-61
1.5       11.1      39.       1.66      113.      135.      32.       6.7

INDONESIA-OIL 1949-62
154.      11.2      24.       2.02      150.      127.      80.       95.9

MOROCCO-SILVER 1958-62
46.       8.3       36.       1.52      71.1      159.      50.       11.6

EGYPT-PHOSPHATE 1954-62
160.      10.8      46.       1.76      108.      133.      52.       26.1

GUINEA-IRON 1957-62
14.9      5.5       4.        1.33      210.      58.       14.       2.7

MOROCCO-IRON 1957-62
30.       8.3       36.       1.51      71.1      159.      50.       11.6

INDIA-OIL 1947-62
4.5       33.       24.       2.00      146.      72.       279.      436.4

GHANA-DIAMONDS 1957-62
1200.     11.1      39.       1.67      113.      135.      32.       6.7

MOROCCO-CEMENT 1956-58
20.       8.3       36.       1.48      71.1      159.      50.       11.6

INDONESIA-ALUMINUM 1949-53
591.      11.2      24.       2.00      150.      127.      80.       95.9

          END
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RECENT PERIODS NOT DIRECTLY RELATED TO INDEPENDENCE

COUNTRY-MINERAL DATES	Y	Y(A)	Y(B)	Y(C)	Y(D)	Y(E)	Y(F)	Y(G)	Z(A)
BRAZIL-NITRATES 1957/8-60/1	111.	96.9	102.	95.4	109.5	100.5	96.9	102.	0.
CHILE-SILVER 1946-62	12.5	42.9	7.2	41.4	11.	5.7	42.9	7.2	-3.7
PERU-SILVER 1946-62	10.	40.4	4.7	38.9	8.5	3.2	40.4	4.7	-0.6
THAILAND-CEMENT 1947-62	33.3	34.1	18.7	32.6	31.8	17.2	34.1	18.7	-1.4
JORDAN-PHOSPHATE 1952-62	46.	31.9	36.2	-0.1	14.0	4.2	-3.9	0.4	-2.0
VENEZUELA-ENERGY 1949-61	25.	31.6	17.8	30.1	23.5	16.3	31.6	17.8	0.
THAILAND-ENERGY 1949-61	25.	31.6	17.8	30.1	23.5	16.3	31.6	17.8	0.
CHILE-IRON 1955-62	33.3	31.5	28.6	30.0	31.8	26.8	31.5	28.3	-2.8
LIBERIA-ENERGY 1949-61	22.3	28.9	15.1	23.5	16.9	9.3	28.9	15.1	-2.5
MEXICO-SILVER 1946-62	-1.8	28.6	-7.1	27.1	-3.3	-8.6	28.6	-7.1	-3.1
BRAZIL-OIL 1942-62	50.	27.	39.5	-10.3	12.7	2.2	-8.8	3.7	-2.0
JORDAN-CEMENT 1956-62	25.	25.8	14.3	-7.7	-8.5	-17.7	-10.	-21.5	-1.7
VENEZUELA-CEMENT 1935-62	25.	25.8	16.1	-11.5	-12.3	-21.2	-10.	-19.7	-0.7
BOLIVIA-SILVER 1944-62	-4.6	25.8	-6.9	24.3	-6.1	-8.4	25.8	-6.9	-3.9
PERU-COPPER 1948-62	25.	23.5	18.3	22.	23.5	16.8	23.5	18.3	-2.1
BOLIVIA-CEMENT 1957-62	22.3	23.1	10.8	21.6	20.8	9.3	23.1	10.8	0.
P.I.-CEMENT 1953-62	22.3	23.1	11.7	17.7	16.9	6.3	23.1	11.7	-1.1

MOROCCO-MANGANESE 1952-62	2.9	21.1	-6.4	28.5	10.3	1.0	21.1	-6.4	-1.0
TURKEY-CEMENT 1943-62	20.	20.8	8.5	19.3	18.5	7.0	20.8	8.5	0.
PERU-IRON 1953-62	22.3	20.5	15.	-16.8	-15.0	-22.3	-15.3	-20.8	-3.3
LIBERIA-IRON 1952-62	20.	18.2	8.3	-23.	-21.6	-33.3	-17.6	-27.5	-1.0
BRAZIL-IRON 1948-62	20.	18.2	10.7	16.7	18.5	9.2	18.2	10.7	-0.7
CHILE-MANGANESE 1952-62	0.	18.2	-9.4	16.7	-1.5	-10.9	18.2	-9.4	-4.0
BRAZIL-GOLD 1920-62	0.	17.7	-3.9	16.2	-1.5	-5.4	17.7	-3.9	-0.7
P.I.-GOLD 1953-62	0.	17.7	-6.4	12.3	-5.4	-11.8	17.7	-6.4	0.
COLOMBIA-GOLD 1949-62	0.	17.7	-5.3	16.2	-1.5	-6.8	17.7	-5.3	-1.5
PERU-ENERGY 1949-61	11.1	17.7	3.9	16.2	9.6	2.4	17.7	3.9	-1.6
COLOMBIA-CEMENT 1934-62	16.7	17.5	7.6	-19.8	-20.6	-29.7	-18.3	-28.2	+0.7
SYRIA-CEMENT 1953-62	16.7	17.5	4.8	24.9	24.1	12.2	17.5	4.8	-1.1
BRAZIL-ENERGY 1949-61	10.8	17.4	3.6	15.9	9.3	2.1	17.4	3.6	-1.7
CHILE-OIL 1950-62	40.	17.	29.	-20.3	2.7	-8.3	-18.8	-6.8	0.
COLOMBIA-ENERGY 1949-61	10.	16.6	2.8	15.1	8.5	1.3	16.6	2.8	0.
MEXICO-ENERGY 1949-61	10.	16.6	2.8	15.1	8.5	1.3	16.6	2.8	0.
MOROCCO-CEMENT 1958-62	15.4	16.2	2.	23.6	22.8	9.4	16.2	2.0	0.
BRAZIL-ALUMINUM 1948-62	22.3	16.0	8.0	14.5	20.8	6.5	16.0	8.0	-4.3
MEXICO-CEMENT 1935-62	14.3	15.1	5.4	13.6	12.8	3.9	15.1	5.4	+0.7

INDONESIA-ENERGY 1955-61	8.3	14.9	0.2	30.1	23.5	15.4	14.9	0.2	0.
P.I.-NITRATES 1953/4-60/1	28.6	14.5	17.7	-26.7	-12.6	-23.5	-21.3	-18.1	-1.4
BRAZIL-CEMENT 1955-62	13.4	14.2	2.5	12.8	11.9	1.0	14.2	2.5	0.
BOLIVIA-ENERGY 1949-61	6.9	13.5	-0.3	12.	5.4	-1.8	13.5	-0.3	-3.3
CHILE-ENERGY 1949-61	5.6	12.2	-1.6	10.7	4.1	-3.1	12.2	-1.6	-0.8
PERU-GOLD 1955-62	-5.9	11.8	-12.2	10.3	-7.4	-13.7	11.8	-12.2	0.
MEXICO-IRON 1933-62	13.4	11.6	4.6	10.1	11.9	3.1	11.6	4.6	-1.4
TURKEY-ENERGY 1953-61	5.0	11.6	-2.2	10.1	3.5	-3.7	11.6	-2.2	0.
THAILAND-TIN 1950-62	4.6	11.4	4.4	9.9	3.1	2.9	11.4	4.4	0.
CHILE-GOLD 1940-62	-5.4	11.3	-5.5	9.8	-6.9	-7.0	11.3	-5.5	-4.1
MALAYA-GOLD 1959-62	-6.7	11.0	-14.1	14.8	-2.9	-10.3	11.	-14.1	0.
PERU-CEMENT 1941-62	10.	10.8	-0.9	9.3	8.5	-2.4	10.8	-0.9	+1.1
COLOMBIA-IRON 1955-62	11.8	10.0	4.3	-27.3	-25.5	-33.0	-25.8	-31.5	0.
INDIA-MANGANESE 1953-62	-8.5	9.7	-14.7	13.5	-4.7	-10.9	9.7	-14.7	0.
INDONESIA-ALUMINUM 1953-62	15.4	9.1	1.3	24.3	30.6	16.5	9.1	1.3	-4.4
CHILE-CEMENT 1935-62	8.0	8.8	-3.1	7.3	6.5	-4.6	8.8	-3.1	-0.4
MEXICO-GOLD 1952-62	-9.1	8.6	-14.4	7.1	-10.6	-15.9	8.6	-14.4	-1.0
TURKEY-COPPER 1938-62	9.5	8.0	4.9	-29.3	-27.8	-32.4	-27.8	-30.9	-1.2
BOLIVIA-TIN 1940-62	-4.4	2.4	-4.3	0.9	-5.9	-5.8	2.4	-4.3	-2.3

CHILE COPPER 1936-62	3.4	1.9	-1.9	0.4	1.9	-3.4	1.9	-1.9	-0.8
IRAQ-OIL 1942-62	22.3	-0.7	11.9	-2.2	20.8	10.4	-0.7	11.9	-3.0
ISRAEL-POTASH 1958-62	13.4	-0.7	5.2	-2.2	11.9	3.7	-0.7	5.2	0.
MEXICO-COPPER 1932-62	0.	-1.5	-7.2	-3.0	-1.5	-8.7	-1.5	-7.2	-2.3
CHILE-POTASH 1955-62	12.5	-1.6	6.1	-3.1	11.	4.6	-1.6	6.1	-1.4
P.I.-IRON 1954-62	0.	-1.8	-10.7	-7.2	-5.4	-16.1	-1.8	-10.7	-1.2
TURKEY-MANGANESE 1952-62	-22.3	-4.1	-31.4	-5.6	-23.8	-32.9	-4.1	-31.4	-4.0
TURKEY-OIL 1955-62	16.7	-6.3	8.1	-7.8	15.2	6.6	-6.3	8.1	0.
INDONESIA-TIN 1954-62	-13.4	-6.6	-14.4	8.6	1.8	0.8	-6.6	-14.4	+1.2
VENEZUELA-DIAMONDS 1947-62	11.8	-8.1	-1.0	-9.6	10.3	-2.5	-8.1	-1.0	-6.0
ISRAEL-PHOSPHATE 1958-62	3.6	-10.5	-12.0	-12.0	2.1	-13.5	-10.5	-12.0	0.
VENEZUELA-OIL 1932-62	11.1	-11.9	1.9	-13.4	9.6	0.4	-11.9	1.9	-1.0
BOLIVIA-COPPER 1948-62	-10.5	-12.0	-18.4	-13.5	-12.0	-19.9	-12.0	-18.4	-2.1
TURKEY-IRON 1957-62	-12.5	-14.3	-17.7	-15.8	-14.0	-19.2	-14.3	-17.7	0.
MEXICO-OIL 1945-62	7.7	-15.3	-2.5	-16.8	6.2	-4.0	-15.3	-2.5	0.
CHILE-NITRATES 1945/6-61/2	-1.2	-15.3	-14.0	-16.8	-2.7	-15.5	-15.3	-14.0	-4.4
VENEZUELA-GOLD 1957-62	-33.0	-15.6	-40.	-17.1	-34.8	-41.5	-15.6	-40.	0.
COLOMBIA-OIL 1928-62	4.4	-18.6	-3.6	-20.1	2.9	-5.1	-18.6	-3.6	-1.5
CHILE-PHOSPHATE 1956-62	-33.3	-19.2	-43.1	-20.7	-34.8	-44.6	-19.2	-43.1	-1.7

PERU-OIL 1939-62								
3.1	-19.9	-5.7	-21.4	1.6	-7.2	-19.9	-5.7	0.
BOLIVIA-OIL 1957-62								
-2.0	-25.0	-13.9	-26.5	-3.5	-15.4	-25.	-13.9	0.
INDONESIA-MANGANESE 1956-62								
-59.	-40.8	-63.2	-25.6	-43.8	-48.	-40.8	-63.2	-5.0
CUBA-SILVER 1945-58								
11.1	41.5	6.5	40.	9.6	5.0	41.5	6.5	-4.6
CUBA-ENERGY 1949-59								
11.1	17.7	3.9	16.2	9.6	2.4	17.7	3.9	0.
CUBA-CEMENT 1940-58								
14.3	15.1	4.8	13.6	12.8	3.3	15.1	4.8	+0.6

END

Sample Calculations

Brazil-Oil 1942-1962 (page 72, seventh from the bottom)

To obtain y_a: Take the uncorrected growth index, y, (50.) and subtract 23.0, the petroleum correction. This gives 27., the tabulated value of y_a.

Then to obtain y_f from this number, subtract 35.8 (to normalize for initial growth in an independent country). The result of 27.-35.8 is -8.8, the tabulated value of y_f.

To obtain y_d: Start again with the uncorrected growth index, y, (50.) and subtract 1.5 (status of country correction to account for the absence of a recent colonial period) and also subtract 35.8 (to normalize for initial growth in an independent country) to obtain 12.7, the tabulated value of y_d.

The actual production curve for this example will be found on page 301.

RECENT PERIODS NOT DIRECTLY RELATED TO INDEPENDENCE

COUNTRY-MINERAL DATES	X(8)	X(1)	X(2)	X(3)	X(4)	X(5)	X(6)	X(7)
BRAZIL-NITRATES 1957/8-60/1	11.0	5.1	93.	1.66	170.	262.	157.	70.5
CHILE-SILVER 1946-62	72.0	18.0	146.	1.77	116.	180.	54.0	7.4
PERU-SILVER 1946-62	958.	4.9	82.	1.46	97.2	140.	48.	10.9
THAILAND-CEMENT 1947-62	18.0	15.3	50.	0.93	48.7	100.	54.0	25.5
JORDAN-PHOSPHATE 1952-62	80.0	5.3	26.0	0.70	49.5	96.0	66.0	1.7
VENEZUELA-ENERGY 1949-61	37.0	4.9	117.	1.26	51.4	762.	304.	5.0
THAILAND-ENERGY 1949-61	3.1	15.3	50.	0.95	48.7	100.	54.0	25.5
CHILE-IRON 1955-62	93.0	18.0	146.	1.82	116.	180.	54.	7.4
LIBERIA-ENERGY 1949-61	0.1	1.9	9.0	-0.47	200.	103.	11.0	1.3
MEXICO-SILVER 1946-62	1870.	15.3	103.	1.58	70.1	187.	146.	34.9
BRAZIL-OIL 1942-62	1.7	5.1	93.0	1.59	170.	262.	157.	70.5
JORDAN-CEMENT 1956-62	3.8	5.3	26.	0.95	49.5	96.	66.	1.7
VENEZUELA-CEMENT 1935-62	25.0	4.9	117.	1.06	51.4	762.	304.	5.0
BOLIVIA-SILVER 1944-62	305.	3.7	52.	1.43	90.7	66.	30.0	3.5
PERU-COPPER 1948-62	140.	4.9	82.	1.46	97.2	140.	48.0	10.9
BOLIVIA-CEMENT 1957-62	1.2	3.7	52.0	1.53	90.7	66.0	30.0	3.5
P.I.-CEMENT 1953-62	24.0	20.5	74.0	1.74	73.1	201.	90.0	24.0

MOROCCO-MANGANESE 1952-62							
379.	8.3	36.	1.45	71.1	159.	50.0	11.6
TURKEY-CEMENT 1943-62							
27.0	24.0	103.	1.22	165.	276.	124.	27.8
PERU-IRON 1953-62							
88.0	4.9	82.0	1.51	97.2	140.	48.	10.9
LIBERIA-IRON 1952-62							
55.0	1.9	9.0	0.0	200.	103.	11.0	1.3
BRAZIL-IRON 1948-62							
91.0	5.1	93.0	1.61	170.	262.	157.	70.5
CHILE-MANGANESE 1952-62							
40.0	18.0	146.	1.81	116.	180.	54.0	7.4
BRAZIL-GOLD 1920-62							
36.0	5.1	93.0	1.45	170.	262.	78.5	70.5
P.I.-GOLD 1953-62							
104.	20.5	74.	1.74	73.1	201.	90.0	24.0
COLOMBIA-GOLD 1949-62							
114.0	4.8	105.	1.35	89.6	330.	30.0	14.8
PERU-ENERGY 1949-61							
7.9	4.9	82.0	1.48	97.2	140.	48.0	10.9
COLOMBIA-CEMENT 1934-62							
36.0	4.8	105.	1.18	89.6	330.	30.0	14.8
SYRIA-CEMENT 1953-62							
16.0	10.8	69.0	0.0	26.3	111.	9.0	4.7
BRAZIL-ENERGY 1949-61							
51.0	5.1	93.	1.62	170.	262.	157.	70.5
CHILE-OIL 1950-62							
5.6	18.0	146.	1.80	116.	180.	54.0	7.4
COLOMBIA-ENERGY 1949-61							
16.0	4.8	105.	1.34	89.6	330.	30.0	14.8
MEXICO-ENERGY 1949-61							
61.0	15.3	103.	1.59	70.1	187.	146.	34.9
MOROCCO-CEMENT 1958-62							
18.0	8.3	36.	1.52	71.1	159.	50.0	11.6
BRAZIL-ALUMINUM 1948-62							
25.0	5.1	93.0	1.62	170.	262.	157.	70.5
MEXICO-CEMENT 1935-62							
106.	15.3	103.	1.51	70.1	187.	146.	34.9

INDONESIA-ENERGY 1955-61
28.0 11.2 24.0 2.03 150. 127. 80.0 95.9

P.I.-NITRATES 1953/4-60/1
9.8 20.5 74.0 1.74 73.1 201. 90.0 24.0

BRAZIL-CEMENT 1955-62
132. 5.1 93.0 1.65 170. 262. 157. 70.5

BOLIVIA-ENERGY 1949-61
1.4 3.7 52.0 1.46 90.7 66.0 30.0 3.5

CHILE-ENERGY 1949-61
16.0 18.0 146. 1.79 116. 180. 54. 7.4

PERU-GOLD 1955-62
25.0 4.9 82. 1.53 97.2 140. 48.0 10.9

MEXICO-IRON 1933-62
16.0 15.3 103. 1.50 70.1 187. 146. 34.9

TURKEY-ENERGY 1953-61
18.0 24.0 103. 1.32 165. 276. 124. 27.8

THAILAND-TIN 1950-62
628. 15.3 50.0 1.00 48.7 100.0 54.0 25.5

CHILE-GOLD 1940-62
52.0 18.0 146. 1.76 116. 180. 54.0 7.4

MALAYA-GOLD 1959-62
2.6 15.9 84.0 1.76 62.1 298. 34.0 6.7

PERU-CEMENT 1941-62
23.0 4.9 82.0 1.56 97.2 140. 48.0 10.9

COLOMBIA-IRON 1955-62
9.3 4.8 105. 1.41 89.6 330. 30.0 14.8

INDIA-MANGANESE 1953-62
1010. 33.0 24.0 2.01 146. 72.0 279. 436.4

INDONESIA-ALUMINUM 1953-62
162.0 11.2 24.0 2.03 150. 127. 80.0 95.9

CHILE-CEMENT 1935-62
43.0 18.0 146. 1.74 116. 180. 54.0 7.4

MEXICO-GOLD 1952-62
88.0 15.3 103. 1.61 70.1 187. 146. 34.9

TURKEY-COPPER 1938-62
47.0 24.0 103. 1.15 165. 276. 124. 27.8

BOLIVIA-TIN 1940-62	1960.	3.7	52.0	1.40	90.7	66.0	30.0	3.5
CHILE COPPER 1936-62	1660.	18.0	146.	1.75	116.	180.	54.0	7.4
IRAQ-OIL 1942-62	315.	5.4	34.0	1.15	27.2	195.	36.	6.4
ISRAEL-POTASH 1958-62	80.0	45.5	275.	1.95	31.4	540.	212.	2.2
MEXICO-COPPER 1932-62	280.	15.3	103.	1.49	70.1	187.	146.	34.9
CHILE-POTASH 1955-62	16.0	18.0	146.	1.81	116.	180.	54.0	7.4
P.I.-IRON 1954-62	27.0	20.5	74.0	1.75	73.1	201.	90.0	24.0
TURKEY-MANGANESE 1952-62	44.0	24.0	103.	1.32	165.	276.	124.	27.8
TURKEY-OIL 1955-62	3.7	24.0	103.	1.35	165.	276.	124.	27.8
INDONESIA-TIN 1954-62	1520.	11.2	24.0	2.03	150.	127.	80.0	95.9
VENEZUELA-DIAMONDS 1947-62	61.0	4.9	117.	1.24	51.4	762.	304.	5.0
ISRAEL-PHOSPHATE 1958-62	54.0	45.5	275.	1.95	31.4	540.	212.	2.2
VENEZUELA-OIL 1932-62	695.0	4.9	117.	1.00	51.4	762.	304.	5.0
BOLIVIA-COPPER 1948-62	68.0	3.7	52.0	1.46	90.7	66.0	30.0	3.5
TURKEY-IRON 1957-62	15.0	24.0	103.	1.37	165.	276.	124.	27.8
MEXICO-OIL 1945-62	151.0	15.3	103.	1.57	70.1	187.	146.	34.9
CHILE-NITRATES 1945/6-61/2	650.	18.0	146.	1.78	116.	180.	54.0	7.4
VENEZUELA-GOLD 1957-62	68.0	4.9	117.	1.35	51.4	762.	304.	5.0
COLOMBIA-OIL 1928-62	85.0	4.8	105.	1.08	89.6	330.	15.0	14.8

CHILE-PHOSPHATE 1956-62

5.1	18.0	146.	1.82	116.	180.	54.0	7.4

PERU-OIL 1939-62

38.0	4.9	82.0	1.40	97.2	140.	48.0	10.9

BOLIVIA-OIL 1957-62

4.3	3.7	52.0	1.53	90.7	66.0	30.0	3.5

INDONESIA-MANGANESE 1956-62

33.0	11.2	24.0	2.04	150.	127.	80.0	95.9

CUBA-SILVER 1945-58

7.6	86.7	165.	1.69	38.9	361.	85.0	5.8

CUBA-ENERGY 1949-59

12.0	86.7	165.	1.72	38.9	361.	85.0	5.8

CUBA-CEMENT 1940-58

13.0	86.7	165.	1.67	38.9	361.	85.0	5.8

END

DATA USED IN NORMALIZING BUT NOT USED IN THE ANALYSIS PROPER

COUNTRY-MINERAL DATES	Y	Y(A)	Y(B)	Y(C)	Y(D)	Y(E)	Y(F)	Y(G)	Z(A)
BRAZIL-PHOSPHATE 1956-59	143.	128.9	139.	91.6	105.7	101.7	93.1	103.2	-3.3
ALBANIA-OIL 1935-40	143.0	120.0	136.0	82.7	105.7	98.7	84.2	100.2	-2.0
COLOMBIA-OIL 1921-28	125.0	102.0	114.0	64.7	87.7	76.7	66.2	78.2	-2.9
VENEZUELA-OIL 1917-28	83.0	60.0	70.5	22.7	45.7	33.2	24.2	34.7	0.
VENEZUELA-IRON 1950-57	58.9	56.8	48.7	19.5	21.6	11.4	21.0	12.9	+1.4
MEXICO-OIL 1902-21	56.0	33.0	45.1	-4.3	18.7	7.8	-2.8	9.3	-2.1
IRAN-OIL 1913-24	33.3	10.3	20.8	-27.0	-4.0	-16.5	-25.5	-15.0	0.
BOLIVIA-OIL 1930-57	28.6	5.6	19.6	-31.7	-8.7	-17.7	-30.2	-15.2	-2.6
ALGERIA-OIL 1957-63	182.0	159.0	173.0	112.3	135.3	126.3	126.2	140.2	0.
SIERRA LEONE-DIAMONDS 1932-37	143.0	138.4	130.0	99.8	104.4	91.4	105.2	97.2	0.
GUINEA-ALUMINUM 1952-54	143.0	134.7	124.0	88.0	96.3	77.3	101.9	91.2	-5.0
GHANA-DIAMONDS 1922-28	100.0	80.1	87.7	41.5	61.4	49.1	47.3	54.9	-1.6
EGYPT-OIL 1911-18	83.0	60.0	74.4	21.4	44.4	35.8	27.2	41.6	-7.2
AUSTRALIAN NEW GUINEA AND PAPUA-SILVER 1929-40	28.6	59.0	27.8	20.4	-10.0	-10.8	26.2	-5.0	-3.6
INDIA-COPPER 1913-31	40.0	38.5	36.9	-0.1	1.4	-1.7	5.7	4.1	-3.9
SIERRA LEONE-IRON 1934-41	33.3	31.5	19.7	-7.1	-5.3	-18.9	-1.3	-13.1	-1.4
CONGO (LEO).-COPPER 1913-30	28.6	27.1	24.2	7.1	8.6	4.2	-4.7	-7.6	-1.2

TRINIDAD-OIL 1909-18	50.0	27.0	40.8	-11.6	11.4	2.2	-4.8	8.0	-1.1
ISRAEL-POTASH 1931-41	40.0	25.9	30.0	-12.7	1.4	-8.6	-6.9	-2.8	-2.0
MALAYA-IRON 1921-40	22.3	20.5	26.5	-18.1	-16.3	-12.1	-12.3	-6.3	+3.3
SURINAM-ALUMINUM 1922-51	25.0	18.7	27.2	-37.8	-21.5	-19.3	-14.1	-5.6	-1.7
ANGOLA-CEMENT 1953-57	6.7	7.5	-3.4	-28.7	-29.5	-39.6	-25.3	-36.2	-2.5
INDONESIA-OIL 1893-1907	28.6	5.6	17.7	-40.9	-17.9	-28.8	-26.2	-15.1	-2.9
ANGOLA-DIAMONDS 1919-40	20.0	0.1	10.9	-36.1	-16.2	-25.3	-32.3	-21.9	+1.5
CONGO (LEO.)-CEMENT 1934-56	25.0	25.8	16.0				25.8	16.0	-0.9
ISLAND OF NEW GUINEA-ENERGY 1955-61	9.1	15.7	1.0	6.0	-0.6	-8.7	15.7	1.0	0.
NORTHERN RHODESIA-COPPER 1934-62	6.9	5.4	0.3	-0.4	1.1	-5.5	5.4	0.3	-1.0
MADAGASCAR-ENERGY 1949-61	9.1	15.7	1.9	1.8	-4.8	-12.0	15.7	1.9	-0.8
IRAN-CEMENT 1952-62	40.0	40.8	30.5	39.3	38.5	29.0	40.8	30.5	-2.0
IRAN-ENERGY 1955-61	16.7	23.3	8.5	21.8	15.2	7.0	23.3	8.5	-1.1
IRAN-OIL 1956-62	1.8	21.2	-6.4	-22.7	0.3	-7.9	21.2	-6.4	0.
BULGARIA-MANGANESE 1959-62	20.0	38.2	14.5	52.7	34.5	29.0	38.2	14.5	0.
ALBANIA-ENERGY 1955-61	23.8	30.4	15.5	44.9	38.3	30.0	30.4	15.5	0.
ALBANIA-CEMENT 1951-62	28.6	29.4	16.6	43.9	43.1	31.1	29.4	16.6	-3.6
BULGARIA-ENERGY 1955-61	18.2	24.8	9.9	39.3	32.7	24.4	24.8	9.9	0.

BULGARIA-COPPER 1955-62

25.0	23.5	12.8	38.0	39.5	27.3	23.5	12.8	0.

BULGARIA-IRON 1952-62

25.0	23.2	16.5	37.3	39.5	31.0	23.2	16.5	0.

RUMANIA-ALUMINUM 1950-62

28.6	22.3	11.6	36.8	43.1	26.1	22.3	11.6	-3.3

RUMANIA-ENERGY 1955-61

10.0	16.6	1.7	31.1	24.5	16.2	16.6	1.7	0.

RUMANIA-IRON 1948-62

18.2	16.4	8.9	30.9	32.7	23.4	16.4	8.9	0.

RUMANIA-CEMENT 1950-62

15.4	16.2	2.6	30.7	29.9	17.1	16.2	2.6	-1.7

BULGARIA-CEMENT 1950-62

13.4	14.2	0.6	28.7	27.9	15.1	14.2	0.6	0.

ALBANIA-OIL 1953-62

18.2	-4.8	8.8	9.7	32.7	23.3	-4.8	8.8	-3.3

RUMANIA-OIL 1953-62

4.2	-18.8	-4.5	-4.3	18.7	10.0	-18.8	-4.5	0.

RUMANIA-MANGANESE 1955-62

-143.0	-124.8	-137.0	-110.3	-128.5	-122.5	-124.8	-137.0	-5.7

CUBA-ENERGY 1959-61

11.1	17.7	3.9	32.2	25.6	18.4	17.7	3.9	0.

CUBA-CEMENT 1958-62

-33.3	-32.5	-47.4	-18.0	-18.8	-32.9	-32.5	-47.4	-2.5

CUBA-SILVER 1958-60

-6.7	-36.6	-6.8	-22.1	7.8	7.7	-36.6	-6.8	0.

END

DATA USED IN NORMALIZING BUT NOT USED IN THE ANALYSIS PROPER

COUNTRY-MINERAL DATES	X(8)	X(1)	X(2)	X(3)	X(4)	X(5)	X(6)	X(7)
CONGO (LEO.)-CEMENT 1934-56	90.	6.3					12.8	5.1
ISLAND OF NEW GUINEA-ENERGY 1955-61	0.37	1.2		-0.85				2.6
NORTHERN RHODESIA-COPPER 1934-62	930.	6.8						2.5
MADAGASCAR-ENERGY 1949-61	0.46	6.8		1.38	10.6			5.5
IRAN-CEMENT 1952-62	13.	3.0	19.	-1.00		100	93.	18.9
IRAN-ENERGY 1955-61	15.	3.0	19.	0.85		100.	93.	18.9
IRAN-OIL 1956-62	4.75	3.0	19.	0.78		100.	93.	18.9
BULGARIA-MANGANESE 1959-62	27.	59.		1.53			74.	7.6
ALBANIA-ENERGY 1955-61	0.94	14.7		-0.85			34.	1.6
ALBANIA-CEMENT 1951-62	2.8	14.7		-0.93			34.	1.6
BULGARIA-ENERGY 1955-61	20.	59.		1.49			74.	7.6
BULGARIA-COPPER 1955-62	27.	59.		1.50			74.	7.6
BULGARIA-IRON 1952-62	6.3	59.		1.48			74.	7.6
RUMANIA-ALUMINUM 1950-62	28.	80.5		1.69			42.	18.4
RUMANIA-ENERGY 1955-61	59.	80.5		1.71			42.	18.4
RUMANIA-IRON 1948-62	17.	80.5		1.68			42.	18.4
RUMANIA-CEMENT 1950-62	89.	80.5		1.69			42.	18.4

BULGARIA-CEMENT 1950-62				
36.5	59.0	1.46	74.	7.6
ALBANIA-OIL 1953-62				
4.1	14.7	-0.88	34.	1.6
RUMANIA-OIL 1953-62				
129.	80.5	1.70	42.	18.4
RUMANIA-MANGANESE 1955-62				
153.	80.5	1.71	42.	18.4
CUBA-ENERGY 1959-61				
14.	86.7	1.76	85.	5.8
CUBA-CEMENT 1958-62				
27.0	86.7	1.76	85.	5.8
CUBA-SILVER 1958-60				
9.8	86.7	1.76	85.	5.8

C. The Functional Models

The choice of a functional model was straightforward once the dependent and independent variables had been selected and defined. The constraints on the choice of model were simply that it take into account the definitions of the variables and, because of the moderate errors in their measurements, that higher powers of the variables should be avoided wherever possible. This constraint includes mathematical forms such as x_1^2, x_4^3, etc., and also forms such as x_1x_2, $x_4x_5^2$, x_4x_5/x_1x_8, etc. The models look extremely simple inasmuch as they show linear dependence with most of the variables but they are actually often complex, the complexity being taken up in the definition of the variables. For example, the dependent variables appear to vary linearly with a measure of the geological survey of each country. In point of fact, the dependent variables vary logarithmically with the difference of two numbers. (See definition of the survey factor.)

For the first model, that which is used for the corrected growth indices y_f and y_g, the dependent variable stands alone on the left hand side of the equation. The dependent variables were defined in a way so that this would be possible. The dependent variable is set equal to a sum of terms which include all of the independent variables (as defined). The corrected growth indices, y_f and y_g, are viewed as varying linearly and directly with all the independent variables except x_4 and x_8. The dependence on x_4, the infant mortality rate, is viewed as linear and indirect. The dependence on x_8, percent of world production, is more complex. The growth index would be moderate for very small industries, increase for larger industries with more experience and economies of scale, reach a maximum growth index, and then exhibit lower and negative growth indices as the industry got large and the base quantity of production which was to be doubled became substantial. This relationship is non-linear and may be expressed as a parabola, with its vertex in the upper right hand quadrant, concave downwards and symmetrical about a vertical line an unknown distance, a_8, to the right of the growth index (y) axis. The analytical form for such a function, employing the notation used in this study, is:

$$y = a_o + a_7 (x_8 - a_8)^2$$

where x_8 is the variable,

a_o and a_8 are positive parameters and

a_7 is a negative parameter.

The parameter a_o in the above function would measure the distance the parabola vertex was above the percent of world production (x) axis, but in the final functional model, a sum of terms, it will not do so. In the final functional model a_o will include this distance and also the sum of distances at which the linear plots may appear to intersect the growth index (y) axis. For the case where all x's are zero, $y = a_o$. The value of a_o will have meaning within the range of the observational data. The trivial case used as an example above would give a meaningless value for a_o because the range of observational data does not include the region near all x's equal zero. It would be interesting to obtain a group of

$a_{01}, a_{02}, \ldots a_{08}$, one for each dependent variable, but the mathematical procedure used for a least squares fit of the overall function must group all constant terms into one.

The sum of terms which comprises the final functional model is therefore:

$$y_f \text{ or } y_g = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4/x_4 + a_5x_5 + a_6x_6 + a_7(x_8 - a_8)^2$$

where y_f and y_g are the corrected growth indices,

$x_1, x_2 \ldots x_8$ are the independent variables characteristic of each country-mineral growth curve from which the growth indices were taken and,

$a_0, a_1 \ldots a_8$ are the parameters to be determined by a least squares fit for each of three sets of y_f or y_g and $x_1, x_2 \ldots x_8$.

As noted before the functional model for stability of production and volume of production was similar,

$$z_a \text{ or } z_b = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4/x_4 + a_5x_5 + a_6x_6 + a_9x_7$$

where z_a is the measure of stability of production and

z_b is the measure of volume of production,

x_1, x_2, ... x_7 are the independent variables characteristic of each country-mineral growth curve from which the growth indices were taken (x_7, absent from the first model, is the population factor,) and

a_o, a_1, ... a_9 are the parameters to be determined by a least squares fit for each of three sets of z_a or z_b and x_1, x_2 ... x_7.

D. The Analysis, its Results and Conclusions

The data and functional models described above were processed at the Computer Center at M.I.T. on the I.B.M. 7094 computer. The nonlinear regression method was applied twice, the second time as a check. Essential details of the analysis whose results are presented here, may be found in Subroutine Gauss - Nonlinear Regression Subroutine by Robert M. Baer. Details of the check program may be found in the reference (listed in the bibliography) by Booth and Peterson and in that by Barker, Scott and Doyle. The print-outs of the functional subroutines used with both these methods are found in Appendix III. Linear programming, though probably applicable to the problem, was not employed.

The results of the computer analysis were disappointing but interesting. Parameter values were obtained which could be used to predict the dependent variables (corrected growth index, stability and volume of production) but the standard deviation associated with the resultant values of the dependent variables was so large that the prediction could not be relied upon for any useful application. This result was suspected during the data gathering stage but, of course, could not be proved until the results of the nonlinear regression were obtained.

The results of this study suggest strongly that nonlinear estimation combined with relatively simple functional models can not be used to predict the future patterns or to explain the past patterns of the mineral industries of underdeveloped countires.

Sources of error in this study may be the selection of non-ideal functional models (perhaps some cross product terms should have been employed) and possibly the inclusion of some data in an improper form (for example, a good argument can be made for including the foreign aid and long term investment factor on a per capita basis). Another source of error, suggested before was that the time rates of change of the variables should have been included along with the variables themselves. Such information was not available for this study; (some of it, such as the demographic data, is certainly not available anywhere.) Perhaps, however, other such data is available to an agency of the federal government or to the United Nations. If so it would be a straightforward, though lengthy task, for a staff of workers to measure the rates of change of a set of independent variables for each of the country-mineral-date combinations of this study and to apply the methods used here. Such a project would certainly give better parameter values and lower standard deviations on the dependent variable, but whether they would be low enough to be of practical use is not evident. A serious objection to such a project is that the input data would be so hard to find that a corporation interested in mining in a certain country-mineral-date outside the study could probably not obtain the necessary input data to obtain a prediction of the future mineral status of that country-mineral-date.

Numerical results of the nonlinear regression are presented below with various notes and commentary. The minimum sum of the squares obtained is listed so that any future investigation of the data of this study will have a guide to what is needed to improve the fit of the data to the function. With a total of eight variables it is possible that an imperfect computer program would sometimes give answers pertaining to a local minimum rather than to an absolute minimum. The author does not believe that this actually occurred in his work but on two occasions the minimum sum of the squares was lowered very slightly by substituting a different computer library subroutine to perform the matrix operations necessary for the solution of the simultaneous equations. The name of the library subroutine used is therefore tabulated just after the minimum sum of squares.

Periods just prior to independence

Corrected growth index y_f

Average value: 13.4

Standard deviation on predictable value: 24.93

Clearly a figure for the corrected growth index such as 13.4 ± 24.9 is not a figure subject to practical applications but it is the best the data will give.

Minimal value of the sum of the squares:

41641.3 ISIMEQ

Values of the parameters		Average values of the independent variables		Average values of each factor (first two columns of this table combined according to the functional model)
a_o	4.83		--	4.83
a_1	- 0.094	$\bar{x}_1$	16.1	- 1.59
a_2	- 0.027	$\bar{x}_2$	51.3	- 1.39
a_3	2.98	$\bar{x}_3$	1.23	3.67
a_4	116.3	$\bar{x}_4$	109.7	1.07
a_5	0.0184	$\bar{x}_5$	154.	2.83
a_6	0.187	$\bar{x}_6$	28.6	0.053
a_7	1.5×10^{-6}			
a_8	945.5	$\bar{x}_8$	411.	- 2.74

The absolute values of the results of column three in the above table were normalized, and each factor, with the sign restored, was calculated as a percentage of the whole functional value. Thus the percentage dependence of y_f on each factor is given. Properly the last factor should be negative and all the others except the a_o factor should be positive. The a_o term may take on any value, positive or negative. Also the parameter a_8 may have any sign inasmuch as its sign does not determine the sign of a factor.

Each factor has associated with it an error and when these errors are summed they account for the deviation of the whole, the deviation in the calculated values of y_f. Some of the factors have negative values but a negative sign before the percentage dependence is impossible in reality. The physical interpretation of a negative sign is not inverse dependence but negative dependence. A negatively signed transport factor would indicate that the more roads and railroads that were built, the harder the earth would be sucking back already mined minerals! Thus the negatively signed dependences must be plus (or minus) an error at least large enough to bring them back to zero. (This holds in reverse for a_7 which should be negative.) The presence of a considerable number of negatively signed parameters, and their seemingly random distribution among the independent variables on different sets of data is a very discouraging aspect of the results of this study.

Factor	% dependence
a_o	25.9
$a_1\bar{x}_1$	- 8.6
$a_2\bar{x}_2$	- 7.4
$a_3\bar{x}_3$	19.7
$a_4/\bar{x}_4$	5.7
$a_5\bar{x}_5$	15.2
$a_6\bar{x}_6$	2.8
$a_7\ (\bar{x}_8 - a_8)^2$	- 14.7
	100.0

Following each set of data as presented above is a copy of the computer print out of the results. The number and sequence of each set follows the order of the data as presented in the tables which follow section B of this paper. The notation on the print out follows a standard format with the numbers after the E indicating the power of ten to which the number before the E is raised. The numbers following the maximum deviation and maximum percent deviation note the sequence number of the observations at which these maxima are found.

"Y OBSERVED" is the input data for the dependent variable and "Y CALCULATED" is the calculated value of the dependent variable using the parameters which gave the minimal value of the sum of squares. "DELTA Y" and "PCT DEVIATION" refer to the difference between these values. This last item, the percentage deviation is investigated further and a histogram is constructed a description of which follows below. This histogram will be found for each run following the print out of the computed results.

The absolute percentage deviation for each set of data was calculated and the histogram was constructed with four groupings: 0 - 33-1/3 % (good), 33-1/3 - 60 % (working range), 60 - 150 % (possibly subject to more analysis) and over 150 % (unacceptable). This was done in the hope that something common to the members of the two groups in the 0 - 60 % absolute deviation range could be found and then country-mineral combinations with such a characteristic could be selected for a separate analysis. What was found, was that these country-mineral combinations were usually characterized by growth indices (also true for stability and amount of production) which had moderate absolute values. Selecting such country-mineral combinations for future analysis would be self-defeating because by selecting a group with restricted values for the dependent variable, the required magnitude of standard deviation would be greatly lowered.

yf

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	.14980E 03	.26847E 02	.12295E 03	.45798E 03
2	.48700E 02	.18068E 02	.30632E 02	.16954E 03
3	.68200E 02	.20580E 02	.47620E 02	.23140E 03
4	.34200E 02	.12636E 02	.21564E 02	.17066E 03
5	.59000E 02	.13442E 02	.45558E 02	.33892E 03
6	.35400E 02	.12469E 02	.22931E 02	.18389E 03
7	.11200E 02	.66087E 01	.45913E 01	.69474E 02
8	.40000E 02	.13639E 02	.26361E 02	.19327E 03
9	.54000E 01	.18060E 02	-.12660E 02	-.70099E 02
10	.34000E 02	.12824E 02	.21176E 02	.16513E 03
11	.31500E 02	.18668E 02	.12832E 02	.68738E 02
12	-.13000E 01	.10834E 02	-.12134E 02	-.11200E 03
13	.30400E 02	.15509E 02	.14891E 02	.96020E 02
14	.30400E 02	.20272E 02	.10128E 02	.49962E 02
15	.30400E 02	.12088E 02	.18312E 02	.15150E 03
16	.30100E 02	.13537E 02	.16563E 02	.12236E 03
17	.25800E 02	.19794E 02	.60062E 01	.30344E 02
18	.23300E 02	.31610E 01	.20139E 02	.63712E 03
19	-.97000E 01	.97585E 01	-.19459E 02	-.19940E 03
20	.23100E 02	.34208E 02	-.11108E 02	-.32473E 02
21	-.10500E 02	.13201E 00	-.10632E 02	-.80538E 04
22	.21800E 02	.16113E 02	.56868E 01	.35293E 02
23	.21300E 02	.16682E 02	.46185E 01	.27686E 02
24	.20800E 02	.14456E 02	.63441E 01	.43886E 02
25	.20200E 02	.10292E 02	.99080E 01	.96268E 02
26	.19900E 02	.13164E 02	.67359E 01	.51169E 02
27	.17700E 02	.88802E 01	.88198E 01	.99319E 02
28	.20000E 02	.13478E 02	.65222E 01	.48392E 02
29	.16600E 02	.12150E 02	.44503E 01	.36629E 02
30	.16600E 02	.15684E 02	.91600E 00	.58404E 01
31	.16100E 02	.15710E 02	.39039E 00	.24850E 01
32	.15700E 02	.17005E 02	-.13046E 01	-.76721E 01
33	.15600E 02	.15775E 02	-.17498E 00	-.11092E 01
34	.15300E 02	-.32554E 01	.18555E 02	-.56999E 03
35	-.17700E 02	.34883E 01	-.21188E 02	-.60741E 03
36	.54000E 01	.66435E 01	-.12435E 01	-.18718E 02
37	-.18300E 02	.19732E 02	-.38032E 02	-.19274E 03
38	.14200E 02	.13622E 02	.57829E 00	.42454E 01
39	.13900E 02	.18700E 02	-.47998E 01	-.25667E 02
40	.13400E 02	.10057E 02	.33432E 01	.33243E 02
41	.12000E 02	.18268E 02	-.62675E 01	-.34310E 02
42	.11100E 02	.17264E 02	-.61641E 01	-.35705E 02
43	.10000E 02	.20783E 02	-.10783E 02	-.51883E 02
44	.10000E 02	.19791E 02	-.97910E 01	-.49472E 02
45	-.24100E 02	.16465E 02	-.40565E 02	-.24637E 03
46	.80000E 01	.22418E 02	-.14418E 02	-.64315E 02
47	.67000E 01	.89289E 01	-.22289E 01	-.24963E 02
48	.56000E 01	.12644E 02	-.70444E 01	-.55712E 02
49	.52000E 01	.17147E 02	-.11947E 02	-.69675E 02
50	.46000E 01	.20627E 02	-.16027E 02	-.77699E 02
51	.44000E 01	.13339E 02	-.89392E 01	-.67014E 02
52	.28000E 01	.14176E 02	-.11376E 02	-.80249E 02
53	.17000E 01	.20673E 02	-.18973E 02	-.91777E 02
54	1.00000E-01	.14742E 02	-.14642E 02	-.99322E 02
55	-.34700E 02	.16009E 02	-.50709E 02	-.31676E 03
56	-.89000E 01	.20023E 02	-.28923E 02	-.14445E 03
57	-.11900E 02	-.29275E 01	-.89725E 01	.30649E 03
58	-.12700E 02	-.15942E 02	.32419E 01	-.20336E 02
59	-.15000E 02	.12873E 02	-.27873E 02	-.21652E 03
60	-.15500E 02	.17779E 02	-.33279E 02	-.18718E 03
61	-.20600E 02	.12184E 02	-.32784E 02	-.26908E 03
62	-.25200E 02	.16137E 02	-.41337E 02	-.25617E 03
63	.38200E 02	.55195E 01	.32680E 02	.59209E 03
64	.28900E 02	.45160E 01	.24384E 02	.53995E 03
65	.80000E 00	.66219E 01	-.58219E 01	-.87919E 02
66	-.99000E 01	.74647E 01	-.17365E 02	-.23262E 03
67	-.63000E 01	.14252E 02	-.20552E 02	-.14420E 03

AVERAGE DEVIATION -.12572E-02 AVERAGE PCT DEV -.11575E 03 AVE ABS PCT DEV .26678E 03

MAXIMUM DEVIATION .12295E 03 1

MAXIMUM PCT DEV .80538E 04 21

ROOT MEAN SQUARE DEVIATION .24930E 02

THE MINIMIZING VALUES OF THE PARAMETERS ARE

.4830366E 01 -.9409644E-01 -.2702251E-01 .2989306E 01 .1162798E 03
.1839031E-01 .1873166E 00 -.1499922E-05 .9454830E 03

THE MINIMAL VALUE OF THE SUM OF SQUARES .416413E 05

Y_f JUST PRIOR TO INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

CONGO (LEO.)-DIAMONDS 1949-59
SIERRA LEONE-IRON 1943-62
SIERRA LEONE-DIAMONDS 1955-62
MALAYA-ENERGY 1949-57
P.I.-CEMENT 1929-39
ANGOLA-IRON 1958-62
ALGERIA-CEMENT 1950-61
FRENCH WEST AFRICA GROUP-ENERGY 1951-61
ALGERIA-ENERGY 1949-61
GHANA-ENERGY 1949-57
GHANA-MANGANESE 1936-57
INDIA-CEMENT 1933-42
MOROCCO-CEMENT 1945-55

33⅓-60% ABSOLUTE DEVIATION

MALAYA-TIN 1949-57
MOROCCO-IRON 1940-57
INDIA-IRON 1913-40
CONGO (LEO.)-MANGANESE 1955-62
MALAYA-ALUMINUM 1953-57
NIGERIA-ENERGY 1949-61
MOZAMBIQUE-ENERGY 1949-61
BRITISH GUIANA-ENERGY 1949-61
INDONESIA-CEMENT 1933-39
GHANA-GOLD 1944-57
MOROCCO-SILVER 1952-58

60-150% ABSOLUTE DEVIATION

SURINAM-ALUMINUM 1952-62
ANGOLA-CEMENT 1957-62
EGYPT-PHOSPHATE 1946-54
GHANA-DIAMONDS 1947-57
INDIA-ALUMINUM 1918-43
BRITISH GUIANA-ALUMINUM 1947-62
NIGERIA-TIN 1940-62
MOROCCO-PHOSPHATE 1946-57
CONGO(LEO.)-COPPER 1933-62
ISRAEL-CEMENT 1934-49
SIERRA LEONE-ENERGY 1949-61
BURMA-TIN 1922-39
BRITISH GUIANA-DIAMONDS 1958-62
GHANA-SILVER 1938-58
GUINEA-IRON 1953-57
MALAYA-IRON 1951-57
P.I.-IRON 1935-40
ANGOLA-OIL 1958-62

OVER 150% ABSOLUTE DEVIATION

ANGOLA-DIAMONDS 1956-62
ANGOLA-ENERGY 1949-61
ANGOLA-MANGANESE 1953-62
ALGERIA-PHOSPHATE 1953-62
GUINEA-ALUMINUM 1954-59
CONGO (LEO.)-TIN 1956-62
INDONESIA-OIL 1907-40
TRINIDAD-OIL 1951-62
GHANA-ALUMINUM 1942-56
FRENCH WEST AFRICA GROUP-DIAMONDS 1936-61
EGYPT-NITRATES 1952-54
JAMAICA-CEMENT 1952-62
TRINIDAD-ENERGY 1949-61
JAMAICA-ALUMINUM 1954-62
SENEGAL-CEMENT 1948-60
JAMAICA-ENERGY 1949-61
BURMA-SILVER 1930-41
CONGO (LEO.)-SILVER 1932-60
P.I.-GOLD 1921-41
INDONESIA-MANGANESE 1920-28
P.I.-SILVER 1921-41
NIGERIA-OIL 1958-60
MOROCCO-MANGANESE 1944-52
P.I.-COPPER 1937-41
INDONESIA-TIN 1945-48

Periods just prior to independence (continued)

Corrected growth index y_g

Average value: 4.0

Standard deviation on predictable value: 20.52

Minimal value of the sum of the squares:

28206.0 XSIMEQF

	Values of the parameters	Average values of the independent variables	Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	- 1.50		- 1.50	- 11.9
a_1	- 0.0677	16.1	- 1.09	- 8.6
a_2	- 0.026	51.3	- 1.34	- 10.6
a_3	0.700	1.23	0.865	6.9
a_4	84.5	109.7	0.776	6.3
a_5	0.0114	154.0	1.76	14.0
a_6	0.177	28.6	5.08	40.0
a_7	$- 5.73 \times 10^7$	411	- 0.218	- 1.7
a_8	- 1027.			

y_g

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	.11910E 03	.14590E 02	.10451E 03	.71634E 03
2	.43300E 02	.71098E 01	.36190E 02	.50902E 03
3	.31400E 02	.95718E 01	.21828E 02	.22805E 03
4	.46400E 02	.25227E 01	.43877E 02	.17393E 04
5	.25600E 02	.30155E 01	.22584E 02	.74894E 03
6	-.25000E 01	.16373E 01	-.41373E 01	-.25269E 03
7	.24200E 02	.37095E 00	.23829E 02	.64239E 04
8	.15600E 02	.30977E 01	.12502E 02	.40360E 03
9	-.50000E 01	.71172E 01	-.12117E 02	-.17025E 03
10	.17000E 01	.30585E 01	-.13585E 01	-.44417E 02
11	.26500E 02	.66217E 01	.19878E 02	.30020E 03
12	-.52000E 01	.18393E 01	-.70393E 01	-.38271E 03
13	.90000E 00	.51475E 01	-.42475E 01	-.82516E 02
14	.00000E 00	.93644E 01	-.93644E 01	-1.00000E 02
15	-1.00000E-01	.14096E 01	-.15096E 01	-.10709E 03
16	.39400E 02	.18786E 01	.37521E 02	.19973E 04
17	.47000E 01	.92140E 01	-.45140E 01	-.48991E 02
18	.95000E 01	-.46783E 01	.14178E 02	-.30307E 03
19	-.23000E 02	.86538E 00	-.23865E 02	-.27578E 04
20	.20500E 02	.22721E 02	-.22214E 01	-.97768E 01
21	-.17000E 02	-.56570E 01	-.11343E 02	.20052E 03
22	-.30000E 00	.53844E 01	-.56844E 01	-.10557E 03
23	-.33000E 01	.57157E 01	-.90157E 01	-.15774E 03
24	.83000E 01	.34220E 01	.48780E 01	.14255E 03
25	.13300E 02	-.18143E 00	.13481E 02	-.74308E 04
26	.61000E 01	.17725E 01	.43275E 01	.24414E 03
27	.39000E 01	-.35534E 00	.42553E 01	-.11975E 04
28	.62000E 01	.36465E 01	.25535E 01	.70025E 02
29	.28000E 01	.24075E 01	.39254E 00	.16305E 02
30	.28000E 01	.51879E 01	-.23879E 01	-.46028E 02
31	.23000E 01	.42841E 01	-.19841E 01	-.46313E 02
32	.19000E 01	.75822E 01	-.56822E 01	-.74941E 02
33	.18000E 01	.43113E 01	-.25113E 01	-.58249E 02
34	.15000E 01	-.71216E 01	.86216E 01	-.12106E 03
35	-.30900E 02	-.46073E 01	-.26293E 02	.57068E 03
36	-.29000E 01	.38543E 00	-.32854E 01	-.85242E 03
37	-.14200E 02	.86999E 01	-.22900E 02	-.26322E 03
38	.10100E 02	.30630E 01	.70370E 01	.22974E 03
39	.50000E 00	.66404E 01	-.61404E 01	-.92470E 02
40	.24400E 02	.12721E 00	.24273E 02	.19082E 05
41	.62000E 01	.65148E 01	-.31481E 00	-.48322E 01
42	-.13000E 02	.67988E 01	-.19799E 02	-.29121E 03
43	.10800E 02	.10232E 02	.56819E 00	.55531E 01
44	.57000E 01	.92292E 01	-.35292E 01	-.38240E 02
45	-.11900E 02	.74883E 01	-.19388E 02	-.25892E 03
46	.15000E 01	.14534E 02	-.13034E 02	-.89679E 02
47	.21000E 01	-.30228E 00	.24023E 01	-.79471E 03
48	-.53000E 01	.46132E 01	-.99132E 01	-.21489E 03
49	-.70000E 00	.68815E 01	-.75815E 01	-.11017E 03
50	-.13000E 01	.96607E 01	-.10961E 02	-.11346E 03
51	-.40000E 00	.28868E 01	-.32868E 01	-.11386E 03
52	-.70000E 01	.22936E 01	-.92936E 01	-.40520E 03
53	-.24000E 01	.10175E 02	-.12575E 02	-.12359E 03
54	.44000E 01	.50347E 01	-.63465E 00	-.12606E 02
55	-.37200E 02	.53457E 01	-.42546E 02	-.79588E 03
56	-.85000E 01	.88329E 01	-.17333E 02	-.19623E 03
57	.16000E 01	-.70231E 01	.86231E 01	-.12278E 03
58	-.22000E 01	-.53599E 01	.31599E 01	-.58954E 02
59	-.10000E 01	.18067E 01	-.28067E 01	-.15535E 03
60	-.22100E 02	.70229E 01	-.29123E 02	-.41469E 03
61	-.25400E 02	.26799E 01	-.28080E 02	-.10478E 04
62	-.21900E 02	.44572E 01	-.26357E 02	-.59134E 03
63	.13800E 02	.13501E 00	.13665E 02	.10121E 05
64	.15100E 02	-.11958E 00	.15220E 02	-.12728E 05
65	-.11100E 02	.37644E 00	-.11476E 02	-.30487E 04
66	.38000E 01	.73336E 00	.30666E 01	.41816E 03
67	-.13700E 02	.41134E 01	-.17813E 02	-.43306E 03

AVERAGE DEVIATION -.33374E-03 AVERAGE PCT DEV .10892E 03 AVE ABS PCT DEV .12095E 04

MAXIMUM DEVIATION .10451E 03 1

MAXIMUM PCT DEV .19082E 05 40

ROOT MEAN SQUARE DEVIATION .20518E 02

THE MINIMIZING VALUES OF THE PARAMETERS ARE

-.1500582E 01 -.6775178E-01 -.2622405E-01 .7006265E 00 .8454429E 02
.1135099E-01 .1770179E 00 -.5732871E-06 .1026889E 04

THE MINIMAL VALUE OF THE SUM OF SQUARES .282060E 05

Yg
JUST PRIOR TO INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

INDIA-CEMENT 1933-42
NIGERIA-ENERGY 1949-61
MALAYA-ALUMINUM 1953-57
INDIA-IRON 1913-40
GHANA-DIAMONDS 1947-57

33⅓-60% ABSOLUTE DEVIATION

CONGO (LEO.)-SILVER 1932-60
MOROCCO-CEMENT 1945-55
GHANA-ENERGY 1949-57
ALGERIA-ENERGY 1949-61
ALGERIA-CEMENT 1950-61
MOROCCO-IRON 1940-57
CONGO (LEO.)-DIAMONDS 1949-59

60-150% ABSOLUTE DEVIATION

BURMA-SILVER 1930-41
MOROCCO-SILVER 1952-58
GHANA-SILVER 1938-58
GHANA-GOLD 1944-57
INDONESIA-CEMENT 1933-39
MOZAMBIQUE-ENERGY 1949-61
FRENCH WEST AFRICA GROUP-ENERGY 1951-61
TRINIDAD-ENERGY 1949-61
MALAYA-ENERGY 1949-57
ISRAEL-CEMENT 1934-49
NIGERIA-TIN 1940-62
MOROCCO-PHOSPHATE 1946-57
CONGO(LEO.)-COPPER 1933-62
INDIA-ALUMINUM 1918-43
TRINIDAD-OIL 1951-62

OVER 150% ABSOLUTE DEVIATION

SURINAM-ALUMINUM 1952-62
ANGOLA-DIAMONDS 1956-62
ANGOLA-CEMENT 1957-62
ANGOLA-ENERGY 1949-61
ANGOLA-MANGANESE 1953-62
ALGERIA-PHOSPHATE 1953-62
GUINEA-ALUMINUM 1954-59
CONGO (LEO.)-TIN 1956-62
INDONESIA-OIL 1907-40
EGYPT-PHOSPHATE 1946-54
GHANA-ALUMINUM 1942-56
BRITISH GUIANA-ALUMINUM 1947-62
MALAYA-TIN 1949-57
SIERRA LEONE-IRON 1943-62
FRENCH WEST AFRICA GROUP-DIAMONDS 1936-61
CONGO (LEO.)-MANGANESE 1955-62
SIERRA LEONE-DIAMONDS 1955-62
P.I.-CEMENT 1929-39
EGYPT-NITRATES 1952-54
ANGOLA-IRON 1958-62
JAMAICA-CEMENT 1952-62
SIERRA LEONE-ENERGY 1949-61
BRITISH GUIANA-ENERGY 1949-61
BURMA-TIN 1922-39
GHANA-MANGANESE 1936-57
JAMAICA-ALUMINUM 1954-62
SENEGAL-CEMENT 1948-60
JAMAICA-ENERGY 1949-61
BRITISH GUIANA-DIAMONDS 1958-62
GUINEA-IRON 1953-57
MALAYA-IRON 1951-57
P.I.-IRON 1935-40
P.I.-GOLD 1921-41
ANGOLA-OIL 1958-62
INDONESIA-MANGANESE 1920-28
P.I.-SILVER 1921-41
NIGERIA-OIL 1958-60
MOROCCO-MANGANESE 1944-52
P.I.-COPPER 1937-41
INDONESIA-TIN 1945-48

Periods just prior to independence (continued)

Stability of production z_a

Average value: - 1.58

Standard deviation on predictable value: 1.853

Minimal value of the sum of squares

229.937 XSIMEQF

Values of the parameters		Average values of the independent variables		Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	- 2.36	--		- 2.36	- 56.1
a_1	0.0043	$\bar{x}_1$	16.1	0.07	1.7
a_2	- 0.0086	$\bar{x}_2$	51.3	- 0.44	- 10.4
a_3	0.308	$\bar{x}_3$	1.23	0.38	9.0
a_4	- 53.05	$\bar{x}_4$	109.7	- 0.49	- 11.6
a_5	0.0014	$\bar{x}_5$	154.	0.22	5.3
a_6	- 0.00539	$\bar{x}_6$	28.6	- 0.15	- 3.6
a_9	0.00276	$\bar{x}_7$	35.0	0.097	2.3

The deviation histogram for the stability of production analyses show overly large bars for the absolute range 60 - 150 %. This is due to the large number of stability measures which were zero. Any percentage deviation calculated on a zero base is nominally $\pm$ 100 %. Such values are tabulated above the other absolute percentage deviations in the 60 - 120 % range and separated from them by a horizontal line. This was also done on the other two histograms for percentage deviation of stability of production analyses.

z_a

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	-.33000E 01	-.15444E 01	-.17556E 01	.11367E 03
2	.00000E 00	-.15946E 01	.15946E 01	-1.00000E 02
3	.12000E 01	-.14967E 01	.26967E 01	-.18017E 03
4	.00000E 00	-.10130E 01	.10130E 01	-1.00000E 02
5	-.40000E 01	-.15073E 01	-.24927E 01	.16537E 03
6	.12000E 01	-.12014E 01	.24014E 01	-.19989E 03
7	-.25000E 01	-.20849E 01	-.41509E 00	.19909E 02
8	-.10000E 01	-.15073E 01	.50735E 00	-.33658E 02
9	.20000E 01	-.16008E 01	.36008E 01	-.22494E 03
10	-.39000E 01	-.18421E 01	-.20579E 01	.11172E 03
11	.33000E 01	-.13796E 01	.46796E 01	-.33919E 03
12	.00000E 00	-.17281E 01	.17281E 01	-1.00000E 02
13	-.55000E 01	-.16700E 01	-.38300E 01	.22933E 03
14	-.33000E 01	-.14566E 01	-.18434E 01	.12655E 03
15	.00000E 00	-.18506E 01	.18506E 01	-1.00000E 02
16	-.25000E 01	-.16007E 01	-.89933E 00	.56185E 02
17	-.10000E 01	-.14844E 01	.48440E 00	-.32633E 02
18	-.25000E 01	-.14157E 01	-.10843E 01	.76587E 02
19	-.42000E 01	-.14385E 01	-.27615E 01	.19196E 03
20	.00000E 00	-.92543E 00	.92543E 00	-1.00000E 02
21	-.25000E 01	-.13633E 01	-.11367E 01	.83376E 02
22	-.15000E 01	-.16608E 01	.16079E 00	-.96818E 01
23	-.24000E 01	-.16731E 01	-.72687E 00	.43444E 02
24	-.17000E 01	-.12367E 01	-.46328E 00	.37460E 02
25	-.60000E 00	-.18049E 01	.12049E 01	-.66756E 02
26	-.80000E 00	-.16284E 01	.82841E 00	-.50872E 02
27	-.42000E 01	-.15172E 01	-.26828E 01	.17683E 03
28	.00000E 00	-.39874E 00	.39874E 00	-1.00000E 02
29	-.17000E 01	-.10624E 01	-.63762E 00	.60018E 02
30	-.62000E 01	-.16515E 01	-.45485E 01	.27541E 03
31	.00000E 00	-.15151E 01	.15151E 01	-1.00000E 02
32	-.20000E 01	-.18292E 01	-.17078E 00	.93359E 01
33	-.90000E 00	-.15151E 01	.61510E 00	-.40598E 02
34	-.17000E 01	-.22434E 01	.54340E 00	-.24222E 02
35	-.10000E 01	-.13787E 01	.37873E 00	-.27470E 02
36	-.25000E 01	-.20849E 01	-.41509E 00	.19909E 02
37	.00000E 00	-.17116E 01	.17116E 01	-1.00000E 02
38	-.10000E 01	-.14919E 01	.49193E 00	-.32973E 02
39	-.25000E 01	-.13827E 01	-.11173E 01	.80801E 02
40	-.43000E 01	-.14975E 01	-.28025E 01	.18715E 03
41	-.25000E 01	-.14136E 01	-.10864E 01	.76858E 02
42	-.28000E 01	-.18754E 01	-.92460E 00	.49301E 02
43	-.40000E 00	-.56695E 00	.16695E 00	-.29448E 02
44	-.40000E 00	-.14936E 01	.10936E 01	-.73220E 02
45	-.24000E 01	-.19032E 01	-.49678E 00	.26102E 02
46	-.47000E 01	-.29506E 01	-.17494E 01	.59291E 02
47	-.11000E 01	-.15252E 01	.42522E 00	-.27879E 02
48	.12000E 01	-.13827E 01	.25827E 01	-.18678E 03
49	-.30000E 00	-.19401E 01	.16401E 01	-.84537E 02
50	-.18000E 01	-.14751E 01	-.32485E 00	.22022E 02
51	.50000E 00	-.10470E 01	.15470E 01	-.14776E 03
52	-.40000E 01	-.16315E 01	-.23685E 01	.14517E 03
53	-.22000E 01	-.56079E 00	-.16392E 01	.29230E 03
54	.00000E 00	-.16546E 01	.16546E 01	-1.00000E 02
55	-.50000E 01	-.16639E 01	-.33361E 01	.20050E 03
56	-.50000E 01	-.17178E 01	-.32822E 01	.19108E 03
57	.00000E 00	-.22218E 01	.22218E 01	-1.00000E 02
58	-.10000E 01	-.18970E 01	.89698E 00	-.47285E 02
59	-.12000E 01	-.12014E 01	.13691E-02	-.11396E 00
60	.17000E 01	-.18723E 01	.35723E 01	-.19080E 03
61	-.20000E 01	-.13095E 01	-.69053E 00	.52734E 02
62	-.11000E 01	-.15120E 01	.41202E 00	-.27250E 02
63	-.33000E 01	-.22082E 01	-.10918E 01	.49440E 02
64	-.25000E 01	-.23007E 01	-.19926E 00	.86608E 01
65	.00000E 00	-.20849E 01	.20849E 01	-1.00000E 02
66	.00000E 00	-.20849E 01	.20849E 01	-1.00000E 02
67	-.20000E 01	-.13154E 01	-.68458E 00	.52043E 02

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AVERAGE DEVIATION .82023E-06 AVERAGE PCT DEV .18505E 00 AVE ABS PCT DEV .98040E 02

MAXIMUM DEVIATION .46796E 01 11

MAXIMUM PCT DEV .33919E 03 11

ROOT MEAN SQUARE DEVIATION .18525E 01

THE MINIMIZING VALUES OF THE PARAMETERS ARE

-.2363564E 01 .4309894E-02 -.8628004E-02 .3083198E 00 .5305241E 02
.1420299E-02 -.5385354E-02 .2755280E-02

THE MINIMAL VALUE OF THE SUM OF SQUARES .229937E 03

STABILITY OF PRODUCTION, Z_a JUST PRIOR TO INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

ANGOLA-ENERGY 1949-61
ALGERIA-PHOSPHATE 1953-62
INDONESIA-OIL 1907-40
MOROCCO-PHOSPHATE 1946-57
SIERRA LEONE-IRON 1943-62
FRENCH WEST AFRICA GROUP-DIAMONDS 1936-61
INDIA-IRON 1913-40
P.I.-CEMENT 1929-39
ANGOLA-IRON 1958-62
JAMAICA-CEMENT 1952-62
TRINIDAD-ENERGY 1949-61
FRENCH WEST AFRICA GROUP-ENERGY 1951-61
GHANA-GOLD 1944-57
MOROCCO-CEMENT 1945-55
ANGOLA-OIL 1958-62

33⅓-60% ABSOLUTE DEVIATION

SURINAM-ALUMINUM 1952-62
ANGOLA-MANGANESE 1953-62
GUINEA-ALUMINUM 1954-59
CONGO (LEO.)-DIAMONDS 1949-59
ISRAEL-CEMENT 1934-49
CONGO (LEO.)-MANGANESE 1955-62
ALGERIA-CEMENT 1950-61
BRITISH GUIANA-ENERGY 1949-61
INDONESIA-CEMENT 1933-39
GHANA-MANGANESE 1936-57
JAMAICA-ENERGY 1949-61
BRITISH GUIANA-DIAMONDS 1958-62
P.I.-GOLD 1921-41

60-150% ABSOLUTE DEVIATION

ANGOLA-DIAMONDS 1956-62
ANGOLA-CEMENT 1957-62
TRINIDAD-OIL 1951-62
GHANA-DIAMONDS 1947-57
EGYPT-NITRATES 1952-54
ALGERIA-ENERGY 1949-61
MOZAMBIQUE-ENERGY 1949-61
INDIA-CEMENT 1933-42
BURMA-SILVER 1930-41
GUINEA-IRON 1953-57
NIGERIA-OIL 1958-60
P.I.-COPPER 1937-41
INDONESIA-TIN 1945-48

BRITISH GUIANA-ALUMINUM 1947-62
NIGERIA-TIN 1940-62
CONGO (LEO.)-COPPER 1933-62
MOROCCO-IRON 1940-57
MALAYA-ENERGY 1949-57
NIGERIA-ENERGY 1949-61
BURMA-TIN 1922-39
JAMAICA-ALUMINUM 1954-62
MOROCCO-SILVER 1952-58
CONGO (LEO.)-SILVER 1932-60

OVER 150% ABSOLUTE DEVIATION

CONGO (LEO.)-TIN 1956-62
EGYPT-PHOSPHATE 1946-54
GHANA-ALUMINUM 1942-56
INDIA-ALUMINUM 1918-43
MALAYA-TIN 1949-57
MALAYA-ALUMINUM 1953-57
SIERRA LEONE-DIAMONDS 1955-62
GHANA-ENERGY 1949-57
SIERRA LEONE-ENERGY 1949-61
SENEGAL-CEMENT 1948-60
GHANA-SILVER 1938-58
MALAYA-IRON 1951-57
P.I.-IRON 1935-40
INDONESIA-MANGANESE 1920-28
P.I.-SILVER 1921-41
MOROCCO-MANGANESE 1944-52

Periods just prior to independence (continued)

Volume of production z_b

Average value: 411.

Standard deviation on predictable value: 966.7

Minimal value of the sum of squares:

62,611,400 XSIMEQF

Values of the parameters		Average values of the independent variables		Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	- 0.47		--	- 0.47	- 0.2
a_1	0.90	$\bar{x}_1$	16.1	14.5	7.8
a_2	- 0.43	$\bar{x}_2$	51.3	- 21.8	- 11.7
a_3	28.3	$\bar{x}_3$	1.23	34.8	18.6
a_4	- 2229.	$\bar{x}_4$	109.7	- 20.6	- 11.0
a_5	0.38	$\bar{x}_5$	154.	57.0	30.5
a_6	0.896	$\bar{\bar{x}}_6$	28.6	25.7	13.8
a_9	- 0.347	$\bar{x}_7$	35.0	- 12.1	- 6.4

zb

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	.13900E 04	.12717E 03	.12628E 04	.99299E 03
2	.35000E 02	.10854E 03	-.73535E 02	-.67752E 02
3	.45000E 03	.98752E 02	.35125E 03	.35569E 03
4	.57000E 01	.37510E 02	-.31810E 02	-.84804E 02
5	.53000E 01	.85259E 02	-.79959E 02	-.93784E 02
6	.39000E 02	.61329E 02	-.22329E 02	-.36408E 02
7	.62000E 00	.22325E 02	-.21705E 02	-.97223E 02
8	.78000E 02	.85259E 02	-.72592E 01	-.85142E 01
9	.54000E 02	.10797E 03	-.53970E 02	-.49986E 02
10	.38100E 03	.59077E 02	.32192E 03	.54492E 03
11	.40000E 02	.13166E 03	-.91659E 02	-.69618E 02
12	.18000E 02	.60605E 02	-.42605E 02	-.70299E 02
13	.28000E 01	.94282E 02	-.91482E 02	-.97030E 02
14	.10300E 03	.10243E 03	.57036E 00	.55683E 00
15	.26300E 03	.50321E 02	.21268E 03	.42264E 03
16	.38000E 02	.66599E 02	-.28599E 02	-.42942E 02
17	.24000E 02	.99884E 02	-.75884E 02	-.75972E 02
18	.17000E 02	.93925E 02	-.76925E 02	-.81900E 02
19	.31000E 01	.43449E 02	-.40349E 02	-.92865E 02
20	.16100E 03	.59230E 02	.10177E 03	.17182E 03
21	.27400E 04	.98734E 02	.26413E 04	.26751E 04
22	.20700E 03	.95131E 02	.11187E 03	.11759E 03
23	.12400E 04	.93999E 02	.11460E 04	.12192F 04
24	.15000E 02	.71988E 02	-.56988E 02	-.79163E 02
25	.17000E 03	.42704E 02	.12730E 03	.29809E 03
26	.76000E 00	.64053E 02	-.63293E 02	-.98813E 02
27	.24000E 00	.63863E 02	-.63623E 02	-.99624E 02
28	.16000E 01	.10483E 02	-.88831E 01	-.84737E 02
29	.30000E 01	.32984E 02	-.29984E 02	-.90905E 02
30	.14000E 01	.95980E 02	-.94580E 02	-.98541E 02
31	.65000E 01	.10114E 03	-.94639E 02	-.93573E 02
32	.18000E 01	.80923E 02	-.79123E 02	-.97776E 02
33	.30000E 02	.10114E 03	-.71139E 02	-.70338E 02
34	.40000E 01	.32976E 02	-.28976E 02	-.87870E 02
35	.58000E 01	.97319E 02	-.91519E 02	-.94040E 02
36	.13000E 02	.22325E 02	-.93251E 01	-.41769E 02
37	.35000E 02	.10562E 03	-.70619E 02	-.66862E 02
38	.16000E 02	.86674E 02	-.70674E 02	-.81540E 02
39	.63000E 02	.13138E 03	-.68376E 02	-.52046E 02
40	.45000E 03	.66418E 02	.38358E 03	.57753E 03
41	.14000E 02	.12855E 03	-.11455E 03	-.89109E 02
42	.30000E 03	.84521E 02	.21548E 03	.25494E 03
43	.10600E 03	-.52019E 01	.11120E 03	-.21377E 04
44	.56000E 02	.99035E 02	-.43035E 02	-.43454E 02
45	.67000E 02	.74134E 02	-.71338E 01	-.96229E 01
46	.29000E 02	.12315E 03	-.94154E 02	-.76452E 02
47	.41000E 02	.63872E 02	-.22872E 02	-.35809E 02
48	.31400E 04	.13138E 03	.30086E 04	.22901E 04
49	.67000E 03	.78581E 02	.59142E 03	.75263E 03
50	.15400E 04	.10073E 03	.14393E 04	.14288E 04
51	.50400E 03	.34398E 02	.46960E 03	.13652E 04
52	.13900E 04	.63770E 02	.13262E 04	.20797E 04
53	.41000E 02	-.46361E 01	.45636E 02	-.98436E 03
54	.21700E 04	.95697E 02	.20743E 04	.21676E 04
55	.17400E 03	.94848E 02	.79152E 02	.83451E 02
56	.17400E 03	.10505E 03	.68946E 02	.65630E 02
57	.47000E 02	.34956E 02	.12044E 02	.34455E 02
58	.56800E 04	.82541E 02	.55975E 04	.67814E 04
59	.20200E 03	.61329E 02	.14067E 03	.22937E 03
60	.64000E 03	.84804E 02	.55520E 03	.65468E 03
61	.17900E 03	.43427E 02	.13557E 03	.31219E 03
62	.16000E 03	.10142E 03	.58578E 02	.57757E 02
63	.39000E 02	.11010E 02	.27990E 02	.25422E 03
64	.55000E 00	.25237E 01	-.19737E 01	-.78207E 02
65	.53000E 01	.22325E 02	-.17025E 02	-.76260E 02
66	.37800E 03	.22325E 02	.35567E 03	.15932E 04
67	.16500E 04	.71049E 02	.15790E 04	.22223E 04

AVERAGE DEVIATION .33750E 03 AVERAGE PCT DEV .36218E 03 AVE ABS PCT DEV .53345E 03

MAXIMUM DEVIATION .55975E 04 58

MAXIMUM PCT DEV .67814E 04 58

ROOT MEAN SQUARE DEVIATION .96669E 03

THE MINIMIZING VALUES OF THE PARAMETERS ARE

-.4678031E 00 .9014508E 00 -.4296388E 00 .2828761E 02 -.2229236E 04
.3800716E 00 .8962025E 00 -.3467766E 00

THE MINIMAL VALUE OF THE SUM OF SQUARES .626114E 08

VOLUME OF PRODUCTION, z_b
JUST PRIOR TO INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

FRENCH WEST AFRICA GROUP-DIAMONDS 1936-61
MOROCCO-SILVER 1952-58
P.I.-GOLD 1921-41

33⅓-60% ABSOLUTE DEVIATION

ALGERIA-PHOSPHATE 1953-62
TRINIDAD-OIL 1951-62
SIERRA LEONE-IRON 1943-62
MOROCCO-IRON 1940-57
MALAYA-ENERGY 1949-57
ANGOLA-IRON 1958-62
BRITISH GUIANA-DIAMONDS 1958-62
P.I.-IRON 1935-40
INDONESIA-MANGANESE 1920-28

60-150% ABSOLUTE DEVIATION

ANGOLA-CEMENT 1957-62
ANGOLA-ENERGY 1949-61
EGYPT-PHOSPHATE 1946-54
GHANA-ALUMINUM 1942-56
ISRAEL-CEMENT 1934-49
MALAYA-ALUMINUM 1953-57
P.I.-CEMENT 1929-39
EGYPT-NITRATES 1952-54
MOZAMBIQUE-ENERGY 1949-61
NIGERIA-ENERGY 1949-61
GHANA-ENERGY 1949-57
ALGERIA-ENERGY 1949-61
FRENCH WEST AFRICA GROUP-ENERGY 1951-61
ALGERIA-CEMENT 1950-61
TRINIDAD-ENERGY 1949-61
JAMAICA-CEMENT 1952-62
SIERRA LEONE-ENERGY 1949-61
BRITISH GUIANA-ENERGY 1949-61
INDONESIA-CEMENT 1933-39
GHANA-GOLD 1944-57
SENEGAL-CEMENT 1948-60
JAMAICA-ENERGY 1949-61
MOROCCO-CEMENT 1945-55
GHANA-SILVER 1938-58
GUINEA-IRON 1953-57
MALAYA-IRON 1951-57
ANGOLA-OIL 1958-62
P.I.-SILVER 1921-41
NIGERIA-OIL 1958-60
P.I.-COPPER 1937-41

OVER 150% ABSOLUTE DEVIATION

SURINAM-ALUMINUM 1952-62
ANGOLA-DIAMONDS 1956-62
ANGOLA-MANGANESE 1953-62
GUINEA-ALUMINUM 1954-59
CONGO (LEO.)-TIN 1956-62
INDONESIA-OIL 1907-40
CONGO (LEO.)-DIAMONDS 1949-59
MALAYA-TIN 1949-57
CONGO (LEO.)-COPPER 1933-62
MOROCCO-PHOSPHATE 1946-57
NIGERIA-TIN 1940-62
BRITISH GUIANA-ALUMINUM 1947-62
INDIA-ALUMINUM 1918-43
GHANA-DIAMONDS 1947-57
INDIA-IRON 1913-40
CONGO (LEO.)-MANGANESE 1955-62
SIERRA LEONE-DIAMONDS 1955-62
BURMA-TIN 1922-39
GHANA-MANGANESE 1936-57
JAMAICA-ALUMINUM 1954-62
INDIA-CEMENT 1933-42
BURMA-SILVER 1930-41
CONGO (LEO.)-SILVER 1932-60
MOROCCO-MANGANESE 1944-52
INDONESIA-TIN 1945-48

Periods just after independence

Corrected growth index y_f

Average value: 13.1

Standard deviation on predictable value: 23.94

Minimal value of the sum of squares:

30376.5 ISIMEQ

	Values of the parameters		Average values of the independent variables	Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	- 27.2		--	- 27.2	- 23.1
a_1	0.916	$\bar{x}_1$	19.3	17.7	15.0
a_2	- 0.0567	$\bar{x}_2$	63.8	- 3.6	- 3.1
a_3	21.4	$\bar{x}_3$	1.69	36.3	31.0
a_4	1031.4	$\bar{x}_4$	104.4	9.9	8.5
a_5	- 0.00958	$\bar{x}_5$	169.	- 1.6	- 1.4
a_6	- 0.0565	$\bar{x}_6$	110.1	- 6.2	- 5.2
a_7	$- 5.17 \times 10^{-7}$				
a_8	- 5191.3	$\bar{x}_8$	177.	- 14.9	- 12.7

This run had only 53 sets of observations in it. When all 54 were present a singularity in the matrix prevented the solution of the normal equations and no parameter estimates could be obtained. The numbering in the computer print out still refers to the ordering of the data in the tables at the end of section B.

y_f

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
2	.65400E 02	.12010E 02	.53390E 02	.44454E 03
3	.50100E 02	.14536E 02	.35564E 02	.24466E 03
4	.67800E 02	.15754E 02	.52046E 02	.33036E 03
5	.67700E 02	.15956E 02	.51744E 02	.32428E 03
6	.31200E 02	.15548E 02	.15652E 02	.10067E 03
7	.58200E 02	.12300E 02	.45900E 02	.37318E 03
8	.55400E 02	.12131E 02	.43269E 02	.35668E 03
9	.15000E 02	.10494E 02	.45059E 01	.42938E 02
10	.12100E 02	.13357E 02	-.12572E 01	-.94122E 01
11	.12100E 02	.18540E 02	-.64402E 01	-.34736E 02
12	.42900E 02	.17230E 02	.25670E 02	.14898E 03
13	.31800E 02	.68762E 01	.24924E 02	.36246E 03
14	-.43000E 01	.16711E 02	-.21011E 02	-.12573E 03
15	.31500E 02	.17349E 02	.14151E 02	.81562E 02
16	.27100E 02	.16646E 02	.10454E 02	.62806E 02
17	.27000E 02	.20847E 02	.61532E 01	.29516E 02
18	.26800E 02	.93308E 01	.17469E 02	.18722E 03
19	.25800E 02	.12002E 02	.13798E 02	.11496E 03
20	.24800E 02	.13454E 02	.11346E 02	.84331E 02
21	.24800E 02	.12482E 02	.12318E 02	.98685E 02
22	.21800E 02	.75049E 01	.14295E 02	.19048E 03
23	.19200E 02	.20903E 02	-.17026E 01	-.81453E 01
24	.18400E 02	.17303E 02	.10966E 01	.63377E 01
25	-.42600E 02	.85789E 01	-.51179E 02	-.59657E 03
26	.17500E 02	.19972E 02	-.24721E 01	-.12378E 02
27	.16100E 02	.68767E 01	.92233E 01	.13412E 03
28	.15300E 02	-.28291E 00	.15583E 02	-.55080E 04
29	.14900E 02	.20746E 02	-.58465E 01	-.28181E 02
30	-.16300E 02	.89315E 01	-.25232E 02	-.28250E 03
31	.14500E 02	.19833E 02	-.53331E 01	-.26890E 02
32	.13900E 02	.90610E 01	.48390E 01	.53405E 02
33	.13900E 02	.20404E 02	-.65045E 01	-.31878E 02
34	.13300E 02	.88232E 01	.44768E 01	.50740E 02
35	.12600E 02	.13319E 02	-.71945E 00	-.54015E 01
36	.12000E 02	.17855E 02	-.58546E 01	-.32790E 02
37	.11400E 02	.20885E 02	-.94847E 01	-.45415E 02
38	.82000E 01	.63531E 01	.18469E 01	.29072E 02
39	.55000E 01	.81059E 01	-.26059E 01	-.32148E 02
40	.46000E 01	-.46546E 01	.92546E 01	-.19883E 03
41	.27000E 01	.20763E 02	-.18063E 02	-.86996E 02
42	.20000E 01	.12265E 02	-.10265E 02	-.83694E 02
43	.11000E 01	.11977E 02	-.10877E 02	-.90816E 02
44	.70000E 00	.17590E 02	-.16890E 02	-.96020E 02
45	-.29000E 01	.83601E 01	-.11260E 02	-.13469E 03
46	-.87000E 01	.11284E 02	-.19984E 02	-.17710E 03
47	-.96000E 01	.68615E 01	-.16462E 02	-.23991E 03
48	-.10700E 02	.82752E 01	-.18975E 02	-.22930E 03
49	-.14300E 02	-.43782E 01	-.99218E 01	.22662E 03
50	-.16100E 02	.67341E 01	-.22834E 02	-.33908E 03
51	-.17100E 02	.21103E 02	-.38203E 02	-.18103E 03
52	-.18700E 02	.13989E 01	-.20099E 02	-.14367E 04
53	-.24200E 02	.61462E 01	-.30346E 02	-.49374E 03
54	-.56300E 02	.83434E 01	-.64643E 02	-.77479E 03

AVERAGE DEVIATION .83968E 00 AVERAGE PCT DEV -.13706E 03 AVE ABS PCT DEV .29097E 03

MAXIMUM DEVIATION -.64643E 02 54

MAXIMUM PCT DEV .55080E 04 28

ROOT MEAN SQUARE DEVIATION .23940E 02

THE MINIMIZING VALUES OF THE PARAMETERS ARE

-.2719929E 02 .9159631E 00 -.5667169E-01 .2139391E 02 .1031401E 04
-.9584059E-02 -.5653932E-01 -.5168014E-06 -.5191343E 04

THE MINIMAL VALUE OF THE SUM OF SQUARES .303765E 05

Y_f
JUST AFTER INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

- GHANA-ALUMINUM 1957-62
- GHANA-MANGANESE 1957-62
- MALAYA-ALUMINUM 1957-62
- INDIA-ENERGY 1949-61
- INDIA-NITRATES 1944/5-60/1
- INDIA-IRON 1947-62
- INDIA-CEMENT 1948-62
- P.I.-ENERGY 1949-61
- INDIA-PHOSPHATE 1948-62
- INDIA-ALUMINUM 1948-62
- ISRAEL-PHOSPHATE 1952-58

33⅓-60% ABSOLUTE DEVIATION

- INDIA-GOLD 1952-62
- ISRAEL-CEMENT 1949-61
- EGYPT-CEMENT 1952-62
- EGYPT-ENERGY 1955-61
- ISRAEL-NITRATES 1955/6-61/2
- NIGERIA-CEMENT 1958-62

60-150% ABSOLUTE DEVIATION

- GHANA-ENERGY 1957-61
- MALAYA-ENERGY 1957-61
- BURMA-TIN 1947-62
- BURMA-OIL 1948-62
- INDIA-COPPER 1948-62
- MOROCCO-ENERGY 1957-61
- BURMA-ENERGY 1949-61
- ISRAEL-ENERGY 1949-61
- INDONESIA-CEMENT 1951-62
- P.I.-COPPER 1946-62
- MALAYA-IRON 1957-62
- P.I.-IRON 1949-54
- P.I.-SILVER 1948-62
- NIGERIA-OIL 1960-62

OVER 150% ABSOLUTE DEVIATION

- INDONESIA-ALUMINUM 1949-53
- MOROCCO-CEMENT 1956-58
- GHANA-DIAMONDS 1957-62
- INDIA-OIL 1947-62
- MOROCCO-IRON 1957-62
- GUINEA-IRON 1957-62
- EGYPT-PHOSPHATE 1954-62
- MOROCCO-SILVER 1958-62
- INDONESIA-OIL 1949-62
- MOROCCO-PHOSPHATE 1957-62
- EGYPT-NITRATES 1954-61
- INDONESIA-TIN 1948-54
- GHANA-SILVER 1958-62
- GHANA-GOLD 1957-62
- EGYPT-IRON 1956-62
- MOROCCO-COPPER 1957-62
- BURMA-SILVER 1951-62
- INDIA-MANGANESE 1945-53
- P.I.-GOLD 1947-52
- P.I.-CEMENT 1945-50
- ISRAEL-POTASH 1953-58
- INDONESIA-MANGANESE 1952-56

Periods just after independence (continued)

Corrected growth index y_g

Average value: 6.0

Standard deviation on predictable value: 26.14

Minimal value of the sum of squares:

36903.5 XSIMEQF

Value of the parameters		Average values of the independent variables		Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	30.10		--	30.10	15.3
a_1	3.76	$\bar{x}_1$	19.1	71.6	36.3
a_2	- 0.11	$\bar{x}_2$	62.8	- 6.91	- 3.5
a_3	- 14.69	$\bar{x}_3$	1.67	- 24.60	- 12.5
a_4	50.60	$\bar{x}_4$	107.1	0.471	0.2
a_5	- 0.11	$\bar{x}_5$	168.0	- 18.5	- 9.4
a_6	- 0.354	$\bar{x}_6$	108.0	- 38.2	- 19.4
a_7	$- 6.36 \times 10^{-6}$				
a_8	1257.	$\bar{x}_8$	185	- 7.29	- 3.7

y_g

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	.10860E 03	.16738E 02	.91862E 02	.54884E 03
2	.38100E 02	-.11570E 02	.49670E 02	-.42931E 03
3	.59000E 02	.19516E 02	.39484E 02	.20232E 03
4	.40300E 02	.12100E 02	.28200E 02	.23304E 03
5	.44700E 02	.12895E 02	.31805E 02	.24664E 03
6	.44700E 02	.17620E 02	.27080E 02	.15368E 03
7	.25000E 02	.16362E 02	.86377E 01	.52790E 02
8	.22200E 02	.74982E 01	.14702E 02	.19607E 03
9	.58000E 01	.20908E 02	-.15108E 02	-.72260E 02
10	.19400E 02	.20571E 02	-.11714E 01	-.56944E 01
11	.11000E 02	.16904E 02	-.59039E 01	-.34926E 02
12	.89000E 01	.11135E 02	-.22351E 01	-.20073E 02
13	.25900E 02	-.90533E 01	.34953E 02	-.38608E 03
14	-.11600E 02	.11694E 02	-.23294E 02	-.19919E 03
15	.27900E 02	.30518E 01	.24848E 02	.81421E 03
16	.20300E 02	.11879E 02	.84206E 01	.70884E 02
17	.19000E 02	.67310E 01	.12269E 02	.18227E 03
18	.21300E 02	-.26649E 01	.23965E 02	-.89927E 03
19	.13900E 02	-.11082E 02	.24982E 02	-.22542E 03
20	.11000E 02	.20287E 02	-.92869E 01	-.45778E 02
21	.11000E 02	.64869E 01	.45131E 01	.69574E 02
22	.15100E 02	.10355E 02	.47448E 01	.45820E 02
23	.23100E 02	.60952E 01	.17005E 02	.27898E 03
24	.46000E 01	.10920E 02	-.63202E 01	-.57876E 02
25	-.73200E 02	.74600E 01	-.80660E 02	-.10812E 04
26	.32000E 01	.90087E 01	-.58087E 01	-.64479E 02
27	.23000E 01	-.90549E 01	.11355E 02	-.12540E 03
28	.35000E 01	-.33393E 01	.68393E 01	-.20481E 03
29	.90000E 01	.65531E 01	.24469E 01	.37340E 02
30	-.23100E 02	-.19777E 01	-.21122E 02	.10680E 04
31	.10700E 02	.85930E 01	.21070E 01	.24520E 02
32	1.00000E-01	-.23531E 01	.24531E 01	-.10425E 03
33	1.00000E-01	.79315E 01	-.78315E 01	-.98739E 02
34	1.00000E-01	-.16704E 01	.17704E 01	-.10599E 03
35	-.18000E 01	.20681E 02	-.22481E 02	-.10870E 03
36	.46000E 01	.16392E 01	.29608E 01	.18063E 03
37	-.10800E 02	.66234E 01	-.17423E 02	-.26306E 03
38	-.12600E 02	.12832E 02	-.25432E 02	-.19819E 03
39	-.19000E 01	.88091E 01	-.10709E 02	-.12157E 03
40	-.49000E 01	-.11349E 01	-.37651E 01	.33174E 03
41	-.27000E 01	.65062E 01	-.92062E 01	-.14150E 03
42	.15000E 02	.66417E 01	.83583E 01	.12584E 03
43	-.10800E 02	.74777E 01	-.18278E 02	-.24443E 03
44	1.00000E-01	.23972E 01	-.22972E 01	-.95828E 02
45	-.35000E 01	.76214E 01	-.11121E 02	-.14592E 03
46	.39000E 01	-.95900E 01	.13490E 02	-.14067E 03
47	-.40600E 02	-.85353E 01	-.32065E 02	.37567E 03
48	-.65000E 01	-.21061E 00	-.62894E 01	.29863E 04
49	-.17600E 02	.99762E 01	-.27576E 02	-.27642E 03
50	-.19400E 02	-.86366E 01	-.10763E 02	.12463E 03
51	-.43000E 01	.59882E 01	-.10288E 02	-.17181E 03
52	-.51000E 01	.17489E 02	-.22589E 02	-.12916E 03
53	-.32900E 02	-.83527E 01	-.24547E 02	.29389E 03
54	-.69800E 02	-.43759E 01	-.65424E 02	.14951E 04

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AVERAGE DEVIATION -.14125E-02 AVERAGE PCT DEV .72977E 02 AVE ABS PCT DEV .30253E 03

MAXIMUM DEVIATION .91862E 02 1

MAXIMUM PCT DEV .29863E 04 48

ROOT MEAN SQUARE DEVIATION .26142E 02

THE MINIMIZING VALUES OF THE PARAMETERS ARE

.3009974E 02 .3760542E 01 -.1095460E 00 -.1469055E 02 .5059630E 02
-.1085057E 00 -.3539271E 00 -.6360214E-05 .1257630E 04

THE MINIMAL VALUE OF THE SUM OF SQUARES .369035E 05

Y_g

JUST AFTER INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

ISRAEL-PHOSPHATE 1952-58
P.I.-SILVER 1948-62
INDIA-NITRATES 1944/5-60/1

33⅓-60% ABSOLUTE DEVIATION

ISRAEL-ENERGY 1949-61
INDIA-IRON 1947-62
ISRAEL-NITRATES 1955/6-61/2
INDIA-MANGANESE 1945-53
P.I.-ENERGY 1949-61
GHANA-GOLD 1957-62

60-150% ABSOLUTE DEVIATION

NIGERIA-CEMENT 1958-62
BURMA-ENERGY 1949-61
INDIA-CEMENT 1948-62
GHANA-ALUMINUM 1957-62
BURMA-OIL 1948-62
GHANA-ENERGY 1957-61
P.I.-COPPER 1946-62
EGYPT-ENERGY 1955-61
EGYPT-CEMENT 1952-62
ISRAEL-CEMENT 1949-61
MALAYA-ENERGY 1957-61
MOROCCO-IRON 1957-62
MOROCCO-ENERGY 1957-61
INDIA-COPPER 1948-62
INDONESIA-OIL 1949-62
GHANA-DIAMONDS 1957-62
INDIA-ENERGY 1949-61

OVER 150% ABSOLUTE DEVIATION

GHANA-MANGANESE 1957-62
EGYPT-PHOSPHATE 1954-62
GUINEA-IRON 1957-62
MALAYA-ALUMINUM 1957-62
INDONESIA-TIN 1948-54
BURMA-SILVER 1951-62
MOROCCO-PHOSPHATE 1957-62
INDIA-OIL 1947-62
INDONESIA-ALUMINUM 1949-53
MOROCCO-CEMENT 1956-58
MOROCCO-SILVER 1958-62
BURMA-TIN 1947-62
INDIA-GOLD 1952-62
EGYPT-NITRATES 1954-61
GHANA-SILVER 1958-62
INDIA-PHOSPHATE 1948-62
INDONESIA-CEMENT 1951-62
EGYPT-IRON 1956-62
INDIA-ALUMINUM 1948-62
MALAYA-IRON 1957-62
P.I.-IRON 1949-54
MOROCCO-COPPER 1957-62
GUINEA-ALUMINUM 1959-62
INDONESIA-MANGANESE 1952-56
ISRAEL-POTASH 1953-58
P.I.-CEMENT 1945-50
P.I.-GOLD 1947-52
NIGERIA-OIL 1960-62

Y_8

Periods just after independence (continued)

Stability of production z_a

Average value: - 1.88

Standard deviation on predictable value: 2.210

Minimal value of the sum of squares:

263.785 XSIMEQF

Values of the parameters		Average values of the independent variables		Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	- 10.60	--		- 10.60	- 34.4
a_1	0.135	$\bar{x}_1$	19.1	2.57	8.3
a_2	- 0.041	$\bar{x}_2$	62.8	- 2.58	- 8.4
a_3	3.26	$\bar{x}_3$	1.67	5.45	17.7
a_4	320.0	$\bar{x}_4$	107.1	2.99	9.7
a_5	- 0.0082	$\bar{x}_5$	168.	- 1.38	- 4.5
a_6	0.028	$\bar{x}_6$	108.0	3.03	9.8
a_9	- 0.022	$\bar{x}_7$	100.2	- 2.24	- 7.2

The deviation histogram on the following page shows an overly large bar for the absolute range 60 - 150 %. This is due to the large number of stability measures which were zero. Any percentage deviation calculated on a zero base is nominally $\pm$ 100 %. Such values are tabulated above the other absolute percentage deviations in the 60 - 120 % range and separated from them by a horizontal line.

Z_a

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	-.33000E 01	-.42335E 01	.93352E 00	-.22051E 02
2	-.25000E 01	-.22666E 01	-.23344E 00	.10299E 02
3	-.40000E 01	-.18021E 01	-.21979E 01	.12197E 03
4	-.40000E 01	-.71816E 00	-.32818E 01	.45698E 03
5	.00000E 00	-.62043E 00	.62043E 00	-1.00000E 02
6	.00000E 00	-.43414E 00	.43414E 00	-1.00000E 02
7	.00000E 00	-.95215E 00	.95215E 00	-1.00000E 02
8	-.33000E 01	-.27733E 01	-.52670E 00	.18992E 02
9	-.25000E 01	-.12160E 01	-.12840E 01	.10559E 03
10	-.17000E 01	-.19649E 01	.26495E 00	-.13484E 02
11	-.17000E 01	-.11831E 01	-.51692E 00	.43692E 02
12	-.36000E 01	-.49011E 00	-.31099E 01	.63452E 03
13	.00000E 00	-.16666E 01	.16666E 01	-1.00000E 02
14	.40000E 01	-.55527E 00	.45553E 01	-.82037E 03
15	-.40000E 01	-.26459E 01	-.13541E 01	.51178E 02
16	-.60000E 00	-.55527E 00	-.44730E-01	.80556E 01
17	.00000E 00	-.85442E 00	.85442E 00	-1.00000E 02
18	-.67000E 01	-.24822E 01	-.42178E 01	.16993E 03
19	-.11000E 01	-.22340E 01	.11340E 01	-.50760E 02
20	.00000E 00	-.19649E 01	.19649E 01	-1.00000E 02
21	-.80000E 00	-.27733E 01	.19733E 01	-.71154E 02
22	.00000E 00	-.27622E 01	.27622E 01	-1.00000E 02
23	-.43000E 01	-.88700E 00	-.34130E 01	.38478E 03
24	.00000E 00	-.49011E 00	.49011E 00	-1.00000E 02
25	.00000E 00	-.27622E 01	.27622E 01	-1.00000E 02
26	.00000E 00	-.85442E 00	.85442E 00	-1.00000E 02
27	.00000E 00	-.16666E 01	.16666E 01	-1.00000E 02
28	-.33000E 01	-.23969E 01	-.90313E 00	.37680E 02
29	.13000E 01	-.88700E 00	.21870E 01	-.24656E 03
30	-.29000E 01	-.25147E 01	-.38527E 00	.15320E 02
31	-.25000E 01	-.91958E 00	-.15804E 01	.17186E 03
32	.00000E 00	-.25147E 01	.25147E 01	-1.00000E 02
33	.00000E 00	-.85442E 00	.85442E 00	-1.00000E 02
34	.00000E 00	-.25147E 01	.25147E 01	-1.00000E 02
35	-.17000E 01	-.19649E 01	.26495E 00	-.13484E 02
36	-.40000E 01	-.26459E 01	-.13541E 01	.51178E 02
37	-.20000E 01	-.85442E 00	-.11456E 01	.13408E 03
38	-.60000E 01	-.27622E 01	-.32378E 01	.11721E 03
39	-.80000E 01	-.27622E 01	-.52378E 01	.18962E 03
40	.00000E 00	-.16666E 01	.16666E 01	-1.00000E 02
41	-.70000E 00	-.88700E 00	.18700E 00	-.21082E 02
42	-.21000E 01	-.28059E 01	.70588E 00	-.25157E 02
43	-.53000E 01	-.28059E 01	-.24941E 01	.88889E 02
44	.00000E 00	-.26459E 01	.26459E 01	-1.00000E 02
45	.00000E 00	-.27948E 01	.27948E 01	-1.00000E 02
46	.00000E 00	-.22666E 01	.22666E 01	-1.00000E 02
47	.00000E 00	-.16340E 01	.16340E 01	-1.00000E 02
48	-.13000E 01	-.25147E 01	.12147E 01	-.48305E 02
49	-.60000E 01	-.42987E 01	-.17013E 01	.39578E 02
50	-.40000E 01	-.16666E 01	-.23334E 01	.14001E 03
51	.00000E 00	-.85442E 00	.85442E 00	-1.00000E 02
52	.00000E 00	-.27622E 01	.27622E 01	-1.00000E 02
53	-.50000E 01	-.17643E 01	-.32357E 01	.18340E 03
54	-.75000E 01	-.23317E 01	-.51683E 01	.22165E 03

AVERAGE DEVIATION -.20089E-06 AVERAGE PCT DEV -.66558E 00 AVE ABS PCT DEV .12646E 03

MAXIMUM DEVIATION -.52378E 01 39

MAXIMUM PCT DEV .82037E 03 14

ROOT MEAN SQUARE DEVIATION .22102E 01

THE MINIMIZING VALUES OF THE PARAMETERS ARE

-.1059864E 02 .1354102E 00 -.4080167E-01 .3257763E 01 .3200167E 03
-.8197627E-02 .2840935E-01 -.2243005E-01

THE MINIMAL VALUE OF THE SUM OF SQUARES .263785E 03

STABILITY OF PRODUCTION, Z_a
JUST AFTER INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

- BURMA-OIL 1948-62
- INDIA-COPPER 1948-62
- ISRAEL-CEMENT 1949-61
- EGYPT-NITRATES 1954-61
- P.I.-COPPER 1946-62
- ISRAEL-PHOSPHATE 1952-58
- BURMA-SILVER 1951-62
- INDONESIA-MANGANESE 1952-56
- GUINEA-ALUMINUM 1959-62

33⅓-60% ABSOLUTE DEVIATION

- GUINEA-IRON 1957-62
- EGYPT-PHOSPHATE 1954-62
- MALAYA-ALUMINUM 1957-62
- INDONESIA-TIN 1948-54
- INDONESIA-CEMENT 1951-62
- MALAYA-IRON 1957-62
- ISRAEL-NITRATES 1955/6-61/2

60-150% ABSOLUTE DEVIATION

- GHANA-DIAMONDS 1957-62
- INDIA-OIL 1947-62
- MALAYA-ENERGY 1957-61
- GHANA-ENERGY 1957-61
- INDONESIA-OIL 1949-62
- MOROCCO-SILVER 1958-62
- MOROCCO-PHOSPHATE 1957-62
- EGYPT-ENERGY 1955-61
- INDIA-ENERGY 1949-61
- EGYPT-CEMENT 1952-62
- MOROCCO-ENERGY 1957-61
- INDIA-CEMENT 1948-62
- GHANA-SILVER 1958-62
- P.I.-ENERGY 1949-61
- BURMA-ENERGY 1949-61
- ISRAEL-ENERGY 1949-61
- INDIA-ALUMINUM 1948-62
- MOROCCO-COPPER 1957-62
- P.I.-GOLD 1947-52
- NIGERIA-OIL 1960-62
- INDIA-MANGANESE 1945-53
- MOROCCO-IRON 1957-62
- BURMA-TIN 1947-62
- INDIA-GOLD 1952-62
- GHANA-MANGANESE 1957-62
- GHANA-GOLD 1957-62
- ISRAEL-PHOSPHATE 1952-58
- ISRAEL-POTASH 1953-58

OVER 150% ABSOLUTE DEVIATION

- INDONESIA-ALUMINUM 1949-53
- MOROCCO-CEMENT 1956-58
- GHANA-ALUMINUM 1957-62
- INDIA-NITRATES 1944/5-60/1
- INDIA-IRON 1947-62
- INDIA-PHOSPHATE 1948-62
- EGYPT-IRON 1956-62
- P.I.-IRON 1949-54
- P.I.-SILVER 1948-62
- P.I.-CEMENT 1945-50

Periods just after independence (continued)

Volume of production z_b

Average value: 185.

Standard deviation on predictable value: 431.4

Minimal value of the sum of squares:

10,048,900 XSIMBQF

Values of the parameters		Average values of the independent variables		Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	171.		--	171.	26.9
a_1	- 7.03	$\bar{x}_1$	19.1	- 164.	- 25.7
a_2	- 0.14	$\bar{x}_2$	62.8	- 8.8	- 1.4
a_3	- 50.44	$\bar{x}_3$	1.67	- 84.5	- 13.3
a_4	- 5326.	$\bar{x}_4$	320.0	- 49.7	- 7.8
a_5	0.451	$\bar{x}_5$	168.	75.8	11.9
a_6	0.764	$\bar{x}_6$	108.0	82.6	12.9
a_9	0.0052	$\bar{x}_7$	100.2	0.5	0.1

z_b

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	.59800E 03	.75619E 02	.52238E 03	.69081E 03
2	.21000E 02	.70820E 02	-.49820E 02	-.70347E 02
3	.37000E 01	.16233E 02	-.12533E 02	-.77207E 02
4	.18000E 02	.20404E 02	-.24042E 01	-.11783E 02
5	.99000E 02	.18891E 02	.80109E 02	.42406E 03
6	.20000E 02	-.17433E 02	.37433E 02	-.21472E 03
7	.13500E 04	.47943E 02	.13021F 04	.27159E 04
8	.67000E 02	.23933E 01	.64607E 02	.26995E 04
9	.50000E 01	-.53281E 01	.10328E 02	-.19384E 03
10	.24000E 02	.18755E 02	.52451E 01	.27967E 02
11	.15000E 02	.66498E 01	.83502E 01	.12557E 03
12	.22000E 02	.16874E 02	.51264E 01	.30381E 02
13	.36000E 01	.66957E 02	-.63357E 02	-.94623E 02
14	.39000E 02	.17882E 02	.21118E 02	.11809E 03
15	.11000E 03	.34340E 02	.75660E 02	.22033E 03
16	.51000E 02	.17882E 02	.33118E 02	.18520E 03
17	.52000E 02	.46430E 02	.55704E 01	.11998E 02
18	.56000E 01	.50328E 02	-.44728E 02	-.88873E 02
19	.62000E 02	.70316E 02	-.83156E 01	-.11826E 02
20	.60000E 01	.18755E 02	-.12755E 02	-.68008E 02
21	.20000E 01	.23933E 01	-.39327E 00	-.16432E 02
22	.19700E 03	.41954E 02	.15505E 03	.36956E 03
23	.20000E 01	.46934E 02	-.44934E 02	-.95739E 02
24	.84000E 01	.16874E 02	-.84736E 01	-.50218E 02
25	.59000E 00	.41954E 02	-.41364E 02	-.98594E 02
26	.21100E 03	.46430E 02	.16457E 03	.35445E 03
27	.35000E 01	.66957E 02	-.63457E 02	-.94773E 02
28	.18300E 04	.72838E 02	.17572E 04	.24124E 04
29	.31000E 02	.46934E 02	-.15934E 02	-.33950E 02
30	.40000E 02	.50832E 02	-.10832E 02	-.21310E 02
31	.15900E 03	.47438E 02	.11156E 03	.23517E 03
32	.16000E 02	.50832E 02	-.34832E 02	-.68524E 02
33	.13300E 03	.46430E 02	.86570E 02	.18646E 03
34	.60000E 02	.50832E 02	.91676E 01	.18035E 02
35	.31000E 02	.18755E 02	.12245E 02	.65291E 02
36	.17000E 02	.34340E 02	-.17340E 02	-.50494E 02
37	.45000E 02	.46430E 02	-.14296E 01	-.30790E 01
38	.40000E 03	.41954E 02	.35805E 03	.85342E 03
39	.88000E 02	.41954E 02	.46046E 02	.10975E 03
40	.18300E 04	.66957E 02	.17630E 04	.26331E 04
41	.28000E 02	.46934E 02	-.18934E 02	-.40342E 02
42	.25000E 01	.28976E 01	-.39764E 00	-.13723E 02
43	.56000E 02	.28976E 01	.53102E 02	.18326E 04
44	.66000E 02	.34340E 02	.31660E 02	.92198E 02
45	.15000E 01	.42458E 02	-.40958E 02	-.96467E 02
46	.15400E 03	.70820E 02	.83180E 02	.11745E 03
47	.46000E 02	.66453E 02	-.20453E 02	-.30778E 02
48	.16000E 03	.50832E 02	.10917C 03	.21476E 03
49	.14900E 02	.76628E 02	-.61728E 02	-.80555E 02
50	.30000E 02	.66957E 02	-.36957E 02	-.55195E 02
51	.45000E 01	.46430E 02	-.41930E 02	-.90308E 02
52	.12000E 04	.41954E 02	.11580E 04	.27603E 04
53	.20000E 02	.68470E 02	-.48470E 02	-.70790E 02
54	.59100E 03	.71829E 02	.51917E 03	.72279E 03

AVERAGE DEVIATION .14604E 03 AVERAGE PCT DEV .34046E 03 AVE ABS PCT DEV .40870E 03

MAXIMUM DEVIATION .17630E 04 40

MAXIMUM PCT DEV .27603E 04 52

ROOT MEAN SQUARE DEVIATION .43138E 03

THE MINIMIZING VALUES OF THE PARAMETERS ARE

.1714284E 03 -.7032324E 01 -.1397038E 00 -.5043755E 02 -.5326434E 04
.4513535E 00 .7635269E 00 .5171472E-02

THE MINIMAL VALUE OF THE SUM OF SQUARES .100489E 08

VOLUME OF PRODUCTION, Z_b, JUST AFTER INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

- MOROCCO-SILVER 1958-62
- INDIA-GOLD 1952-62
- EGYPT-CEMENT 1952-62
- EGYPT-NITRATES 1954-61
- BURMA-ENERGY 1949-61
- INDONESIA-CEMENT 1951-62
- P.I.-SILVER 1948-62
- ISRAEL-PHOSPHATE 1952-58

33⅓-60% ABSOLUTE DEVIATION

- MOROCCO-IRON 1957-62
- INDIA-COPPER 1948-62
- MALAYA-ALUMINUM 1957-62
- ISRAEL-CEMENT 1949-61
- INDIA-IRON 1947-62
- P.I.-ENERGY 1949-61
- ISRAEL-ENERGY 1949-61

60-150% ABSOLUTE DEVIATION

- MOROCCO-CEMENT 1956-58
- INDIA-OIL 1947-62
- GUINEA-IRON 1957-62
- INDONESIA-OIL 1949-62
- GHANA-ENERGY 1957-61
- MALAYA-ENERGY 1957-61
- BURMA-OIL 1948-62
- GHANA-ALUMINUM 1957-62
- EGYPT-ENERGY 1955-61
- MOROCCO-ENERGY 1957-61
- GHANA-SILVER 1958-62
- INDIA-PHOSPHATE 1948-62
- EGYPT-IRON 1956-62
- INDIA-ALUMINUM 1948-62
- P.I.-IRON 1949-54
- MOROCCO-COPPER 1957-62
- ISRAEL-NITRATES 1955/6-61/2
- P.I.-CEMENT 1945-50
- ISRAEL-POTASH 1953-58
- INDONESIA-MANGANESE 1952-56

OVER 150% ABSOLUTE DEVIATION

- INDONESIA-ALUMINUM 1949-53
- GHANA-DIAMONDS 1957-62
- EGYPT-PHOSPHATE 1954-62
- BURMA-TIN 1947-62
- MOROCCO-PHOSPHATE 1957-62
- GHANA-MANGANESE 1957-62
- INDIA-ENERGY 1949-61
- INDIA-NITRATES 1944/5-60/1
- INDONESIA-TIN 1948-54
- INDIA-CEMENT 1948-62
- GHANA-GOLD 1957-62
- P.I.-COPPER 1946-62
- MALAYA-IRON 1957-62
- NIGERIA-CEMENT 1958-62
- BURMA-SILVER 1951-62
- INDIA-MANGANESE 1945-53
- NIGERIA-OIL 1960-62
- P.I.-GOLD 1947-52
- GUINEA-ALUMINUM 1959-62

Z_b

It had been hoped that the results of the following four analyses would be superior to the previous eight. The reasons for this are 1) that the data for the dependent variables and the data for the independent variables were in every case taken at virtually the same dates and 2) this set includes the largest number of observations, eighty. The results of this set, however, appear no more promising than those of previous sets.

Recent periods not directly related to independence

Corrected growth index y_f

Average value: 6.8

Standard deviation on predictable value: 20.35

Minimal value of the sum of squares:

33142.0 XSIMEQF

Values of the parameters		Average values of the independent variables		Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	9.91		--	9.91	31.6
a_1	0.147	$\bar{x}_1$	15.1	2.23	7.1
a_2	0.017	$\bar{x}_2$	94.4	1.61	5.1
a_3	- 2.997	$\bar{x}_3$	1.45	- 4.34	- 13.7
a_4	61.07	$\bar{x}_4$	99.96	0.611	1.9
a_5	- 0.035	$\bar{x}_5$	234.	- 8.21	- 26.1
a_6	0.0424	$\bar{x}_6$	95.7	4.04	12.8
a_7	1.65×10^{-6}				
a_8	771.	$\bar{x}_8$	189.	0.52	1.7

y_f

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	.96900E 02	.60934E 01	.90807E 02	.14903E 04
2	.42900E 02	.70924E 01	.35808E 02	.50487E 03
3	.40400E 02	.54934E 01	.34907E 02	.63543E 03
4	.34100E 02	.11213E 02	.22887E 02	.20412E 03
5	-.39000E 01	.10501E 02	-.14401E 02	-.13714E 03
6	.31600E 02	-.28085E 01	.34408E 02	-.12252E 04
7	.31600E 02	.11190E 02	.20410E 02	.18239E 03
8	.31500E 02	.68949E 01	.24605E 02	.35686E 03
9	.28900E 02	.99039E 01	.18996E 02	.19180E 03
10	.28600E 02	.11712E 02	.16888E 02	.14420E 03
11	-.88000E 01	.63267E 01	-.15127E 02	-.23909E 03
12	-.10000E 02	.99348E 01	-.19935E 02	-.20066E 03
13	-.10000E 02	-.21797E 01	-.78203E 01	.35878E 03
14	.25800E 02	.70593E 01	.18741E 02	.26548E 03
15	.23500E 02	.60920E 01	.17408E 02	.28575E 03
16	.23100E 02	.73787E 01	.15721E 02	.21306E 03
17	.23100E 02	.75232E 01	.15577E 02	.20705E 03
18	.21100E 02	.50759E 01	.16024E 02	.31569E 03
19	.20800E 02	.84420E 01	.12358E 02	.14639E 03
20	-.15300E 02	.60548E 01	-.21355E 02	-.35269E 03
21	-.17600E 02	.83604E 01	-.25960E 02	-.31052E 03
22	.18200E 02	.60532E 01	.12147E 02	.20067E 03
23	.18200E 02	.70480E 01	.11152E 02	.15823E 03
24	.17700E 02	.33337E 01	.14366E 02	.43094E 03
25	.17700E 02	.73366E 01	.10363E 02	.14126E 03
26	.17700E 02	-.49369E 00	.18194E 02	-.36853E 04
27	.17700E 02	.63358E 01	.11364E 02	.17936E 03
28	-.18300E 02	.19496E 00	-.18495E 02	-.94867E 04
29	.17500E 02	.12448E 02	.50518E 01	.40583E 02
30	.17400E 02	.61156E 01	.11284E 02	.18452E 03
31	-.18800E 02	.71629E 01	-.25963E 02	-.36246E 03
32	.16600E 02	-.23548E 00	.16835E 02	-.71494E 04
33	.16600E 02	.10520E 02	.60805E 01	.57802E 02
34	.16200E 02	.55478E 01	.10652E 02	.19201E 03
35	.16000E 02	.61785E 01	.98215E 01	.15896E 03
36	.15100E 02	.10657E 02	.44428E 01	.41688E 02
37	.14900E 02	.61519E 01	.87481E 01	.14220E 03
38	-.21300E 02	.75585E 01	-.28858E 02	-.38180E 03
39	.14200E 02	.58442E 01	.83558E 01	.14298E 03
40	.13500E 02	.75881E 01	.59119E 01	.77911E 02
41	.12200E 02	.71668E 01	.50332E 01	.70230E 02
42	.11800E 02	.61434E 01	.56566E 01	.92077E 02
43	.11600E 02	.10898E 02	.70199E 00	.64414E 01
44	.11600E 02	.81644E 01	.34356E 01	.42080E 02
45	.11400E 02	.10101E 02	.12985E 01	.12855E 02
46	.11300E 02	.71692E 01	.41308E 01	.57619E 02
47	.11000E 02	.13968E 01	.96032E 01	.68754E 03
48	.10800E 02	.60584E 01	.47416E 01	.78265E 02
49	-.25800E 02	-.42854E 00	-.25371E 02	.59204E 04
50	.97000E 01	.18965E 02	-.92654E 01	-.48854E 02
51	.91000E 01	.58531E 01	.32469E 01	.55474E 02
52	.88000E 01	.72506E 01	.15494E 01	.21369E 02
53	.86000E 01	.10398E 02	-.17975E 01	-.17288E 02
54	-.27800E 02	.86033E 01	-.36403E 02	-.42313E 03
55	.24000E 01	.91244E 01	-.67244E 01	-.73697E 02
56	.19000E 01	.76512E 01	-.57512E 01	-.75167E 02
57	-.70000E 00	.51386E 01	-.58386E 01	-.11362E 03
58	-.70000E 00	.83248E 01	-.90248E 01	-.10841E 03
59	-.15000E 01	.10385E 02	-.11885E 02	-.11444E 03
60	-.16000E 01	.71068E 01	-.87068E 01	-.12251E 03
61	-.18000E 01	.74858E 01	-.92858E 01	-.12405E 03
62	-.41000E 01	.81010E 01	-.12201E 02	-.15061E 03
63	-.63000E 01	.81104E 01	-.14410E 02	-.17768E 03
64	-.66000E 01	.61676E 01	-.12768E 02	-.20701E 03
65	-.81000E 01	-.28057E 01	-.52943E 01	.18870E 03
66	-.10500E 02	.83852E 01	-.18885E 02	-.22522E 03
67	-.11900E 02	-.29080E 01	-.89920E 01	.30921E 03
68	-.12000E 02	.74263E 01	-.19426E 02	-.26159E 03
69	-.14300E 02	.80220E 01	-.22322E 02	-.27826E 03
70	-.15300E 02	.10382E 02	-.25682E 02	-.24737E 03
71	-.15300E 02	.62809E 01	-.21581E 02	-.34360E 03
72	-.15600E 02	-.31517E 01	-.12448E 02	.39497E 03
73	-.18600E 02	-.25597E 00	-.18344E 02	.71666E 04
74	-.19200E 02	.71042E 01	-.26304E 02	-.37026E 03
75	-.19900E 02	.65013E 01	-.26401E 02	-.40609E 03
76	-.25000E 02	.73709E 01	-.32371E 02	-.43917E 03
77	-.40800E 02	.61097E 01	-.46910E 02	-.76779E 03
78	.41500E 02	.13929E 02	.27571E 02	.19794E 03
79	.17700E 02	.13828E 02	.38719E 01	.28000E 02
80	.15100E 02	.13975E 02	.11245E 01	.80464E 01

AVERAGE DEVIATION -.34971E-03 AVERAGE PCT DEV -.70470E 02 AVE ABS PCT DEV .64520E 03

MAXIMUM DEVIATION .90807E 02 1

MAXIMUM PCT DEV .94867E 04 28

ROOT MEAN SQUARE DEVIATION .20354E 02

THE MINIMIZING VALUES OF THE PARAMETERS ARE

.9910547E 01 .1467926E 00 .1724127E-01 -.2997440E 01 .6106873E 02
-.3496229E-01 .4238829E-01 .1649820E-05 .7707992E 03

THE MINIMAL VALUE OF THE SUM OF SQUARES .331420E 05

Y_f

PERIODS NOT RELATED TO INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

MEXICO-IRON 1933-62
THAILAND-TIN 1950-62
CHILE-CEMENT 1935-62
MEXICO-GOLD 1952-62
CUBA-ENERGY 1949-59
CUBA-CEMENT 1940-58

33⅓-60% ABSOLUTE DEVIATION

SYRIA-CEMENT 1953-62
MEXICO-ENERGY 1949-61
MEXICO-CEMENT 1935-62
TURKEY-ENERGY 1953-61
CHILE-GOLD 1940-62
INDIA-MANGANESE 1953-62
INDONESIA-ALUMINUM 1953-62

60-150% ABSOLUTE DEVIATION

JORDAN-PHOSPHATE 1952-62
MEXICO-SILVER 1946-62
TURKEY-CEMENT 1943-62
P.I.-GOLD 1953-62
INDONESIA-ENERGY 1955-61
BRAZIL-CEMENT 1955-62
BOLIVIA-ENERGY 1949-61
CHILE-ENERGY 1949-61
PERU-GOLD 1955-62
PERU-CEMENT 1941-62
BOLIVIA-TIN 1940-62
CHILE COPPER 1936-62
IRAQ-OIL 1942-62
ISRAEL-POTASH 1958-62
MEXICO-COPPER 1932-62
CHILE-POTASH 1955-62
P.I.-IRON 1954-62

OVER 150% ABSOLUTE DEVIATION

BRAZIL-NITRATES 1957/8-60/1
CHILE-SILVER 1946-62
PERU-SILVER 1946-62
THAILAND-CEMENT 1947-62
VENEZUELA-ENERGY 1949-61
THAILAND-ENERGY 1949-61
CHILE-IRON 1955-62
LIBERIA-ENERGY 1949-61
BRAZIL-OIL 1942-62
JORDAN-CEMENT 1956-62
VENEZUELA-CEMENT 1935-62
BOLIVIA-SILVER 1944-62
PERU-COPPER 1948-62
BOLIVIA-CEMENT 1957-62
P.I.-CEMENT 1953-62
MOROCCO-MANGANESE 1952-62
PERU-IRON 1953-62
LIBERIA-IRON 1952-62
BRAZIL-IRON 1948-62
CHILE-MANGANESE 1952-62
BRAZIL-GOLD 1920-62
COLOMBIA-GOLD 1949-62
PERU-ENERGY 1949-61
COLOMBIA-CEMENT 1934-62
BRAZIL-ENERGY 1949-61
CHILE-OIL 1950-62
COLOMBIA-ENERGY 1949-61
MOROCCO-CEMENT 1958-62
BRAZIL-ALUMINUM 1948-62
P.I.-NITRATES 1953/4-60/1
MALAYA-GOLD 1959-62
COLOMBIA-IRON 1955-62
TURKEY-COPPER 1938-62
TURKEY-MANGANESE 1952-62
TURKEY-OIL 1955-62
INDONESIA-TIN 1954-62
VENEZUELA-DIAMONDS 1947-62
ISRAEL-PHOSPHATE 1958-62
VENEZUELA-OIL 1932-62
BOLIVIA-COPPER 1948-62
TURKEY-IRON 1957-62
MEXICO-OIL 1945-62
CHILE-NITRATES 1945/6-61/2
VENEZUELA-GOLD 1957-62
COLOMBIA-OIL 1928-62
CHILE-PHOSPHATE 1956-62
PERU-OIL 1939-62
BOLIVIA-OIL 1957-62
INDONESIA-MANGANESE 1956-62
CUBA-SILVER 1945-58

Y_f

Recent periods not directly related to independence (continued)

Corrected growth index y_g

Average value: - 1.96

Standard deviation on predictable value: 18.755

Minimal value of the sum of squares:

28,138.7 ISIMEQ

	Values of the parameters		Average values of the independent variables	Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	7.22		--	7.22	14.7
a_1	- 0.0565	$\bar{x}_1$	15.1	- 0.85	- 1.7
a_2	0.077	$\bar{x}_2$	94.4	7.27	14.7
a_3	- 5.44	$\bar{x}_3$	1.45	- 7.90	- 16.0
a_4	249.6	$\bar{x}_4$	99.96	2.50	5.1
a_5	- 0.040	$\bar{x}_5$	234.	- 9.36	- 19.0
a_6	0.061	$\bar{x}_6$	95.7	5.82	11.8
a_7	$- 1.79 \times 10^{-7}$				
a_8	- 6696.	$\bar{x}_8$	189	- 8.46	- 17.0

y_g

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	.10200E 03	-.24164E 01	.10442E 03	-.43212E 04
2	.72000E 01	-.21258E 01	.93258E 01	-.43870E 03
3	.47000E 01	-.52679E 01	.99679E 01	-.18922E 03
4	.18700E 02	.15044E 01	.17196E 02	.11430E 04
5	.40000E 00	.21308E 01	-.17308E 01	-.81228E 02
6	.17800E 02	-.61124E 01	.23912E 02	-.39121E 03
7	.17800E 02	.14313E 01	.16369E 02	.11436E 04
8	.28300E 02	-.24488E 01	.30749E 02	-.12557E 04
9	.15100E 02	.13453E 00	.14965E 02	.11125E 05
10	-.71000E 01	-.24389E 01	-.46611E 01	.19112E 03
11	.37000E 01	-.20132E 01	.57132E 01	-.28379E 03
12	-.21500E 02	.95428E 00	-.22454E 02	-.23530E 04
13	-.19700E 02	-.49953E 01	-.14705E 02	.29437E 03
14	-.69000E 01	-.35880E 01	-.33120E 01	.92308E 02
15	.18300E 02	-.31473E 01	.21447E 02	-.68144E 03
16	.10800E 02	-.33876E 01	.14188E 02	-.41881E 03
17	.11700E 02	-.49201E 01	.16620E 02	-.33780E 03
18	-.64000E 01	-.71241E 01	.72413E 00	-.10164E 02
19	.85000E 01	-.28902E 01	.11390E 02	-.39410E 03
20	-.20800E 02	-.32927E 01	-.17507E 02	.53170E 03
21	-.27500E 02	-.25549E 01	-.24945E 02	.97638E 03
22	.10700E 02	-.23375E 01	.13037E 02	-.55776E 03
23	-.94000E 01	-.22661E 01	-.71339E 01	.31481E 03
24	-.39000E 01	-.61300E 01	.22300E 01	-.36379E 02
25	-.64000E 01	-.51136E 01	-.12864E 01	.25156E 02
26	-.53000E 01	-.92037E 01	.39037E 01	-.42414E 02
27	.39000E 01	-.29362E 01	.68362E 01	-.23283E 03
28	-.28200E 02	-.80897E 01	-.20110E 02	.24859E 03
29	.48000E 01	.94646E 01	-.46646E 01	-.49285E 02
30	.36000E 01	-.22950E 01	.58950E 01	-.25686E 03
31	-.68000E 01	-.21290E 01	-.46710E 01	.21940E 03
32	.28000E 01	-.89122E 01	.11712E 02	-.13142E 03
33	.28000E 01	.24660E 01	.33405E 00	.13546E 02
34	.20000E 01	-.66144E 01	.86144E 01	-.13024E 03
35	.80000E 01	-.22324E 01	.10232E 02	-.45836E 03
36	.54000E 01	.27921E 01	.26079E 01	.93404E 02
37	.20000E 00	-.92340E 01	.94340E 01	-.10217E 03
38	-.18100E 02	-.48860E 01	-.13214E 02	.27044E 03
39	.25000E 01	-.26550E 01	.51550E 01	-.19416E 03
40	-.30000E 00	-.30072E 01	.27072E 01	-.90024E 02
41	-.16000E 01	-.20995E 01	.49954E 00	-.23793E 02
42	-.12200E 02	-.32493E 01	-.89507E 01	.27547E 03
43	.46000E 01	.30641E 01	.15359E 01	.50126E 02
44	-.22000E 01	-.34126E 01	.12126E 01	-.35534E 02
45	.44000E 01	-.40854E 00	.48085E 01	-.11770E 04
46	-.55000E 01	-.20230E 01	-.34770E 01	.17187E 03
47	-.14100E 02	-.10651E 02	-.34489E 01	.32381E 02
48	-.90000E 00	-.34077E 01	.25077E 01	-.73589E 02
49	-.31500E 02	-.92770E 01	-.22223E 02	.23955E 03
50	-.14700E 02	.15166E 01	-.16217E 02	-.10693E 04
51	.13000E 01	-.95596E 01	.10860E 02	-.11360E 03
52	-.31000E 01	-.18925E 01	-.12075E 01	.63808E 02
53	-.14400E 02	.22917E 01	-.16692E 02	-.72835E 03
54	-.30900E 02	-.25575E 01	-.28343E 02	.11082E 04
55	-.43000E 01	-.80607E 01	.37607E 01	-.46655E 02
56	-.19000E 01	-.63138E 01	.44138E 01	-.69907E 02
57	.11900E 02	-.19525E 01	.13852E 02	-.70948E 03
58	.52000E 01	.62922E 01	-.10922E 01	-.17358E 02
59	-.72000E 01	.24720E 01	-.96720E 01	-.39126E 03
60	.61000E 01	-.22084E 01	.83084E 01	-.37622E 03
61	-.10700E 02	-.49818E 01	-.57182E 01	.11478E 03
62	-.31400E 02	-.34752E 01	-.27925E 02	.80354E 03
63	.81000E 01	-.35416E 01	.11642E 02	-.32871E 03
64	-.14400E 02	-.13222E 02	-.11780E 01	.89096E 01
65	-.10000E 01	-.60615E 01	.50615E 01	-.83503E 02
66	-.12000E 02	.63551E 01	-.18355E 02	-.28882E 03
67	.19000E 01	-.63605E 01	.82605E 01	-.12987E 03
68	-.18400E 02	-.31676E 01	-.15232E 02	.48089E 03
69	-.17700E 02	-.36775E 01	-.14023E 02	.38131E 03
70	-.25000E 01	.23557E 01	-.48557E 01	-.20612E 03
71	-.14000E 02	-.36397E 01	-.10360E 02	.28465E 03
72	-.40000E 02	-.66770E 01	-.33323E 02	.49907E 03
73	-.36000E 01	-.85805E 01	.49805E 01	-.58044E 02
74	-.43100E 02	-.22366E 01	-.40863E 02	.18270E 04
75	-.57000E 01	-.25732E 01	-.31268E 01	.12151E 03
76	-.13900E 02	-.33950E 01	-.10505E 02	.30943E 03
77	-.63200E 02	-.93004E 01	-.53900E 02	.57954E 03
78	.65000E 01	-.50469E 01	.11547E 02	-.22879E 03
79	.39000E 01	-.52207E 01	.91207E 01	-.17470E 03
80	.48000E 01	-.49510E 01	.97510E 01	-.19695E 03

AVERAGE DEVIATION .90305E-02 AVERAGE PCT DEV .50859E 02 AVE ABS PCT DEV .55000E 03

MAXIMUM DEVIATION .10442E 03 1

MAXIMUM PCT DEV .11125E 05 9

ROOT MEAN SQUARE DEVIATION .18755E 02

THE MINIMIZING VALUES OF THE PARAMETERS ARE

.7220523E 01 -.5649556E-01 .7712357E-01 -.5441096E 01 .2496398E 03
-.4008369E-01 .6109719E-01 -.1789130E-06 -.6695864E 04

THE MINIMAL VALUE OF THE SUM OF SQUARES .281387E 05

Y_g

PERIODS NOT RELATED TO INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

INDONESIA-TIN 1954-62
ISRAEL-POTASH 1958-62
MALAYA-GOLD 1959-62
CHILE-ENERGY 1949-61
MEXICO-ENERGY 1949-61
P.I.-GOLD 1953-62
MOROCCO-MANGANESE 1952-62

33⅓-60% ABSOLUTE DEVIATION

COLOMBIA-OIL 1928-62
BOLIVIA-TIN 1940-62
TURKEY-ENERGY 1953-61
MEXICO-IRON 1933-62
SYRIA-CEMENT 1953-62
COLOMBIA-GOLD 1949-62
BRAZIL-GOLD 1920-62

60-150% ABSOLUTE DEVIATION

PERU-OIL 1939-62
VENEZUELA-OIL 1932-62
VENEZUELA-DIAMONDS 1947-62
TURKEY-MANGANESE 1952-62
CHILE COPPER 1936-62
CHILE-CEMENT 1935-62
INDONESIA-ALUMINUM 1953-62
PERU-CEMENT 1941-62
BOLIVIA-ENERGY 1949-61
INDONESIA-ENERGY 1955-61
MEXICO-CEMENT 1935-62
MOROCCO-CEMENT 1958-62
COLOMBIA-ENERGY 1949-61
BOLIVIA-SILVER 1944-62
MEXICO-SILVER 1946-62
JORDAN-PHOSPHATE 1952-62

OVER 150% ABSOLUTE DEVIATION

BRAZIL-NITRATES 1957/8-60/1
CHILE-SILVER 1946-62
PERU-SILVER 1946-62
THAILAND-CEMENT 1947-62
VENEZUELA-ENERGY 1949-61
THAILAND-ENERGY 1949-61
CHILE-IRON 1955-62
LIBERIA-ENERGY 1949-61
BRAZIL-OIL 1942-62
JORDAN-CEMENT 1956-62
VENEZUELA-CEMENT 1935-62
PERU-COPPER 1948-62
BOLIVIA-CEMENT 1957-62
P.I.-CEMENT 1953-62
TURKEY-CEMENT 1943-62
PERU-IRON 1953-62
LIBERIA-IRON 1952-62
BRAZIL-IRON 1948-62
CHILE-MANGANESE 1952-62
PERU-ENERGY 1949-61
COLOMBIA-CEMENT 1934-62
BRAZIL-ENERGY 1949-61
CHILE-OIL 1950-62
BRAZIL-ALUMINUM 1948-62
P.I.-NITRATES 1953/4-60/1
BRAZIL-CEMENT 1955-62
PERU-GOLD 1955-62
THAILAND-TIN 1950-62
CHILE-GOLD 1940-62
COLOMBIA-IRON 1955-62
INDIA-MANGANESE 1953-62
MEXICO-GOLD 1952-62
TURKEY-COPPER 1938-62
IRAQ-OIL 1942-62
MEXICO-COPPER 1932-62
CHILE-POTASH 1955-62
P.I.-IRON 1954-62
TURKEY-OIL 1955-62
ISRAEL-PHOSPHATE 1958-62
BOLIVIA-COPPER 1948-62
TURKEY-IRON 1957-62
MEXICO-OIL 1945-62
CHILE-NITRATES 1945/6-61/2
VENEZUELA-GOLD 1957-62
CHILE-PHOSPHATE 1956-62
BOLIVIA-OIL 1957-62
INDONESIA-MANGANESE 1956-62
CUBA-SILVER 1945-58
CUBA-ENERGY 1949-59
CUBA-CEMENT 1940-58

Y_g

Recent periods not directly related to independence (continued)

Stability of production z_a

Average value: - 1.29

Standard deviation on predictable value: 1.583

Minimal value of the sum of squares:

200.452 XSIMEQF

Values of the parameters		Average values of the independent variables		Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	- 1.567		--	- 1.567	- 54.5
a_1	0.000126	$\bar{x}_1$	15.1	0.002	0.1
a_2	0.0021	$\bar{x}_2$	94.4	0.200	6.9
a_3	- 0.224	$\bar{x}_3$	1.45	- 0.325	- 11.2
a_4	14.46	$\bar{x}_4$	99.96	0.145	5.1
a_5	0.00117	$\bar{x}_5$	234.	0.275	9.5
a_6	- 0.00224	$\bar{x}_6$	95.7	- 0.214	- 7.4
a_9	0.0055	$\bar{x}_7$	28.0	0.154	5.3

The deviation histogram on the following page shows an overly large bar for the absolute range 60 - 150 %. This is due to the large number of stability measures which were zero. Any percentage deviation calculated on a zero base is nominally ± 100 %. Such values are tabulated above the other absolute percentage deviations in the 60 - 120 % range and separated from them by a horizontal line.

z_a

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	.00000E 00	-.13121E 01	.13121E 01	-1.00000E 02
2	-.37000E 01	-.13976E 01	-.23024E 01	.16473E 03
3	-.60000E 00	-.14545E 01	.85446E 00	-.58748E 02
4	-.14000E 01	-.12335E 01	-.16652E 00	.13500E 02
5	-.20000E 01	-.14016E 01	-.59843E 00	.42697E 02
6	.00000E 00	-.10808E 01	.10808E 01	-1.00000E 02
7	.00000E 00	-.12380E 01	.12380E 01	-1.00000E 02
8	-.28000E 01	-.14088E 01	-.13912E 01	.98749E 02
9	-.25000E 01	-.12667E 01	-.12333E 01	.97360E 02
10	-.31000E 01	-.14105E 01	-.16895E 01	.11977E 03
11	-.20000E 01	-.12965E 01	-.70353E 00	.54265E 02
12	-.17000E 01	-.14574E 01	-.24255E 00	.16642E 02
13	-.70000E 00	-.10361E 01	.33608E 00	-.32438E 02
14	-.39000E 01	-.15876E 01	-.23124E 01	.14566E 03
15	-.21000E 01	-.14545E 01	-.64554E 00	.44383E 02
16	.00000E 00	-.16099E 01	.16099E 01	-1.00000E 02
17	-.11000E 01	-.14332E 01	.33315E 00	-.23246E 02
18	-.10000E 01	-.14721E 01	.47212E 00	-.32071E 02
19	.00000E 00	-.13331E 01	.13331E 01	-1.00000E 02
20	-.33000E 01	-.14656E 01	-.18344E 01	.12516E 03
21	-.10000E 01	-.13718E 01	.37177E 00	-.27101E 02
22	-.70000E 00	-.13009E 01	.60094E 00	-.46193E 02
23	-.40000E 01	-.14066E 01	-.25934E 01	.18438E 03
24	-.70000E 00	-.10891E 01	.38906E 00	-.35725E 02
25	.00000E 00	-.14332E 01	.14332E 01	-1.00000E 02
26	-.15000E 01	-.10841E 01	-.41589E 00	.38362E 02
27	-.16000E 01	-.14589E 01	-.14107E 00	.96691E 01
28	.70000E 00	-.10461E 01	.17461E 01	-.16691E 03
29	-.11000E 01	-.73426E 00	-.36574E 00	.49811E 02
30	-.17000E 01	-.13032E 01	-.39682E 00	.30450E 02
31	.00000E 00	-.14043E 01	.14043E 01	-1.00000E 02
32	.00000E 00	-.10819E 01	.10819E 01	-1.00000E 02
33	.00000E 00	-.14128E 01	.14128E 01	-1.00000E 02
34	.00000E 00	-.14878E 01	.14878E 01	-1.00000E 02
35	-.43000E 01	-.13032E 01	-.29968E 01	.22996E 03
36	.70000E 00	-.13949E 01	.20949E 01	-.15018E 03
37	.00000E 00	-.13730E 01	.13730E 01	-1.00000E 02
38	-.14000E 01	-.14332E 01	.33150E-01	-.23131E 01
39	.00000E 00	-.13099E 01	.13099E 01	-1.00000E 02
40	-.33000E 01	-.15943E 01	-.17057E 01	.10699E 03
41	-.80000E 00	-.14021E 01	.60211E 00	-.42943E 02
42	.00000E 00	-.14701E 01	.14701E 01	-1.00000E 02
43	-.14000E 01	-.13927E 01	-.73328E-02	.52653E 00
44	.00000E 00	-.13554E 01	.13554E 01	-1.00000E 02
45	.00000E 00	-.12491E 01	.12491E 01	-1.00000E 02
46	-.41000E 01	-.13954E 01	-.27046E 01	.19382E 03
47	.00000E 00	-.12382E 01	.12382E 01	-1.00000E 02
48	.11000E 01	-.14768E 01	.25768E 01	-.17448E 03
49	.00000E 00	-.10975E 01	.10975E 01	-1.00000E 02
50	.00000E 00	.57548E-02	-.57548E-02	-1.00000E 02
51	-.44000E 01	-.13730E 01	-.30270E 01	.22046E 03
52	-.40000E 00	-.13909E 01	.99093E 00	-.71242E 02
53	-.10000E 01	-.14173E 01	.41725E 00	-.29441E 02
54	-.12000E 01	-.13175E 01	.11745E 00	-.89151E 01
55	-.23000E 01	-.15809E 01	-.71915E 00	.45491E 02
56	-.80000E 00	-.13932E 01	.59317E 00	-.42577E 02
57	-.30000E 01	-.10363E 01	-.19637E 01	.18949E 03
58	.00000E 00	-.78825E 00	.78825E 00	-1.00000E 02
59	-.23000E 01	-.13904E 01	-.90957E 00	.65416E 02
60	-.14000E 01	-.14066E 01	.65792E-02	-.46774E 00
61	-.12000E 01	-.14354E 01	.23539E 00	-.16399E 02
62	-.40000E 01	-.13554E 01	-.26446E 01	.19511E 03
63	.00000E 00	-.13622E 01	.13622E 01	-1.00000E 02
64	.12000E 01	-.13730E 01	.25730E 01	-.18740E 03
65	-.60000E 01	-.10763E 01	-.49237E 01	.45746E 03
66	.00000E 00	-.78825E 00	.78825E 00	-1.00000E 02
67	-.10000E 01	-.10227E 01	.22670E-01	-.22167E 01
68	-.21000E 01	-.15943E 01	-.50574E 00	.31723E 02
69	.00000E 00	-.13666E 01	.13666E 01	-1.00000E 02
70	.00000E 00	-.14083E 01	.14083E 01	-1.00000E 02
71	-.44000E 01	-.13999E 01	-.30001E 01	.21431E 03
72	.00000E 00	-.11009E 01	.11009E 01	-1.00000E 02
73	-.15000E 01	-.99012E 00	-.50988E 00	.51497E 02
74	-.17000E 01	-.14088E 01	-.29119E 00	.20669E 02
75	.00000E 00	-.14411E 01	.14411E 01	-1.00000E 02
76	.00000E 00	-.16099E 01	.16099E 01	-1.00000E 02
77	-.50000E 01	-.13753E 01	-.36247E 01	.26356E 03
78	-.46000E 01	-.95004E 00	-.36500E 01	.38419E 03
79	.00000E 00	-.95674E 00	.95674E 00	-1.00000E 02
80	.60000E 00	-.94557E 00	.15456E 01	-.16345E 03

AVERAGE DEVIATION -.51782E-07 AVERAGE PCT DEV -.13525E 01 AVE ABS PCT DEV .99009E 02

MAXIMUM DEVIATION -.49237E 01 65

MAXIMUM PCT DEV .45746E 03 65

ROOT MEAN SQUARE DEVIATION .15829E 01

THE MINIMIZING VALUES OF THE PARAMETERS ARE

-.1566586E 01 .1260740E-03 .2100527E-02 -.2235028E 00 .1446598E 02
.1173286E-02 -.2243581E-02 .5521103E-02

THE MINIMAL VALUE OF THE SUM OF SQUARES .200452E 03

STABILITY OF PRODUCTION, Z_a
PERIODS NOT RELATED TO INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION	33⅓-60% ABSOLUTE DEVIATION	60-150% ABSOLUTE DEVIATION	OVER 150% ABSOLUTE DEVIATION
		BOLIVIA-OIL 1957-62	
		PERU-OIL 1939-62	
		VENEZUELA-GOLD 1957-62	
		MEXICO-OIL 1945-62	
		TURKEY-IRON 1957-62	
		ISRAEL-PHOSPHATE 1958-62	
		TURKEY-OIL 1955-62	
		ISRAEL-POTASH 1958-62	
		INDIA-MANGANESE 1953-62	
		COLOMBIA-IRON 1955-62	
		MALAYA-GOLD 1959-62	
		THAILAND-TIN 1950-62	
		TURKEY-ENERGY 1953-61	
		PERU-GOLD 1955-62	
		BRAZIL-CEMENT 1955-62	
		INDONESIA-ENERGY 1955-61	
		MOROCCO-CEMENT 1958-62	
		MEXICO-ENERGY 1949-61	
		COLOMBIA-ENERGY 1949-61	CUBA-CEMENT 1940-58
BOLIVIA-COPPER 1948-62		CHILE-OIL 1950-62	CUBA-SILVER 1945-58
VENEZUELA-OIL 1932-62		P.I.-GOLD 1953-62	INDONESIA-MANGANESE 1956-62
P.I.-IRON 1954-62		TURKEY-CEMENT 1943-62	COLOMBIA-OIL 1928-62
CHILE-POTASH 1955-62		BOLIVIA-CEMENT 1957-62	CHILE-NITRATES 1945/6-61/2
TURKEY-COPPER 1938-62	CHILE-PHOSPHATE 1956-62	THAILAND-ENERGY 1949-61	VENEZUELA-DIAMONDS 1947-62
MEXICO-GOLD 1952-62	CHILE COPPER 1936-62	VENEZUELA-ENERGY 1949-61	INDONESIA-TIN 1954-62
MEXICO-IRON 1933-62	BOLIVIA-TIN 1940-62	BRAZIL-NITRATES 1957/8-60/1	TURKEY-MANGANESE 1952-62
P.I.-NITRATES 1953/4-60/1	CHILE-ENERGY 1949-61	BOLIVIA-SILVER 1944-62	IRAQ-OIL 1942-62
BRAZIL-ENERGY 1949-61	SYRIA-CEMENT 1953-62	MEXICO-SILVER 1946-62	INDONESIA-ALUMINUM 1953-62
PERU-ENERGY 1949-61	COLOMBIA-GOLD 1949-62	LIBERIA-ENERGY 1949-61	PERU-CEMENT 1941-62
LIBERIA-IRON 1952-62	BRAZIL-GOLD 1920-62	CHILE-IRON 1955-62	CHILE-GOLD 1940-62
MOROCCO-MANGANESE 1952-62	BRAZIL-IRON 1948-62	MEXICO-COPPER 1932-62	MEXICO-CEMENT 1935-62
P.I.-CEMENT 1953-62	PERU-COPPER 1948-62	CHILE-CEMENT 1935-62	BRAZIL-ALUMINUM 1948-62
VENEZUELA-CEMENT 1935-62	BRAZIL-OIL 1942-62	BOLIVIA-ENERGY 1949-61	COLOMBIA-CEMENT 1934-62
JORDAN-CEMENT 1956-62	JORDAN-PHOSPHATE 1952-62	PERU-IRON 1953-62	CHILE-MANGANESE 1952-62
THAILAND-CEMENT 1947-62	PERU-SILVER 1946-62	CUBA-ENERGY 1949-59	CHILE-SILVER 1946-62

Z_a

Recent periods not directly related to independence (continued)

Volume of production z_b

Average value: 189.

Standard deviation on predictable value: 392.4

Minimal value of the sum of squares:

12,315,400 XSIMEQF

Values of the parameters		Average values of the independent variables		Average values of each factor (first two columns of this table combined according to the functional model)	% dependence
a_0	37.7	--		37.7	7.0
a_1	- 2.89	$\bar{x}_1$	15.1	- 43.6	- 8.0
a_2	- 0.0048	$\bar{x}_2$	94.4	- 0.5	- 0.1
a_3	101.6	$\bar{x}_3$	1.45	147.	27.2
a_4	6079.	$\bar{x}_4$	99.96	60.8	11.2
a_5	- 0.608	$\bar{x}_5$	234.	- 142.	- 26.1
a_6	0.85	$\bar{x}_6$	95.7	81.2	15.0
a_9	1.06	$\bar{x}_7$	28.0	29.6	5.4

z_b

NUMBER	Y OBSERVED	Y CALCULATED	DELTA Y	PCT DEVIATION
1	.11000E 02	.27630E 03	-.26530E 03	-.96019E 02
2	.72000E 02	.16176E 03	-.89763E 02	-.55491E 02
3	.95800E 03	.20145E 03	.75655E 03	.37556E 03
4	.18000E 02	.22499E 03	-.20699E 03	-.92000E 02
5	.80000E 02	.21591E 03	-.13591E 03	-.62947E 02
6	.37000E 02	.69937E 02	-.32937E 02	-.47095E 02
7	.31000E 01	.22702E 03	-.22392E 03	-.98634E 02
8	.93000E 02	.16684E 03	-.73844E 02	-.44259E 02
9	1.00000E-01	-.37005E 02	.37105E 02	-.10027E 03
10	.18700E 04	.28806E 03	.15819E 04	.54917E 03
11	.17000E 01	.26919E 03	-.26749E 03	-.99368E 02
12	.38000E 01	.24131E 03	-.23751E 03	-.98425E 02
13	.25000E 02	.49614E 02	-.24614E 02	-.49611E 02
14	.30500E 03	.22831E 03	.76688E 02	.33589E 02
15	.14000E 03	.20145E 03	-.61447E 02	-.30503E 02
16	.12000E 01	.23847E 03	-.23727E 03	-.99497E 02
17	.24000E 02	.21812E 03	-.19412E 03	-.88997E 02
18	.37900E 03	.20469E 03	.17431E 03	.85160E 02
19	.27000E 02	.96085E 02	-.69085E 02	-.71900E 02
20	.88000E 02	.20653E 03	-.11853E 03	-.57391E 02
21	.55000E 02	.10754E 02	.44246E 02	.41145E 03
22	.91000E 02	.27122E 03	-.18022E 03	-.66448E 02
23	.40000E 02	.16583E 03	-.12583E 03	-.75879E 02
24	.36000E 02	.18814E 03	-.15214E 03	-.80865E 02
25	.10400E 03	.21812E 03	-.11412E 03	-.52320E 02
26	.11400E 03	.68995E 02	.45005E 02	.65229E 02
27	.79000E 01	.20348E 03	-.19558E 03	-.96118E 02
28	.36000E 02	.51721E 02	-.15721E 02	-.30395E 02
29	.16000E 02	.18258E 03	-.16658E 03	-.91237E 02
30	.51000E 02	.27224E 03	-.22124E 03	-.81266E 02
31	.56000E 01	.16481E 03	-.15921E 03	-.96602E 02
32	.16000E D2	.67979E 02	-.51979E 02	-.76463E 02
33	.61000E 02	.28908E 03	-.22808E 03	-.78898E 02
34	.18000E 02	.21180E 03	-.19380E 03	-.91501E 02
35	.25000E 02	.27224E 03	-.24724E 03	-.90817E 02
36	.10600E 03	.28095E 03	-.17495E 03	-.62271E 02
37	.28000E 02	.34499E 03	-.31699E 03	-.91884E 02
38	.98000E 01	.21812E 03	-.20832E 03	-.95507E 02
39	.13200E 03	.27528E 03	-.14328E 03	-.52050E 02
40	.14000E 01	.23136E 03	-.22996E 03	-.99395E 02
41	.16000E 02	.16380E 03	-.14780E 03	-.90232E 02
42	.25000E 02	.20856E 03	-.18356E 03	-.88013E 02
43	.16000E 02	.27993E 03	-.26393E 03	-.94284E 02
44	.18000E 02	.10625E 03	-.88247E 02	-.83058E 02
45	.62800E 03	.23210E 03	.39590E 03	.17057E 03
46	.52000E 02	.16075E 03	-.10875E 03	-.67651E 02
47	.26000E 01	.12304E 03	-.12044E 03	-.97887E 02
48	.23000E 02	.21161E 03	-.18861E 03	-.89131E 02
49	.93000E 01	.75092E 02	-.65792E 02	-.87615E 02
50	.10100E 04	.84609E 03	.16391E 03	.19373E 02
51	.16200E 03	.34499E 03	-.18299E 03	-.53042E 02
52	.43000E 02	.15871E 03	-.11571E 03	-.72907E 02
53	.88000E 02	.29111E 03	-.20311E 03	-.69771E 02
54	.47000E 02	.88972E 02	-.41972E 02	-.47175E 02
55	.19600E 04	.22526E 03	.17347E 04	.77009E 03
56	.16600E 04	.15973E 03	.15003E 04	.93925E 03
57	.31500E 03	.28122E 03	.33776E 02	.12010E 02
58	.80000E 02	.15125E 03	-.71250E 02	-.47107E 02
59	.28000E 03	.27892E 03	.10850E 01	.38900E 00
60	.16000E 02	.16583E 03	-.14983E 03	-.90351E 02
61	.27000E 02	.21914E 03	-.19214E 03	-.87679E 02
62	.44000E 02	.10625E 03	-.62247E 02	-.58587E 02
63	.37000E 01	.10930E 03	-.10560E 03	-.96615E 02
64	.15200E 04	.34499E 03	.11750E 04	.34060E 03
65	.61000E 02	.67905E 02	-.69049E 01	-.10168E 02
66	.54000E 02	.15125E 03	-.97250E 02	-.64297E 02
67	.69500E 03	.43517E 02	.65148E 03	.14971E 04
68	.68000E 02	.23136E 03	-.16336E 03	-.70609E 02
69	.15000E 02	.11133E 03	-.96328E 02	-.86526E 02
70	.15100E 03	.28704E 03	-.13604E 03	-.47395E 02
71	.65000E 03	.16278E 03	.48722E 03	.29931E 03
72	.68000E 02	.79083E 02	-.11083E 02	-.14014E 02
73	.85000E 02	.28791E 02	.56209E 02	.19523E 03
74	.51000E 01	.16684E 03	-.16174E 03	-.96943E 02
75	.38000E 02	.19535E 03	-.15735E 03	-.80548E 02
76	.43000E 01	.23847E 03	-.23417E 03	-.98197E 02
77	.33000E 02	.34600E 03	-.31300E 03	-.90463E 02
78	.76000E 01	-.26219E 02	.33819E 02	-.12899E 03
79	.12000E 02	-.23171E 02	.35171E 02	-.15179E 03
80	.13000E 02	-.28252E 02	.41252E 02	-.14602E 03

AVERAGE DEVIATION -.93313E-01 AVERAGE PCT DEV .94333E 01 AVE ABS PCT DEV .13467E 03

MAXIMUM DEVIATION .17347E 04 55

MAXIMUM PCT DEV .14971E 04 67

ROOT MEAN SQUARE DEVIATION .39236E 03

THE MINIMIZING VALUES OF THE PARAMETERS ARE

.3779651E 02 -.2885092E 01 -.4790057E-02 .1016153E 03 .6078874E 04
-.6083304E 00 .8512098E 00 .1063352E 01

THE MINIMAL VALUE OF THE SUM OF SQUARES .123154E 08

VOLUME OF PRODUCTION, Z_b
PERIODS NOT RELATED TO INDEPENDENCE

0-33⅓% ABSOLUTE DEVIATION

VENEZUELA-GOLD 1957-62
VENEZUELA-DIAMONDS 1947-62
MEXICO-COPPER 1932-62
IRAQ-OIL 1942-62
INDIA-MANGANESE 1953-62
COLOMBIA-CEMENT 1934-62
PERU-COPPER 1948-62

33⅓-60% ABSOLUTE DEVIATION

MEXICO-OIL 1945-62
TURKEY-MANGANESE 1952-62
ISRAEL-POTASH 1958-62
TURKEY-COPPER 1938-62
INDONESIA-ALUMINUM 1953-62
BRAZIL-CEMENT 1955-62
P.I.-GOLD 1953-62
PERU-IRON 1953-62
BOLIVIA-SILVER 1944-62
VENEZUELA-CEMENT 1935-62
CHILE-IRON 1955-62
VENEZUELA-ENERGY 1949-61
CHILE-SILVER 1946-62

60-150% ABSOLUTE DEVIATION

CUBA-CEMENT 1940-58
CUBA-SILVER 1945-58
INDONESIA-MANGANESE 1956-62
BOLIVIA-OIL 1957-62
PERU-OIL 1939-62
CHILE-PHOSPHATE 1956-62
TURKEY-IRON 1957-62
BOLIVIA-COPPER 1948-62
ISRAEL-PHOSPHATE 1958-62
TURKEY-OIL 1955-62
P.I.-IRON 1954-62
CHILE-POTASH 1955-62
MEXICO-GOLD 1952-62
CHILE-CEMENT 1935-62
COLOMBIA-IRON 1955-62
PERU-CEMENT 1941-62
MALAYA-GOLD 1959-62
CHILE-GOLD 1940-62
TURKEY-ENERGY 1953-61
MEXICO-IRON 1933-62
PERU-GOLD 1955-62
CHILE-ENERGY 1949-61
BOLIVIA-ENERGY 1949-61
P.I.-NITRATES 1953/4-60/1
INDONESIA-ENERGY 1955-61
MEXICO-CEMENT 1935-62
BRAZIL-ALUMINUM 1948-62
MOROCCO-CEMENT 1958-62
MEXICO-ENERGY 1949-61
COLOMBIA-ENERGY 1949-61
CHILE-OIL 1950-62
BRAZIL-ENERGY 1949-61
SYRIA-CEMENT 1953-62
PERU-ENERGY 1949-61
COLOMBIA-GOLD 1949-62
BRAZIL-GOLD 1920-62
CHILE-MANGANESE 1952-62
BRAZIL-IRON 1948-62
TURKEY-CEMENT 1943-62
MOROCCO-MANGANESE 1952-62
P.I.-CEMENT 1953-62
BOLIVIA-CEMENT 1957-62
JORDAN-CEMENT 1956-62
BRAZIL-OIL 1942-62
LIBERIA-ENERGY 1949-61
THAILAND-ENERGY 1949-61
JORDAN-PHOSPHATE 1952-62
THAILAND-CEMENT 1947-62
BRAZIL-NITRATES 1957/8-60/1

OVER 150% ABSOLUTE DEVIATION

CUBA-ENERGY 1949-59
COLOMBIA-OIL 1928-62
CHILE-NITRATES 1945/6-61/2
VENEZUELA-OIL 1932-62
INDONESIA-TIN 1954-62
CHILE COPPER 1936-62
BOLIVIA-TIN 1940-62
THAILAND-TIN 1950-62
LIBERIA-IRON 1952-62
MEXICO-SILVER 1946-62
PERU-SILVER 1946-62

Z_b

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APPENDICES

Appendix I.

NOTATION USED FOR THE MORE IMPORTANT QUANTITIES USED IN THIS ANAYSIS

Y	UNCORRECTED GROWTH INDEX
Y(F)	GROWTH INDEX CORRECTED FOR PRODUCTION IN OTHER UNDERDEVELOPED COUNTRIES
Y(G)	GROWTH INDEX CORRECTED FOR WORLD PRODUCTION
Z(A)	STABILITY VARIABLE
Z(B)	VOLUME OF PRODUCTION VARIABLE (SAME AS X(8))
X(1)	TRANSPORT VARIABLE
X(2)	LITERACY AND NEWSPAPER CIRCULATION VARIABLE
X(3)	GEOLOGICAL SURVEY VARIABLE
X(4)	INFANT MORTALITY VARIABLE
X(5)	GNP/CAPITA VARIABLE
X(6)	FOREIGN AID AND LONG-TERM INVESTMENT VARIABLE
X(7)	SIZE OF POPULATION VARIABLE
X(8)	VOLUME OF PRODUCTION VARIABLE (SAME AS Z(B))
A(0)	GENERAL PARAMETER
A(1)	TRANSPORT PARAMETER
X(2)	LITERACY AND NEWSPAPER CIRCULATION PARAMETER
A(3)	GEOLOGICAL SURVEY PARAMETER
A(4)	INFANT MORTALITY PARAMETER
A(5)	GNP/CAPITA PARAMETER
A(6)	FOREIGN AID AND LONG-TERM INVESTMENT PARAMETER
A(7)	VOLUME OF PRODUCTION, MAIN PARAMETER
A(7)	VOLUME OF PRODUCTION, SECONDARY PARAMETER
A(9)	SIZE OF POPULATION PARAMETER

APPENDIX II

Raw data from which the dependent variables were obtained and some sample production curves

Ghana - Bauxite
1950-1962 Long Tons Exported
1942-1949 Metric Tons Exported

1962	280,000	
61	193,000	
60	224,000	
59	148,000	1957-62 doubling time 8.5 years
58	207,120	
57	185,403	
56	138,000	
55	116,285	
54	164,000	
53	115,075	
52	74,368	
51	129,328	
1950	115,000	
49	145,013	1942-56 doubling time 23 years
48	131,000	
47	96,000	
46	114,246	
45	146,330	
44	107,223	
43	105,000	
42	48,005	
1941	0	

Jamaica - Bauxite
Long Tons - Dried Bauxite Equivalent

1962	7,400,000	
61	6,663,000	
60	5,745,000	
59	5,126,000	
58	5,722,000	1954-62 doubling time 3.5 years
57	4,596,000	
56	3,142,000	
55	2,645,345	
54	2,034,000	
53	1,154,172	
52	411,000	
1951	0	

British Guiana - Bauxite
1954-62 Long Tons - Dried Bauxite Equivalent
1933-53 Metric Tons

1962	4,020,000	
61	2,374,000	
60	2,471,000	
59	1,674,416	
58	1,585,879	
57	2,201,903	
56	2,480,966	
55	2,435,282	
54	2,309,919	
53	2,257,747	
52	2,387,938	
51	2,087,079	1947-62 doubling time 11 years
50	1,642,036	
49	1,796,409	
48	1,944,966	
47	1,358,929	
46	1,115,966	
45	669,164	
44	913,516	
43	1,941,813	
42	1,159,589	
41	1,089,333	
40	634,510	
39	483,653	1933-43 doubling time 2 years
38	382,409	
37	305,333	
36	212,681	
35	113,290	
34	51,417	
1933	36,663	

India - Bauxite
1945 - Long Tons, 1916-1944 Metric Tons

1962	565,000	
61	468,000	
60	378,000	
59	214,548	
58	166,188	
57	107,898	1948-62 doubling time 3 years
56	99,266	
55	90,423	
54	74,747	
53	70,848	
52	63,505	
51	67,047	
1950	64,399	
49	42,541	
48	20,663	
47	18,537	
46	16,405	
45	13,893	
44	12,135	

1943	24,160	
42	18,258	
41	13,170	
40	8,154	
39	9,121	
38	15,005	
37	15,393	
36	3,702	
35	7,758	
34	18	
33	1,092	
32	4,539	
31	4,367	1918-43 doubling time 12.5 years
30	2,554	
29	9,189	
28	14,902	
27	4,379	
26	5,036	
25	10,232	
24	23,600	
23	6,652	
22	4,998	
21	6,759	
20	6,401	
19	1,709	
18	1,211	
17	1,385	
1916	762	

Malaya - Bauxite
1942 - Long Tons

1962	344,000 appx	
61	403,000	
60	452,000	
59	381,747	
58	262,354	
57	325,629	
56	264,444	1952-62 doubling time 5.5 years
55	222,162	
54	165,621	
53	152,170	
52	21,796	
1951	0	

Guinea - Bauxite
Long Tons

1962	1,340,000	
61	1,739,000	1959-62 doubling time 0.8 year
60	1,171,000	

1959	296,000	
58	325,000	
57	360,100	1954-59 halving time 7 years
56	444,400	
55	485,389	
54	484,377	1952-54 doubling time 0.7 year
53	320,399	
52	97,813	
51	0	
1950	10,000 exported	

Surinam - Bauxite
1951 - Long Tons - 1922-50 - Metric Tons

1962	3,200,000	
61	3,351,000	
60	3,400,000	
59	3,338,848	
58	2,820,013	
57	3,324,504	
56	3,427,564	1952-62 level
55	3,013,569	
54	3,367,137	
53	3,222,630	
52	3,172,854	
51	2,657,364	
50	2,080,657	
49	2,125,654	
48	2,129,906	
47	1,798,588	
46	857,843 exports	
45	683,990	
44	625,804	
43	1,655,147	
42	1,227,512	
41	1,198,900	
40	615,434	
39	511,619	
38	377,213	
37	392,447	
36	239,845	
35	112,682	1922-51 doubling time 4 years
34	103,338	
33	103,997	
32	126,513	
31	173,154	
30	264,556	
29	209,998	
28	213,869	
27	184,203	
26	44,230	
25	86,277	
24	63,097	
23	15,839	
22	18,805	

Bauxite - Indonesia
1942 - Long Tons

1962	382,000	
61	413,000	
60	389,000	1953-62 doubling time 6.5 years
59	318,137	
58	338,473	
57	237,653	
56	298,510	
55	259,511	
54	170,503	
53	147,190	
52	338,325	
51	632,172	1949-52 halving time 2 years
50	522,754	
49	667,428	
48	430,986	
1947	0	

Albania - Cement
Thousands of Metric Tons

1962	120
61	120
60	73
59	74
58	78
57	70
56	65
55	45
54	15
53	13
52	19
51	18

1951-62 doubling time 3.5 years

Bulgaria - Cement
Thousands of Metric Tons

1962	1893
61	1749
60	1586
59	1433
58	937
57	880
56	859
55	812
54	780
53	701
52	672
51	627
50	602
49	N.A.
48	378
47	N.A.
46	N.A.
45	245
44	126

1950-62 doubling time 7.5 years

Rumania - Cement
Thousand Metric Tons

1962	3489
61	3308
60	3054
59	2851
58	2572
57	2355
56	2098
55	1936
54	1518
53	1906
52	1514
51	1140
50	1028
49	N.A.
48	657

1950-62 doubling time 6.5 years

Syria - Cement
Thousands of Metric Tons

1962	599
61	540
60	489
59	447
58	408
57	315
56	326
55	264
54	249
53	224
52	151
51	39

1953-62 doubling time 6 years

Indonesia - Cement
Thousands of 376 lb. bbls.

1962	2,980	
61	2,609	
60	2,269	
59	2,017	
58	1,753	1951-62 doubling time 4 years
57	1,472	
56	850	
55	874	
54	862	
53	874	
52	809	
51	586	
50		
49	)	
48	221)	Avg. = 82
47	585)	
46	)	
45	)	
44		
43		
42		
41		
40		
39	1,000	
38		
37		
36	800	1933-39 doubling time 5 years
35	820	
34	680	
33	435	
32	470	
31	760	
30		
29	874	

Mozambique - Cement
Thousands of Metric Tons

1962	185
61	212
60	222
59	213
58	180
57	167
56	151
55	137
54	102
53	87
52	83.2
51	77.4
50	50.3
49	34.8
48	37.2
47	35.9
46	26.3
45	19.9
44	27.9
43	30.6
42	24.9
41	27.3
40	28.0
39	27.6
38	24.3
37	15.0
36	11.8
35	11.2
34	11.9
33	20.7

1947-60 doubling time 5 years

Jordan Cement
Thousand Metric Tons

1962	235	
61	223	
60	165	1956-62 doubling time 4 years
59	110	
58	114	
57	107	
56	79	
55	N.A.)	average of 75
54	N.A.)	

Brazil - Cement
Thousand Metric Tons

1962	5072
61	4709
60	4447
59	3841
58	3790
57	3393
56	3275
55	2771
54	1683
53	1655
52	1545

1955-62 doubling time 7.5 years

Egypt - Cement
Thousand Metric Tons

1962	2150	
61	2136	
60	2047	1952-62 doubling time 8 years
59	1784	
58	1511	
57	1466	
56	1351	
55	1371	
54	1237	
53	1097	
52	947	
51	1130	
50	1022	
49	889	1943-51 doubling time 4.5 years
48	769	
47	648	
46	588	
45	432	
44	424	
43	323	
42	381	
41	420	
40	365	1934-42 doubling time 22.5 years
39	368	
38	375	
37	323	
36	335	
35	379	
34	297	
33	288	

Algeria - Cement
Thousand Metric Tons

1962	650
61	1071
60	1062
59	957
58	842
57	711
56	669
55	655
54	632
53	494
52	484.8
51	448.4
50	324.4
49	128.0
48	130.4
47	127.3
46	116.0
45	105.0
44	92.4
43	80.4

1961-62 halving time 1.4 years

1950-60 doubling time 7 years

Israel - Cement
Thousand Metric Tons

1962	954
61	846
60	806
59	781
58	712
57	718
56	613
55	664
54	566
53	465
52	446
51	439
50	380
49	241
48	160
47	328
46	255
45	151
44	159
43	176
42	217
41	115
40	137
39	112
38	98
37	161
36	154
35	187
34	143
33	135

1949-61 doubling time 8.5 years

1934-49 doubling time 14 years

Nigeria - Cement
Thousands of 376 lb. bbls.

1962	2,810	
61	2,680	
60	909	1958-62 doubling time 2 years
59	721	
58	663	
1957	0	

Jamaica - Cement
Thousands of 376 lb. bbls.

1962	1,170	
61	1,266	
60	1,243	1952-62 doubling time 7 years
59	1,155	
58	1,044	
57	844	
56	774	
55	639	
54	575	
53	592	
52	440	
1951	0	

Rumania - Buaxite
Long Tons

1962	88,000
61	68,000
60	87,000
59	70,000
58	72,000
57	60,000
56	51,000
55	36,000
54	31,000
53	12,000
52	9,800
51	20,000
50	6,000
49	probably nil

1950-62 doubling time 3.5 years

Brazil - Buaxite
Long Tons

1962	100,000	
61	96,000	
60	119,000	
59	95,466	
58	68,750	
57	62,546	
56	68,653	
55	44,359	
54	27,182	
53	18,524	
52	14,093	
51	18,731	
50	18,227	
49	15,957	
48	13,822	
47	6,629	
46	4,388	
45	19,238	
44	14,359	
43	67,742	
42	12,201	(exports)
41	14,138	(exports)
40	0	
39	18,000	
38	12,734	(exports)
37	8,631	(exports)
36	6,889	(exports)
35	0	

1948-62 doubling time 4.5 years

India - Cement
Thousands of Metric Tons

1962	8,600	
61	8,244	
60	7,835	
59	6,936	
58	6,186	
57	5,691	1948-62 doubling time 6 years
56	5,008	
55	4,559	
54	4,468	
53	3,841	
52	3,594	
51	3,247	
50	2,654	
49	2,136	
48	1,578	
47	n.a.	
46	2,068	
45	2,243	
44	2,081	
43	2,152	
42	2,213	
41	2,117	1933-42 doubling time 4.5 years
40	1,740	
39	1,748	
38	1,427	
37	1,142	
36	1,013	
35	905	
34	793	
33	653	
1932	0	

(Appx. necessary prior to 1947 to account for cement production in Pakistan area.)

Malaya - Cement
Thousands of 376 lb. bbls.

1962	1,880	
61	1,941	
60	1,677	
59	1,132	1953-62 doubling time 3 years
58	645	
57	668	
56	610	
55	639	
54	504	
53	188	
1952	0	

Angola - Cement
Thousands of 376 lb. bbls.

1962	955	
61	921	
60	944	1956-62 level
59	909	
58	973	
57	756	
56	510	
55	410	1953-56 doubling time 1.5 years
54	276	
53	170	
1952	0	

Congo (Leo.) - Cement
Thousands of 376 lb. bbls. Includes Ruanda-Urundi

1962	950	
61	678	1961-62 doubling time 2 years
60	1,173	
59	2,035	
58	2,427	
57	2,721	1957-61 halving time 2 years
56	2,691	
55	2,375	
54	2,029	
53	1,454	
52	1,407	
51	1,202	
50	1,020	
49	840	
48	740	
47	650	
46	475	
45	445	
44	490	1934-56 doubling time 4 years
43	400	
42	370	
41	245	
40	145	
39	200	
38	90	
37	60	
36	64	
35	45	
34	57	
33	64	
32	90	
31	265	
30	n.a.	
1929	0	

French West Africa (Senegal) - Cement
Thousands of 376 lb. bbls.

1962	1,070	
61	1,067	1958-62 doubling time 40 years
60	985	
59	1,020	
58	874	
57	926	
56	850	
55	756	1948-58 doubling time 4.5 years
54	487	
53	352	
52	469	
51	322	
50	352	
49	258	
1948	65	(U.N. data for Senegal)

Morocco - Cement
Thousands of 376 lb. bbls.

1962	4,070	
61	3,735	
60	3,401	1958-62 doubling time 6.5 years
59	3,236	
58	2,591	
57	2,849	1956-58 halving time 4 years
56	3,729	
55	4,262	
54	3,864	
53	3,577	
52	2,551	
51	2,210	
50	1,882	
49	1,550	1945-55 doubling time 4 years
48	1,550	
47	1,280	
46	1,005	
45	450	
44	650	
1943	820	

Cuba - Cement
Thousands of 376 lb. bbls.

1962	1,759	
61	1,759	
60	2,345	1958-62 halving time 3 years
59	3,670	

1958	4,192	
57	3,805	
56	3,512	
55	2,644	
54	2,468	
53	2,386	
52	2,463	
51	2,240	
50	1,853	1940-58 doubling time 7 years
49	1,820	
48	1,660	
47	1,620	
46	1,560	
45	1,270	
44	1,010	
43	980	
42	930	
41	900	
1934-40	n.a.	
33	0	

Mexico - Cement
Thousands of 376 lb. bbls.

1962	19,610	
61	17,801	
60	18,112	
59	15,884	
58	14,887	
57	15,010	
56	13,351	
55	11,815	
54	10,261	
53	9,774	
52	9,757	1935-62 doubling time 7 years
51	9,469	
50	8,959	
49	7,200	
48	4,850	
47	4,150	
46	4,350	
45	4,400	
44	3,750	
43	3,400	
42	3,450	
41	3.150	
40	2,850	
39	2,400	
38	2,200	
37	2,000	
36	1,650	
35	1,450	
1934	n.a.	

Bolivia - Cement
Thousands of 376 lb. bbls.

1962	293	
61	263	
60	223	
59	170	1957-62 doubling time 4.5 years
58	170	
57	141	
56	193	
55	223	
54	193	
53	199	
52	217	
51	229	1940-57 level
50	223	
49	239	
48	228	
47	226	
46	168	
45	158	
44	158	
43	132	
42	132	
41	140	
40	143	
39	n.a.	
38	105	
37	64	1935-40 doubling time 2 years
36	60	
35	39	
1934	n.a.	

Chile - Cement
Thousands of 376 lb. bbls.

1962	6,710	
61	5,101	
60	4,855	
59	4,902	
58	4,257	
57	4,263	
56	4,521	
55	4,715	
54	4,544	
53	4,468	
52	4,796	
51	4,093	
50	3,008	
49	2,900	1935-62 doubling time 12.5 years
48	3,150	
47	3,550	
46	3,400	

1945	2,400
44	2,150
43	2,200
42	2,150
41	2,100
40	2,250
39	2,600
38	2,100
37	1,850
36	1,450
35	1,650
34	1,200
33	800
32	650
31	600
1930	0

Colombia - Cement
Thousands of 376 lb. bbls.

1962	10,000
61	8,895
60	8,590
59	7,904
58	7,200
57	7,194
56	7,153
55	6,133
54	5,640
53	5,119
52	4,140
51	3,799
50	3,324
49	2,870
48	2,150
47	2,000
46	1,950
45	1,750
44	1,650
43	1,500
42	1,200
41	1,200
40	1,100
39	950
38	820
37	730
36	600
35	450
34	420
1933	n.a.

1934-62 doubling time 6 years

Peru - Cement
Thousands of 376 lb. bbls.

1962	3,860	
61	3,835	
60	3,524	
59	3,412	
58	3,547	
57	3,195	
56	3,237	
55	3,195	
54	2,832	
53	2,663	1941-62 doubling time 10 years
52	2,175	
51	2,111	
50	1,941	
49	1,640	
48	1,640	
47	1,500	
46	1,530	
45	1,530	
44	1,450	
43	1,220	
42	1,100	
41	970	
40	730	
39	690	
38	600	
37	480	1932-41 doubling time 3 years
36	440	
35	350	
34	265	
33	160	
32	125	
1931	165	

Venezuela - Cement
Thousands of 376 lb. bbls.

1962	8,785	
61	8,795	
60	8,719	
59	10,976	
58	9,475	
57	10,243	
56	8,508	
55	7,517	
54	7,122	1935-62 doubling time 4 years
53	5,758	
52	4,925	
51	3,641	
50	2,938	
49	1,660	

1948	1,260	
47	850	
46	750	
45	680	
44	700	
43	650	
42	710	
41	670	
40	520	
39	220	
38	225	
37	255	
36	215	
1935	128	

Iran - Cement
Thousands of 376 lb. bbls.

1962	4,360	
61	4,360	
60	4,585	
59	3,125	1952-62 doubling time 2.5 years
58	2,404	
57	1,835	
56	1,313	
55	469	
54	364	
53	381	
1952	311	

Philippines - Cement
Thousands of 376 lb. bbls.

1962	5,620	
61	5,975	
60	4,661	
59	4,263	1953-62 doubling time 4.5 years
58	3,764	
57	2,996	
56	2,562	
55	2,345	
54	1,818	
53	1,706	
52	1,818	1950-53 level
51	1,812	
50	1,712	
49	1,200	1945-50 doubling time 1.5 years
48	700	
47	800	
46	330	
45	160 (Jun-Dec. only)	
44	n.a.	

1943	n.a.	
42	n.a.	
41	n.a.	
40	n.a.	
39	n.a.	
38	970	
37	880	
36	770	
35	650	
34	560	1929-39 doubling time 7.5 years
33	560	
32	670	
31	560	
30	n.a.	
1929	445	

Thailand - Cement
Thousands of 376 lb. bbls.

1962	9,620	
61	4,673	
60	3,084	
59	2,990	
58	2,674	
57	2,357	
56	2,334	
55	2,263	
54	2,252	1947-62 doubling time 3 years
53	1,689	
52	1,448	
51	1,829	
50	973	
49	740	
48	480	
47	340	
46	525	
45	0	
44	152	
43	375	
42	391	
41	675	
40	680	Year ended Mar. 31
39	540	
38	480	
37	450	1934-40 doubling time 4.5 years
36	365	
35	285	
34	300	
33	260	
32	305	
1931	340	

Turkey - Cement
Thousands of 376 lb. bbls.

1962	13,500	
61	11,891	
60	11,949	
59	10,167	
58	8,895	
57	7,394	
56	5,687	
55	4,814	
54	3,981	
53	2,832	
52	2,691	1943-62 doubling time 5 years
51	2,322	
50	2,322	
49	2,160	
48	2,000	
47	2,040	
46	1,880	
45	1,680	
44	1,650	
43	890	
42	1,220	
41	1,580	
40	1,560	
39	1,650	
38	1,560	
37	1,250	
36	1,050	1934-39 doubling time 4.5 years
35	770	
34	980	
33	690	
32	630	
1931	560	
	n.a.	

N. Rhodesia - Copper
Long Tons of Metal content in Copper ore - Amt est. as recoverable

1962	566,000
61	578,000
60	567,250
59	534,673
58	393,814
57	428,851
56	397,736
55	352,956
54	391,704
53	366,795
52	324,275
51	314,329
50	292,788

1949	254,988		1934-62 doubling time 14.5 years
48	213,615		
47	192,500		
46	182,289		
45	194,014		
44	220,853		
43	250,998		
42	246,606		
41	228,254		
40	262,394		
39	211,668		
38	250,877		
37	245,288		
36	170,728		
35	168,659		
34	157,599		
33	129,423		
32	87,239		
31	22,800		1926-34 doubling time 1.2 years
30	6,269	smelter	
29	5,466	smelter	
28	5,930	smelter	
27	3,290	smelter	
1926	708	smelter	

India - Copper
L.T. Cu content of Copper Ore

1962	9,780	
61	8,705	
60	8,705	
59	7,900	
58	8,170	
57	8,404	
56	8,208	1948-62 doubling time 24 years
55	7,880	
54	7,722	
53	5,206	
52	6,670	
51	7,580	
50	7,180	
49	6,440	
48	6,460	
47	6,350	
46	6,500	
45	6,550	
44	6,600	
43	6,800	
42	6,600	
41	6,800	
40	7,800	
39	7,500	
38	6,000	

1937	11,000 est.	
36	8,900 est.	
35	8,700 est.	
34	11,500 est.	
33	10,700 est.	
32	11,200 est.	
31	11,400 est.	
30	11,600 est.	
29	7,500	
28	5,600	
27	6,000	
26	5,800	
25	4,900	
24	1,234	
23	244	
22	1,154	
21	866	
20	1,056	
19	1,228 est.	
18	136 est.	
17	751 est.	1913-31 doubling time 2.5 years
16	100 est.	
15	333 est.	
14	200 est.	
1913	143 est.	

Angola - Copper
L. T. Cu Metal content of Cu Ore

1962	1,120	
61	915	1960-62 halving time 2 years
60	1,880	
59	1,726	
58	1,506	
57	1,678	
56	1,444	
55	963	1950-60 doubling time 12.5 years
54	1,499	
53	1,451	
52	1,112	
51	1,140	
50	1,259	
49	730	
48	388	
47	280	
46	90	1944-50 doubling time 1.5 years
45	n.a.	
44	70	
43	220	
42	230	
41	0	
40	120	
39	120	

1938	0
1937	0

Congo (Leo) - Copper
L.T. of Cu product from smelter

1962	289,000	
61	289,000	
60	297,500	
59	277,639	
58	233,810	
57	238,418	
56	246,016	1933-62 doubling time 15 years
55	231,394	
54	220,257	
53	210,734	
52	202,499	
51	188,927	
50	173,142	
49	139,166	
48	153,025	
47	148,458	
46	141,613	
45	157,591	
44	162,871	
43	154,373	
42	163,319	
41	159,606	
40	146,479	
39	120,712	
38	121,985	
37	148,210	
36	96,156	
35	105,981	
34	108,346	
33	65,544	
32	53,000	
31	118,000	
30	136,754	
29	134,828	
28	110,680	
27	87,748	
26	79,365	
25	87,888	
24	84,285	
23	55,571	
22	42,655	
21	29,974	
20	18,657	
19	22,634	
18	19,913	
17	27,055	1913-30 doubling time 3.5 years
16	21,809	

1915	13,814
14	10,172
1913	5,324

Morocco - Copper
L.T. Cu metal content in Cu Ore

1962	2,430	
61	1,680	
60	1,500	
59	1,200	
58	1,086	
57	620	1957-62 doubling time 3 years
56	724	
55	735	
54	750	
53	1,129	
52	797	
51	28	
50	20	
49	354	
48	433	
47	40	
46	60	
45	382	
44	625	
43	223	
42	256	
41	133	
40	20	
39	35	
1938	0	

Cuba - Copper
L.T. Cu content in Cu Ore

1962	4,750	
61	4,950	
60	11,650	
59	8,877	
58	12,493	1954-62 halving time 3.5 years
57	13,666	
56	14,327	
55	17,417	
54	15,571	
53	15,184	
52	17,059	
51	20,873	
50	20,235	
49	17,000	
48	15,000	
47	11,044	

Bulgaria - Copper
Long Tons of Copper Metal

1962	16,300
61	12,500
60	10,700
59	9,800
58	7,700
57	7,100
56	5,200
55	5,000

1955-62 doubling time 4 years

Mexico - Copper
L.T. est. recoverable Cu content in Cu Ore

1962	46,400	
61	48,100	
60	59,350	
59	56,369	
58	63,937	1932-62 level
57	59,643	
56	53,998	
55	53,812	
54	53,940	
53	59,198	
52	57,540	
51	66,287	
50	60,724	
49	56,342	
48	58,143	
47	62,489	
46	60,089	
45	60,706	
44	40,647	
43	48,988	
42	50,092	
41	47,946	
40	37,009	
39	43,689	
38	41,190	
37	45,350	
36	29,244	
35	38,751	
34	43,569	
33	39,196	
32	34,698	
31	53,355	
30	72,252	
29	85,189	
28	64,470	
1927	57,806	

Bolivia - Copper
L.T. Cu content of Cu Ore <u>Exported</u> (No prod. data available)

1962	2,360	
61	2,050	
60	2,235	
59	2,650	
58	2,741	1948-62 halving time 9.5 years
57	3,857	
56	4,373	
55	3,442	
54	3,604	
53	4,393	

1952	4,629
51	4,769
50	4,630
49	4,994
48	6,512
47	6,142
46	6,030
45	6,001
1944	6,073

Chile - Copper
1936-62 L.T. Est. recoverable, Cu content in Cu ore
Before 1936 L.T. est. recoverable, Cu content in Cu ore

1962	578,000 Mis.	
61	535,000 U.N. appx.	
60	524,006	
59	537,597	
58	459,597	1936-62 doubling time 29.5 years
57	477,952	
56	482,004	
55	426,673	
54	357,912	
53	357,400	
52	402,179	
51	373,729	
50	357,020	
49	365,233	
48	437,922	
47	419,931	
46	345,336	
45	462,756	
44	490,456	
43	489,303	
42	476,703	
41	461,284	
40	357,307	
39	335,595	
38	345,391	
37	410,000	
36	252,162	
35	262,864	
34	260,000	
33	160,000	
32	101,600	
31	221,000	
30	216,844	
29	315,566	
28	285,311	
27	238,806	
26	199,879	
25	205,000 Approx.	
24	210,419	

1923	202,712	
22	126,256	
21	58,287	
20	103,000	
19	78,301	
18	105,196	
17	100,879	1913-29 doubling time 5.5 years
16	70,143	
15	51,500	
14	43,947	
1913	41,536	

Peru - Copper
L.T. Copper content in Cu ore

1962	163,000 Mis	
61	196,800 U.N.	
60	179,970	1948-62 doubling time 4 years
59	47,453	
58	52,772	
57	56,271	
56	45,506	
55	42,718	
54	37,818	
53	34,842	
52	30,689	
51	31,794	
50	29,797	
49	27,517	
1948	17,784	

Philippines - Copper
L.T. cu content in Cu Ore

1962	53,900	
61	51,200	
60	43,310	
59	48,739	
58	46,287	
57	39,744	
56	26,537	1946-62 doubling time 3.5 years
55	17,185	
54	14,122	
53	12,514	
52	13,032	
51	12,511	
50	10,220	
49	6,896	
48	3,300	
47	2,462	
46	0	

1945	n.a.	
44	n.a.	
43	n.a.	
42	n.a.	
41	9,700 est.	
40	9,113	1937-41 doubling time 1.2 years
39	7.378	
38	3,472	
1937	1,000	

Turkey - Copper
L.T. Cu metal smelted

1962	27,800	
61	28,500	
60	26,885	
59	23,468	
58	22,174	
57	24,016	
56	24,372	
55	23,423	
54	24,815	
53	26,913	
52	22,962	1938-62 doubling time 10.5 years
51	12,889	
50	11,515	
49	11,105	
48	10,806	
47	9,921	
46	9,891	
45	9,692	
44	10,781	
43	9,567	
42	8,127	
41	10,761	
40	8,616	
39	6,630	
38	2,449	
1937	400	

Ghana - Diamonds
Metric carats - 1949 and older = export data

1962	3,208,000 produced	
61	3,040,000	
60	3,273,000	
59	3,076,072 produced	
58	3,131,695 produced	1957-62 doubling time 80 years
57	3,124,825 produced	
56	2,539,429 produced	
55	2,258,270 produced	
54	2,135,459 produced	

1953	2,180,728	produced	
52	2,189,557	produced	
51	1,752,879	produced	
50	1,187,915	produced	
49	963,435	exported	
48	878,092	exported	
47	747,034	exported	
46	809,000	exported	
45	812,450	exported	
44	1,165,857	exported	
43	1,317,795	exported	1947-47 doubling time 5 years
42	1,055,735	exported	
41	1,084,294	exported	
40	572,560	exported	
39	1,087,651	exported	
38	1,296,763	exported	
37	1,577,661	exported	
36	1,414,677	exported	
35	1,349,847	exported	
34	2,391,609	exported	(includes accumulated stocks of bort and diamond sand)
33	803,985	exported	
32	842,297	exported	
31	880,479	exported	
30	861,119	exported	
29	660,536	exported	1922-28 doubling time 1.0 years
28	789,249	produced	
27	460,959	exported	
26	299,835	exported	
25	77,314	exported	
24	53,035	produced	
23	23,342	produced	
22	6,535	produced	
21	1,789	produced	
20	215	produced	
1919	0		

Sierra Leone - Diamonds
Metric carats

1962	1,907,000	exports	
61	1,937,000		
60	1,962,000	min yearbook 1961	
59	1,205,302	exports	
58	1,490,037	exports	1955-62 doubling time 3 years
57	863,202	exports	
56	647,797	exports	
55	418,077		
54	400,076		
53	481,709		
52	452,618		
51	474,821		
50	655,485		

1949	494,119	
48	465,698	
47	605,554	
46	559,232	1937-55 halving time 18.5 years
45	503,999	
44	608,734	
43	834,492	
42	1,046,187	
41	849,912	
40	885,414	
39	683,622	
38	689,622	
37	913,401	
36	616,200	1932-37 doubling time 0.7 years
35	295,483	
34	66,746	
33	26,901	
32	748	
1931	0	

British Guiana - Diamonds
Metric carats

1962	100,000	
61	113,000	
60	101,000	
59	62,328	1958-62 doubling time 2 years
58	33,091	
57	29,037	
1956	29,816	

Angola - Diamonds
Metric carats

1962	1,081,000	
61	1,148,000	
60	1,058,000	
59	1,015,688	
58	1,001,236	1956-62 doubling time 10 years
57	864,372	
56	740,035	
55	743,377	
54	721,606	
53	729,376	
52	729,376	
51	734,324	
50	538,867	1940-56 level
49	769,981	
48	795,509	
47	799,210	
46	806,962	
45	803,887	
44	799,120	

1943	794,990	
42	791,853	
41	786,979	
40	784,271	
39	690,447	
38	651,265	
37	626,424	
36	577,531	
35	481,615	
34	452,963	
33	373,624	
32	367,534	
31	361,495	
30	329,824	
29	311,903	
28	237,573	
27	200,809	
26	154,369	1919-40 doubling time 5 years
25	125,000	
24	118,016	
23	94,478	
22	98,683	
21	106,719	
20	93,529	
1919	48,504	

Congo (Leo.) - Diamonds
Metric carats

1962	18,156,000	
61	18,143,000	
60	13,453,000	
59	14,855,170	
58	16,673,474	
57	15,646,730	
56	14,110,478	
55	13,041,497	
54	12,620,114	1949-62 doubling time 13 years
53	12,580,270	
52	11,608,828	
51	10,564,755	
50	10,147,470	
49	9,649,968	
48	5,824,567	
47	5,474,517	
46	6,033,452	
45	10,385,955	
44	7,533,365	
43	4,881,742	
42	6,018,236	
41	6,865,756	
40	9,602,837	
39	8,360,166	

1938	7,205,921	
37	4,925,228	
36	4,634,266	
35	3,169,090	
34	1,450,000	
33	2,256,771	
32	3,872,171	
31	3,528,379	
30	2,518,100	
29	1,907,765	1919-42 doubling time 4.5 years
28	1,647,700	
27	1,041,544	
26	1,114,384	
25	883,903	
24	548,274	
23	414,954	
22	250,000	
21	244,878 exported	
20	274,013 exported	
1919	211,546 exported	

F.W.A. (Ivory Coast and Guinea) - Diamonds
Metric carats

1962	634,000	
61	1,769,000	1961-62 halving time 0.7 years
60	1,317,000	
59	844,900	
58	280,315	
57	247,138	
56	389,880	
55	318,520	
54	217,650	
53	179,850	
52	136,080	
51	100,980	
50	124,568	
49	94,996	
48	77,970	
47	53,749	
46	51,834	
45	79,802	
44	69,726	
43	36,193	
42	49,866	
41	57,735	
40	65,709	1936-61 doubling time 3.5 years
39	56,316	
38	52,934	
37	54,687	
36	5,500	

Venezuela - Diamonds
Metric Carats

1962	177,000
61	134,000
60	71,000
59	94,986
58	90,004
57	122,597
56	93,833
55	141,147
54	96,983
53	84,790
52	92,291
51	63,226
50	60,389
49	56,662
48	75,512
47	61,634
46	20,912
45	12,762
44	22,037
43	22,846
42	34,048
41	29,416
40	14,525
39	7,969
38	13,599
37	0

1947-62 doubling time 8.5 years

ENERGY CONSUMPTION UNITS DEFINED IN TEXT

Jamaica - Energy

1961	0.99
60	0.85
59	0.85
58	0.63
57	0.68
56	0.64
55	0.55
54	0.445
53	0.345
52	0.27
51	0.234
50	0.177
49	0.24
37	0.094
29	0.057

1949-61 doubling time 6 years

Mexico - Energy

1961	34.63
60	31.90
59	30.28
58	28.03
57	25.78
56	24.08
55	20.00
54	18.55
53	18.33
52	18.74
51	16.60
50	15.39
49	14.97
37	8.18
29	4.77

1949-61 doubling period 10 years

Trinidad - Energy

1961	2.06
60	1.91
59	1.52
58	1.41
57	1.18
56	0.94
55	1.30
54	1.11
53	1.06
52	0.95
51	0.916
50	0.91
49	0.95
37	0.173

1949-61 doubling time 11.5 years

Venezuela - Energy

1961	20.98
60	19.24
59	17.85
58	17.31
57	15.90
56	14.21
55	12.28
54	9.27
53	7.12
52	6.72
51	6.30
50	3.89
49	3.01
37	1.04

1949-61 doubling time 4 years

Bolivia - Energy

1961	0.51
60	0.50
59	0.50
58	0.47
57	0.52
56	0.55
55	0.47
54	0.50
53	0.36
52	0.329
51	0.302
50	0.357
49	0.315
37	0.134
29	0.098

1949-61 doubling time 14.5 years

Brazil - Energy

1961	25.25
60	24.47
59	21.24
58	20.68
57	18.57
56	18.66
55	16.92
54	19.71
53	17.53
52	16.46
51	14.67
50	11.52
49	10.05
37	5.02
29	4.127

1949-61 doubling time 8.5 years

British Guiana - Energy

1961	0.33
60	0.32
59	0.27
58	0.22
57	0.26
56	0.27
55	0.25
54	0.231
53	0.221
52	0.170
51	0.142
50	0.135
49	0.113
37	0.030
29	0.025

1949-61 doubling time 7.5 years

Chile - Energy

1961	6.85
60	6.49
59	6.22
58	5.81
57	5.75
56	5.90
55	5.33
54	5.86
53	5.53
52	5.31
51	5.409
50	4.42
49	4.335
37	3.205
29	3.085

1949-61 doubling time 18 years

Colombia - Energy

1961	7.93
60	7.20
59	6.65
58	6.14
57	6.15
56	5.41
55	5.26
54	4.81
53	4.11
52	3.84
51	3.39
50	3.04
49	2.84
37	1.184
29	0.0597

1949-61 doubling time 10 years

Peru - Energy

1961	3.96
60	3.86
59	3.30
58	3.30
57	2.95
56	2.71
55	2.58
54	3.00
53	2.70
52	2.64
51	2.17
50	1.62
49	1.69
37	0.845
29	0.855

1949-61 doubling time 9 years

Iran - Energy

1961	7.21
60	6.95
59	6.54
58	5.76
57	5.43
56	3.38
55	3.70

1955-61 doubling time 6 years

Israel - Energy

1961	3.03
60	2.67
59	2.31
58	2.25
57	2.09
56	1.93
55	1.97
54	1.64
53	1.506
52	1.491
51	1.244
50	1.016
49	0.671

1949-61 doubling time 5.5 years

Turkey - Energy

1961	6.57	
60	6.82	
59	6.48	1953-61 doubling time 20 years
58	6.90	
57	6.55	
56	5.73	
55	5.41	
54	5.441	
53	5.322	
52		
51		Inconsistancy in U.N. data at 1952
50		
49		
37	1.57	
29	1.247	Questionable

Egypt - Energy

1961	7.90
60	7.29
59	6.08
58	5.94
57	6.02
56	5.37
55	5.60

1955-61 doubling time 14 years

Burma - Energy

1961	1.08
60	1.18
59	1.09
58	0.91
57	0.83
56	0.76
55	0.66
54	0.605
53	0.558
52	0.469
51	0.402
50	0.352
49	0.270
37	0.782

1949-61 doubling time 5.5 years

Malaya (including Singapore) - Energy

1961	2.93
60	2.65
59	2.57
58	2.69
57	2.45
56	2.33
55	2.62
54	2.307
53	2.381
52	2.574
51	2.299
50	1.751.
49	1.664
37	1.775
29	1.472

1949-61 doubling time 14 years

India - Energy

1961	66.46	
60	60.70	
59	55.83	1949-61 doubling time 14 years
58	53.18	
57	49.96	
56	46.70	
55	43.87	
54	41.44	
53	41.418	
52	39.947	
51	37.275	
50	36.151	
49	36.341	
37	26.960	includes Pakistan
29	25.349	includes Pakistan and Burma

Indonesia - Energy

1961	13.47
60	12.41
59	12.12
58	10.93
57	10.63
56	10.16
55	9.46

1955-61 doubling time 12 years

Island of New Guinea - Energy

1961	0.16
60	0.16
59	0.14
58	0.14
57	0.14
56	0.12
55	0.11

1955-61 doubling time 11 years

Philippines - Energy

1961	4.43
60	3.81
59	3.63
58	3.51
57	3.28
56	3.11
55	2.76
54	2.59
53	2.024
52	2.096
51	1.944
50	2.044
49	1.700
37	0.832

1949-61 doubling time 8.5 years

Thailand - Energy

1961	1.82
60	1.61
59	1.48
58	1.34
57	1.30
56	1.14
55	1.03
54	N.A.
53	0.716
52	0.533
51	0.445
50	0.369
49	0.254
37	0.188
29	0.177

1949-61 doubling time 4 years

Algeria - Energy

1961	2.86
60	3.03
59	2.63
58	2.45
57	2.33
56	2.10
55	2.14
54	1.835
53	1.647
52	1.624
51	1.583
50	1.412
49	1.196
37	1.012
29	1.156

1949-61 doubling time 10.5 years

Angola - Energy

1961	0.35
60	0.40
59	0.30
58	0.27
57	0.26
56	0.21
55	0.18
54	0.151
53	0.125
52	0.135
51	0.098
50	0.073
49	0.068
37	0.038

1949-61 doubling time 4.5 years

Congo (Leo.) - Energy

1961	1.25	
60	1.23	
59	1.31	1954-61 halving time 11.5 years
58	1.40	
57	1.52	
56	1.44	
55	1.50	
54	1.823	
53	1.525	
52	1.274	1948-54 doubling time 4.5 years
51	1.059	
50	0.959	
49	0.850	
37	0.400	includes Ruanda-Urundi
29	0.654	includes Ruanda-Urundi

French West Africa (including Guinea) - **Energy**

1961	0.89	
60	0.79	
59	0.74	1951-61 doubling time 11 years
58	0.67	
57	0.63	
56	0.62	
55	0.55	
54	0.573	
53	0.488	
52	0.526	
51	0.456	
50	0.347	
49	0.297	
37	0.212	includes French portion of Togo
29	0.120	

Ghana - Energy

1961	0.64	
60	0.66	
59	0.60	1957-61 doubling time 27.5 years
58	0.61	
57	0.62	
56	0.50	
55	0.55	
54	0.451	1949-57 doubling time 10.5 years
53	0.420	
52	0.364	
51	0.407	
50	0.366	
49	0.299	
37	0.187	
29	0.121	

Liberia - Energy

1961	0.08
60	0.08
59	0.07
58	0.06
57	0.05
56	0.02
55	0.032
54	0.053
53	0.032
52	0.028
51	0.026
50	0.028
49	0.018
37	0.003

1949-61 doubling time 4.5 years

Madagascar - Energy

1961	0.18
60	0.20
59	0.19
58	0.19
57	0.16
56	0.16
55	0.15
54	0.174
53	0.171
52	0.177
51	0.143
50	0.137
49	0.088
37	0.021
29	0.030

1949-61 doubling time 11 years

Mozambique - Energy

1961	0.82
60	0.71
59	0.68
58	0.69
57	0.68
56	0.59
55	0.52
54	0.543
53	0.479
52	0.475
51	0.356
50	0.348
49	0.279
37	0.106
29	0.170

1949-61 doubling time 7.5 years

Nigeria - Energy

1961	1.71
60	1.42
59	1.56
58	1.50
57	1.31
56	1.25
55	1.10
54	1.05
53	1.01
52	0.91
51	0.996
50	0.849
49	0.719
37	0.413
29	0.386

1949-61 doubling time 10 years

Sierra Leone - Energy

1961	0.13	
60	0.10	
59	0.13	
58	0.13	
57	0.11	
56	0.08	
55	0.08	
54	0.058	
53	0.072	
52	0.057	?
51	0.051	
50	0.049	
49	0.050	
37	0.011	
29	0.009	

1949-61 doubling time 9 years

Albania - Energy

1961	0.56
60	0.50
59	0.42
58	0.36
57	0.30
56	0.28
55	0.22

1955-61 doubling time 4.2 years

Morocco - Energy

1961	1.73
60	1.58
59	1.43
58	1.42
57	1.32
56	1.51

1956-61 doubling time 10.5 years

Bulgaria - Energy

1961	12.43
60	10.87
59	9.37
58	7.56
57	6.88
56	6.42
55	5.95

1955-61 doubling time 5.5 years

Cuba - Energy

1961	6.01	
60	5.84	
59	5.37	1949-61 doubling time 9 years
58	4.70	
57	4.71	
56	4.21	
55	3.95	
54	3.69	
53	3.50	
52	3.35	
51	2.84	
50	2.56	
49	2.49	
37	1.487	
29	2.119	

Rumania - Energy

1961	26.62
60.	25.60
59	24.37
58	22.67
57	21.28
56	19.43
55	17.98
54	N.A.
53	N.A.
52	N.A.
51	N.A.
50	7.339
49	6.727
37	5.680
29	4.220

1955-61 doubling time 10 years

"ENERGY CONSUMPTION UNITS DEFINED IN TEXT"

Algeria - Phosphates
Metric tons of P_2O_5

1962	389,866	
61	426,000	
60	548,000	1953-62 halving time 9 years
59	531,000	
58	565,000	
57	613,000	
56	610,000	
55	752,000	
54	774,000	
53	619,000	
52	703,000	
51	777,000	
50	685,000	
49	648,000	
48	671,000	
47	707,000	
46	585,000	
45	401,000	
44	233,000	
43	77,000	
42	331,000	
41	491,000	
40	371,000	
39	500,000	1928-42 halving time 12 years
38	584,000	
37	631,000	
36	531,000	
35	604,000	
34	532,000	
33	588,000	
32	569,000	
31	565,000	
30	847,000	
29	747,000	
28	876,000	

Brazil - Phosphates
Metric Tons of P_2O_5

1962	650,000	
61	652,000	1959-62 halving time 4.5 years
60	880,000	
59	1,006,000	
58	645,000	
57	329,000	
56	45,000	1956-59 doubling time 0.7 years
55	0	

Brazil - Nitrates
Metric Tons of N

1960-1	15,700	
59-60	10,600	
58-9	2,500	
57-8	1,200	
56-7	1,400	
55-6	3,500	est.
54-5	3,500	est.
53-4	N.A.	
52-3	N.A.	
51-2	3,500	est.
50-1	3,500	est.
49-50	800	est.
48-49	900	
47-8	800	
46-7	800	
45-6	0	

1957-8 - 1960-1 doubling time 0.9 years

Chile - Phosphates
Metric tons of P_2O_5

1962	12,591	
61	14,000	
60	18,000	
59	19,000	1956-62 halving time 3 years
58	18,000	
57	33,000	
56	63,000	
55	53,000	

Chile - Potash
Metric tons of K_2O

1962	17,727	
61	14,000	
60	15,000	
59	14,000	
58	9,000	
57	8,000	
56	9,000	
55	10,000	1955-62 doubling time 8 years
54	500	
53	300	
52	12,000	
51	10,000	
50	N.A.	
49	5,000	
48	1,000	

Chile - Nitrates
Metric tons of N

1961-62	179,200	
60-1	145,000	
59-60	148,200	
58-9	202,000	
57-8	257,600	
56-7	257,600	1938-62 halving time 80 years
55-6	180,100	
54-5	233,300	
53-4	253,900	
52-3	227,400	
51-2	271,700	
50-1	268,100	
49-50	241,800	
48-9	275,300	
47-8	274,100	
46-7	261,000	
45-6	221,400	
1938	223,500	

India - Phosphates
Metric Tons of P_2O_5

1962	29,018
61	20,000
60	15,000
59	16,000
58	15,000
57	9,000
56	9,000
55	6,000
54	2,000
53	4,000
52	500
51	400
50	1,100

1948-62 doubling time 3 years

India - Nitrates
Metric Tons of N

1961-2	140,000
60-1	109,900
59-60	87,300
58-9	80,800
57-8	80,800
56-7	80,800
55-6	81,700
54-5	83,100
53-4	65,300
52-3	64,000
51-2	23,100
50-1	8,400
49-50	9,900
48-9	12,600
47-8	7,300
46-7	4,000
45-6	4,300

1944/5-60/1 doubling time 3.5 years

Israel - Phosphates
Metric Tons of P_2O_5

1962	230,000	
61	226,000	
60	224,000	1958-62 doubling time 28 years
59	205,000	
58	210,000	
57	152,000	
56	116,000	
55	72,000	1952-58 doubling time 1.6 years
54	58,000	
53	23,000	
52	17,000	

Israel - Potash
Metric Tons of K_2O

1962	90,900	
61	84,900	
60	82,200	1953-58 doubling time 1.0 years
59	69,000	
58	63,400	
57	45,000	
56	28,000	
55	11,000	
54	11,000	1958-62 doubling time 7.5 years
53	3,000	
52	-	
51	-	
50	-	
49	-	
48	30,000	
47	62,000	
46	45,000	
45	47,000	
44	53,000	
43	47,000	
42	52,000	
41	51,000	
40	45,000	1931-41 doubling time 2.5 years
39	32,000	
38	24,000	
37	15,000	
36	10,000	
35	10,000	
34	7,000	
33	7,000	
32	6,000	
31	3,000	
30	1,000	

Israel - Nitrates
Metric Tons of N

1961-62	16,100
60-61	20,100
59-60	15,600
58-59	14,000
57-58	12,900
56-57	9,700
55-56	1,800
54-55	-

1955/6 - 1961/2 doubling time 1.6 years

Jordan - Phosphates
Metric Tons of P_2O_5

1962	456,846
61	423,000
60	362,000
59	238,000
58	294,000
57	262,000
56	208,000
55	164,000
54	75,000
53	40,000
52	24,000
51	6,600

1952-62 doubling time 2.2 years

Morocco - Phosphates
Metric Tons of P_2O_5

1962	8,161,960	
61	7,950,000	
60	7,472,000	1957-62 doubling time 10.5 years
59	7,164,000	
58	6,538,000	
57	5,567,000	
56	5,522,000	
55	5,328,000	
54	5,020,000	
53	4,156,000	1946-57 doubling time 10.5 years
52	3,953,000	
51	4,717,000	
50	3,872,000	
49	3,626,000	
48	3,226,000	
47	2,881,000	
46	2,860,000	
45	1,654,000	
44	1,445,000	1941-46 doubling time 2 years
43	806,000	
42	715,000	
41	493,000	
40	687,000	
39	1,703,000	
38	1,487,000	
37	1,378,000	
36	1,335,000	
35	1,152,000	
34	1,200,000	
33	960,000	
32	995,000	
31	1,001,000	
30	1,850,000	
29	1,650,000	
28	1,268,000	

Philippines - Nitrates
Metric Tons of N

1960-61	23,200
59-60	N.A.
58-59	14,000
57-58	8,400
56-57	8,000
55-56	6,600
54-55	6,800
53-54	6,000

1953/54 - 1960/1 doubling time 3.5 years

Egypt - Phosphates
Metric Tons of P_2O_5

1962	630,000	
61	627,000	
60	566,000	1954-62 doubling time 29.2 years
59	629,000	
58	558,000	
57	586,000	
56	615,000	
55	626,000	
54	535,000	
53	443,000	
52	478,000	1946-54 doubling time 19.2 years
51	501,000	
50	397,200	
49	350,000	
48	300,000	
47	377,000	
46	371,000	
45	349,000	
44	318,000	

Egypt - Nitrates
Metric Tons of N

1961	106,500	
60	55,000	
59	38,100	1954-62 doubling time 3.5 years
58	34,300	
57	32,200	
56	26,700	
55	29,600	
54	21,700	
53	18,600	
52	17,000	1952-54 doubling time 3.5 years

Brazil - Gold
1955-62 "Mined Gold Only" - Fine Troy Ozs.

1962	120,000	
61	120,900	
60	118,891	1920-62 level
59	112,332	
58	116,190	
57	120,755	
56	122,237	
55	109,602	
54	119,987	
53	115,871	
52	136,764	
51	135,857	
50	131,207	
49	119,182	
48	130,243	
47	135,548	
46	140,482	
45	163,107	
44	166,378	
43	160,370	
42	157,078	
41	147,308	
40	151,000	
39	148,000	
38	142,907	
37	145,800	
36	125,674	
35	119,084	
34	110,900	
33	117,804	
32	124,163	
31	126,440	
30	143,775	
29	109,803	
28	"100,000"	
27	"100,000"	
26	99,606	
25	120,330	
24	120,824	
23	N.A.	
22	146,668	
21	134,482	
20	125,775	

Ghana - Gold
Fine Troy Ozs.

1962	888,038
61	852,619
60	893,113
59	913,200
58	852,834
57	790,381
56	637,755
55	681,151
54	787,075
53	730,963
52	691,460
51	698,676
50	689,429
49	676,931
48	672,388
47	558,011
46	585,910
45	539,252
44	523,225
43	567,282
42	778,925
41	888,887
40	886,326
39	782,271
38	674,927
37	559,212
36	428,144
35	358,835
34	326,040
33	305,908
32	278,782
31	261,651
30	240,899
29	207,851
28	167,042
27	171,585
1926	199,545
25	190,930
24	205,903
23	199,525
22	212,690
21	203,395
20	207,506
19	295,226
18	314,862
17	364,707
16	383,651
15	404,781
14	410,655
13	388,126

1944-62 doubling time
24.5 years

India - Gold
Fine Troy Ozs.

No Pakistan production records

1952-62 Halving time 16 years

1920-40 Halving time 47 years

1962	163,326
61	156,510
60	160,593
59	165,383
58	170,110
57	179,182
56	209,251
55	210,880
54	239,168
53	221,961
52	253,264
51	226,364
50	196,925
49	164,203
48	180,045
47	171,705
46	131,775
45	168,366
44	188,206
43	255,228
42	260,302
41	285,930
40	289,324
39	314,515
38	321,138
37	330,744
36	331,946
35	326,170
34	322,100
33	336,100
32	329,600
31	330,400
30	329,200
29	363,800
28	376,000
27	384,200
26	384,100
25	392,900
24	396,300
23	383,600
22	432,409
21	390,960
20	440,500

New Guinea & Papua - Gold
Fine Troy Ozs.

Fiscal year ends June 30

1962	21,787	
61	41,950	
60	45,191	
59	46,820	
58	43,812	
57	69,029	
56	79,476	1953-62 Halving time 3.5 years
55	79,092	
54	86,728	
53	120,848	
52	127,580	
51	94,438	1947-53 Doubling time 4 years
50	81,764	
49	93,881	
48	86,758	
47	59,400	
46	661	
43-5	-	
42	105,855	
41	263,096	
40	309,713	
39	273,707	
38	249,899	
37	244,972	1931-40 Doubling time 3 years
36	210,067	
35	212,761	
34	175,326	
33	131,431	
32	71,564	
31	35,166	
30	32,765	
29	45,934	
Prior to June 30, 1928	533,653	

Congo (Leo) - Gold
Fine Troy Ozs.

Includes Ruanda-Urandi
Avg. 2-4000 Ozs.

1962	200,000	
61	232,611	
60	316,195	1958-62 Halving time 4.5 years
59	347,967	
58	352,276	
57	371,020	
56	373,849	1948-58 level
55	369,926	
54	365,490	
53	371,020	
52	368,769	
51	352,308	
50	339,415	
49	333,853	
48	299,774	
47	301,405	
46	331,313	

Mexico - Gold
Fine Troy Ozs.

1962	236,758
61	268,684
60	300,256
59	313,662
58	332,250
57	346,328
56	350,250
55	382,883
54	386,920
53	483,483
52	459,370
51	393,429
50	408,122
49	405,549
48	367,612
47	464,739
46	420,500
45	499,301
44	508,882
43	631,537
42	801,357
41	799,975
40	883,117
39	841,642
38	923,798
37	846,381
36	753,950
35	682,319
34	661,390
33	637,727
32	584,198
31	623,003
30	671,871
29	651,873
28	699,102
27	725,175

1952-62 Halving time 11 years

Chile - Gold
Fine Troy Ozs.

1962	100,000
61	110,000
60	109,055
59	78,640
58	112,952
57	103,590
56	94,459
55	136,062
54	124,970
53	130,693
52	177,054
51	174,964
50	186,474
49	184,770
48	164,252
47	168,855
46	230,523
45	180,352
44	203,749
43	173,751
42	187,001
41	263,833
40	335,432
39	329,453
38	294,033
37	315,553
36	248,794
35	265,938
34	238,547
33	147,052
32	38,096

1940-62 Halving time 18.5 years

Colombia - Gold
Fine Troy Ozs.

1962	396,825	
61	401,060	
60	433,947	
59	397,929	
58	371,715	
57	325,114	
56	438,347	
55	380,824	
54	377,467	1949-62 level
53	437,295	
52	422,240	
51	430,723	
50	406,319	
49	385,307	
48	335,260	
47	383,027	
46	437,176	
45	506,695	
44	553,530	
43	565,501	

Peru - Gold
Fine troy ozs.

1962	126,223	
61	137,418	
60	141,001	
59	150,299	1955-62
58	159,127	Halving time
57	161,831	17 years
56	159,074	
55	170,747	
54	147,424	
53	140,228	
52	134,865	
51	158,270	
50	147,964	
49	113,753	
48	111,162	
47	116,017	
46	158,379	
45	172,663	
44	175,180	
43	199,637	
42	257,612	
41	285,189	
40	281,261	
39	267,357	
38	260,326	
37	168,665	
36	152,405	
35	110,959	
34	110,659	
33	119,189	
32	106,443	
31	79,410	
30	71,084	
29	122,141	
28	62,177	
27	92,656	

1926	91,949	
25	120,918	
24	119,000	
23	120,372	
22	81,433	
21	76,386	
20		
19	65,232	1912-41
18	57,645	Doubling time
17	60,667	10.5 years
16	61,310	
15	54,334	
14	49,449	
13	44,135	

Venezuela - Gold
Fine Troy Ozs.

1957-62 Halving time 3 years

1962	28,774
61	30,071
60	46,868
59	53,740
58	75,976
57	89,873
56	69,767
55	61,140
54	56,074
53	27,304
52	4,476
51	2,861
50	34,462
49	61,378
48	49,737
47	21,830
46	48,558
45	76,837
44	77,716
43	82,634
42	115,987
41	99,090
40	146,792
39	146,608
38	114,984
37	116,517
36	109,994
35	112,390

Philippines - Gold
Fine Troy Ozs.

1962	423,394	
61	423,983	
60	410,618	
59	402,615	
58	422,833	1953-62 level
57	379,982	
56	406,163	
55	419,112	
54	416,052	
53	480,625	
52	469,408	
51	393,600	
50	333,991	1946½-52 doubling time 2 years
49	287,838	
48	209,225	
47	64,441	
46	360	
45	N.A.	
44	"	
43	"	
42	"	
41	"	
40	1,114,201	
39	999,408	
38	903,265	
37	716,967	1921-40 doubling time 4.5 years
36	599,675	
35	451,818	
34	332,974	
33	296,258	
32	244,287	
31	174,000	
30	179,220	
29	160,620	
28	92,109	
27	81,571	
26	91,242	
25	92,067	
24	79,906	
23	81,576	
22	73,840	
21	63,521	
20	(incl. with U.S.A.)	

Malaya - Gold
Fine Troy Ozs.

1962	6,923	1959-62
61	12,486	Halving
60	20,745	time
59	26,739	15 years
58	22,484	
57	11,157	
56	19,200	1950-59
55	21,600	Doubling
54	19,900	time
53	17,400	15.5 years
52	18,800	
51	16,200	
50	17,600	
49	13,000	1945-50
48	10,212	Doubling
47	5,312	time
46	445	0.8 years
45	287	
44	1,212	
43	2,213	
42	1,024	
41	24,804	
40	36,180	
39	41,163	
38	40,790	
37	34,300	
36	38,500	
35	30,050	
34	32,550	
33	31,000	
32	27,450	
31	29,462	Put on Market
30	29,597	"
29	26,782	"
28	18,693	"
27	11,758	"

Estimates

1926	14,475	Put on market	
25	14,185	"	
24	14,960	"	1913-38
23	9,567	"	doubling
22	14,500		time 16 years
21	13,200		
20	11,690	Exports	
19	14,995	"	
18	16,694	"	
17	16,552	"	
16	15,852	"	
15	16,996	"	
14	13,013	"	
13	13,654	"	

Sierra Leone - Iron
Long Tons of Ore (including Manganiferous Iron Ore)

1962	1,980,000		
61	1,770,000		
60	1,447,000		
59	1,421,533		
58	1,299,349		
57	1,323,895		
56	1,311,059		
55	1,235,384		
54	816,556		1943-62 doubling time 12 years
53	1,367,046		
52	1,152,459		
51	1,140,325		
50	1,165,039		
49	1,089,036		
48	858,196	Marketable	
47	739,078	ore only;	
46	636,194	washed fines	
45	685,138	excluded	
44	454,660	Exports	
43	556,515	"	
42	623,270	"	
41	1,029,970	"	
40	689,290	"	
39	828,560	"	
38	861,955	"	1934-41 doubling time 3 years
37	633,985	"	
36	566,595	"	
35	433,540	"	
34	210,645	"	
33	24,550	"	

India - Iron
Long Tons of Ore (includes Burma before 1934)

1962	12,950,000			
61	12,061,000			
60	10,514,000			
59	7,856,000			
58	6,033,000			
57	5,073,996		1926	1,659,295
56	4,897,792		25	1,544,578
55	4,677,538		24	1,445,313
54	4,308,273	1947-62	23	821,053
53	3,844,911	doubling	22	625,274
52	3,925,511	time	21	942,084
51	3,657,105	6 years	20	558,005
50	2,965,194		19	563,750
49	2,808,522		18	492,669
48	2,284,587		17	413,357
47	2,498,459		16	411,809
46	2,407,682		15	390,339
45	2,264,184		14	441,574
44	2,364,000		13	370,845
43	2,665,173		12	580,224
42	3,217,430		11	366,190
41	3,194,478		10	54,588
40	3,103,356		09	83,439
39	3,116,074			
38	3,743,675			
37	2,870,832			
36	2,526,931	1913-40		
35	2,341,212	doubling		
34	1,916,918	time		
33	1,228,625	8.5 years		
32	1,760,501			
31	1,624,883			
30	1,849,625			
29	2,428,555			
28	2,055,981			
27	1,846,735			

Malaya - Iron
Long Tons of Ore

1962	6,500,000	
61	6,734,000	
60	5,641,000	
59	3,760,684	
58	2,795,261	
57	2,972,359	
56	2,444,570	1951-62
55	1,466,184	doubling
54	1,212,780	time 3 years
53	1,062,678	
52	1,055,506	
51	846,803	
50	498,903	
49	8,390	
48	641	
47	888	
46	-	
45	13,375	
44	10,452	
43	48,361	
42	90,776	
41	1,148,977	(Jan.-Sept. only)
40	2,105,612	
39	1,942,521	
38	1,581,838	
37	1,661,489	1921-40
36	1,654,996	doubling
35	1,411,636	time 4.5 years
34	1,135,649	
33	766,472	
32	688,179	
31	691,991	
30	777,785	
29	809,518	
28	644,635	
27	458,279	

1926	295,610
25	271,992
24	235,118
23	154,161
22	111,367
21	74,250

Angola - Iron
Long Tons of Ore
(Including Manganiferous Iron Ore)

1962	739,000	
61	799,000	1958-62 doubling time 2.5 years
60	649,000	
59	343,470	
58	282,664	
57	103,932	

Guinea - Iron
Long Tons of Ore

1962	688,000	
61	533,000	1957-62 halving time 8 years
60	764,000	
59	353,000	
58	408,239	
57	1,071,900	
56	833,500	1953-57 doubling time 3 years
55	640,000	
54	582,765	
53	392,335	
52	0	

Liberia - Iron
Long Tons of Ore

1962	3,560,000	Before 1959 data is for exports except 1951 and 1953.
61	3,200,000	
60	3,003,000	
59	2,664,960	
58	2,034,501	
57	2,128,650	
56	2,036,941	1952-62 doubling time 5 years
55	1,716,932	
54	1,190,051	
53	1,264,000	
52	876,974	
51	170,000	
1950	0	

Morocco - Iron
Long Tons of Ore

1962	1,129,000	
61	1,439,000	1957-62 halving time 7 years
60	1,552,000	
59	1,245,043	
58	1,514,385	
57	1,845,217	
56	1,773,541	
55	1,326,344	
54	1,252,226	
53	1,479,254	
52	1,672,119	
51	1,466,326	
1950	1,253,667	
49	1,230,937	
48	1,182,781	
47	1,006,197	
46	897,236	
45	752,843	
44	686,500	
43	549,476	
42	541,986	
41	547,496	1940-57 doubling time 8.5 years
1940	463,400	
39	1,541,923	
38	1,581,932	
37	1,400,000	
36	1,036,355	
35	1,149,323	
34	811,785	
33	507,692	

Mexico - Iron
Long Tons of Ore

1962	1,128,000
61	1,190,000
60	924,000
59	875,000
58	955,000
57	935,000
56	801,000
55	704,000
54	513,830
53	538,550
52	557,870
51	500,000
1950	413,000
49	357,000
48	332,000
47	327,195
46	271,095
45	278,062
44	296,788
43	248,450
42	157,755
41	108,395
1940	109,033
39	141,601
38	97,782
37	133,869
36	121,176
35	94,080
34	104,128
33	76,486
32	26,694
31	64,000
30	105,289
29	n.a.
28	79,025
27	63,000

1933-62 doubling time 7.5 years

Chile - Iron
Long Tons of Ore

1954-62 doubling time 3 years

1962	7,850,000	est
61	6,860,000	
60	5,940,000	
59	4,560,000	
58	3,699,450	
57	2,652,000	(MY)
56	2,624,000	(MY)
55	1,545,000	appx (MY)
54	2,164,300	
53	2,857,579	
52	2,325,363	
51	3,124,204	
1950	2,906,591	
49	2,699,593	
48	2,668,125	
47	1,710,111	
46	1,158,462	
45	272,531	
44	18,122	
43	4,564	
42	402,768	
41	1,669,830	
1940	1,720,804	
39	1,599,948	
38	1,581,670	
37	1,505,542	

Colombia - Iron
Long Tons of Ore

1955-62 doubling time 8.5 years

1962	614,000
61	640,000
60	645,000
59	399,000
58	552,993
57	583,763
56	387,990
55	343,461
54	81,899
53	nil

Peru - Iron
Long Tons of Ore

1960	6,875,000
59	3,478,000
58	3,532,108
57	3,522,765
56	2,873,600
55	1,737,743
54	2,084,888
53	1,359,341
52	nil

1953-62 doubling time 4.5 years

Venezuela - Iron
Long Tons of Ore

1962	13,030,000	
61	14,425,000	
60	19,182,000	
59	16,929,607	
58	15,239,986	
57	15,135,068	1950-57 doubling time 1.7 years
56	10,929,398	
55	8,306,162	
54	5,334,986	
53	2,260,132	
52	1,938,692	
51	1,249,559	
1950	195,159	
49	nil	

Philippines - Iron
Long Tons of Ore

1962	1,364,000	
61	1,153,000	
60	1,121,000	
59	1,210,764	1954-62 level
58	1,081,379	
57	1,325,099	
56	1,417,486	
55	1,410,084	
54	1,402,394	
53	1,198,630	1949-54 doubling time 3 years
52	1,151,866	
51	889,016	
1950	589,633	
49	364,326	
48	18,000	
47	nil	
46	nil	
42-45	n.a.	
41	835,595 (Jan. through Oct.)	
1940	1,228,184	
39	1,166,781	
38	856,310	1935-40 doubling time 2.5 years
37	681,698	
36	529,041	
35	278,836 exports	
34	7,125 exports	
33	--nil	

Turkey - Iron
Long Tons of Ore

1962	760,000	
61	745,000	
60	775,000	
59	859,103	
58	935,890	
57	1,145,812	1957-62 halving time 8 years
56	915,784	
55	860,174	
54	576,947	
53	489,420	
52	474,215	
51	222,244	1946-57 doubling time 3 years
1950	229,902	
49	214,599	
48	165,170	
47	143,320	
46	110,438	
45	123,283	
44	89,002	
43	90,302	
42	18,743	
41	59,794	
1940	128,279	
39	227,663	
38	75,299	
37	nil	

Egypt - Iron
Long Tons of Ore

1962	452,000
61	414,000
60	236,000
59	241,000
58	175,000
57	250,000
56	130,000
55	1,280

1956-62 doubling time 3.5 years

Brazil - Iron
Long Tons of Ore

1962	10,000,000 est.
61	9,193,000
60	9,197,000
59	8,766,000
58	5,102,820
57	4,898,090
56	4,021,305
55	3,328,511
54	3,022,243
53	3,560,351
52	3,112,325
51	2,368,928
50	1,956,036
49	1,857,829
48	1,277,050
47	601,351
46	573,316
45	639,943

1948-62 doubling time 5 years

Rumania - Iron
Long Tons of Ore

1962	1,719,000
61	1,713,000
60	1,437,000
59	1,047,000
58	731,742
57	634,314
56	683,379
55	626,942
54	684,000
53	680,000
52	644,000
51	470,000
50	389,000
49	319,000
48	303,000
47	113,000
46	120,000

1948-62 doubling time 5.5 years

Bulgaria - Iron
Long Tons of Ore

1962	618,000
61	410,000
60	404,000
59	366,000
58	340,000
57	267,000
56	232,000
55	111,000
54	116,000
53	113,000
52	101,000

1952-62 doubling time 4 years

India - Manganese
Long Tons of Ore

1962	1,173,000
61	1,195,000
60	1,136,000
59	1,168,000
58	1,234,000
57	1,654,194
56	1,736,609
55	1,583,538
54	1,413,068
53	1,902,238
52	1,462,264
51	1,292,375
1950	882,929
49	645,825
48	525,876
47	451,035
46	252,916
45	210,583
44	370,980
43	595,347

1953-62 halving time 12 years

1945-53 doubling time 2.5 years

Angola - Manganese
Long Tons of Ore

1962	12,600
61	20,200
60	23,000
59	38,207
58	48,088
57	49,289
56	52,130
55	31,119
54	31,129
53	64,824
52	54,224
51	45,462
1950	9,161
49	18,300
48	394
47	690
46	1,870
45	n.a.
44	1,968
43	3,937

1953-62 doubling time 4 years

1948-53 doubling time 0.7 years

Congo (Leo.) - Manganese
Long Tons of Ore

1962	314,000	
61	308,000	
60	367,000	
59	380,085	
58	332,804	1955-62 halving time 14 years
57	361,225	
56	324,330	
55	454,440	
54	378,857	
53	213,242	
52	125,957	
51	69,825	
1950	16,722	
49	12,054	
48	12,563	
47	8,384	1946-55 doubling time 1.2 years
46	nil	
45	nil	
44	2936	
43	17,137	
42	28,527	
41	30,050	
1940	18,077	
39	4,309	
38	7,603	
37	30,498	

Morocco - Manganese
Long Tons of Ore

1962	463,000	
61	562,000	
60	474,000	
59	463,135	
58	403,608	1952-62 doubling time 34 years
57	484,379	
56	421,276	
55	405,944	
54	394,881	
53	423,718	
52	423,160	
51	367,458	1944-52 doubling time 2 years
1950	282,878	
49	230,775	
48	211,000	
47	107,688	
46	57,074	
45	43,960	
44	27,112	

Chile - Manganese
Long Tons of Ore

1962	45,400	
61	34,500	
60	45,200	1952-62 level
59	38,200	
58	37,554	
57	53,325	
56	47,250	
55	42,674	
54	37,122	
53	53,793	
52	52,997	
51	38,483	
1950	34,960	
49	28,414	
48	20,174	
47	20,015	
46	20,125	

Indonesia - Manganese
Long Tons of Ore

1962	10,900		
61	12,750		
60	10,780		1956-62 halving time 1.7 years
59	42,118		
58	43,161		
57	52,981		
56	106,123		
55	38,447		
54	19,918		1952-56 doubling time 1.2 years
53	21,650		
52	9,835		
51	n.a.		
1950	n.a.		
49	n.a.		
48	0		
47	0		
46	0		
41-45	7,000	Aug.	
1940	11,386		
39	11,883		
38	9,534		
37	10,908		
36	8,483		
35	12,158		
34	11,451		1920-28 doubling time 2.5 years
33	10,298		
32	8,156		
31	14,311		
1930	17,361		
29	20,665		
28	24,066		
27	14,727		
26	11,765		
25	9,866	exported	
24	8,346		
23	5,159		
22	2,278		
21	2,059		
1920	4,112		

Turkey - Manganese
Long Tons of Ore

1962	21,000
61	29,600
60-	27,800
59	35,126
58	22,250
57	55,822
56	59,792
55	49,311
54	49,026
53	72,782
52	105,158
51	49,719
50	31,670
49	24,607
48	8,195
47	4,560
46	1,675
45	5,015
44	1,939
43	821
42	3,261
41	1,339

1952-62 halving time 4.5 years

Ghana - Manganese
Long Tons of Ore

EXPORTS

1962	460,000	
61	385,000	
60	538,080	
59	526,653	
58	513,099	
57	641,343	
56	635,851	
55	539,580	
54	460,245	
53	745,990	
52	794,192	
51	806,080	
1950	711,366	
49	741,069	
48	629,973	
47	588,919	
46	765,300	
45	701,750	
44	504,458	
43	423,393	
42	483,573	
41	428,736	
1940	477,322	
39	336,312	
38	324,207	
37	527,036	
36	411,024	
35	430,659	
34	365,178	produced
33	265,140	
32	50,689	
31	247,191	
1930	417,490	
29	419,224	
28	376,913	produced
27	403,187	produced
26	398,551	produced
25	338,657	
24	233,402	
23	139,634	
22	61,279	
21	7,195	
1920	43,610	
19	35,189	
18	30,292	
17	31,136	
16	4,258	
15	nil	

1957-62 halving time 10 years

1936-57 doubling time 32 years

Bulgaria - Manganese
Long Tons of Ore

1962	39,400	
61	36,500	1959-62 doubling time 5 years
60	27,800	
59	25,600	
58	28,000	1957-59 halving time 0.8 years
57	79,900	
56	75,587	
55	61,612	1952-57 doubling time 2 years
54	32,479	
53	20,669	
52	13,000	
48	probably nil	

Rumania - Manganese
Long Tons of Ore

1962	197,000
61	204,000
60	172,000
59	194,000
58	197,102
57	261,074
56	231,298
55	383,763
54	270,000
53	178,000
52	135,000
51	46,000
50	24,000
49	64,000
48	44,500
47	30,000
46	21,000

1955-62 halving time 7 years

1946-55 doubling time 2.2 years

Rumania - Oil
1000 bbls. daily

1962	228.0	
61	237.7	
60	235.0	1953-62 doubling time 24 years
59	233.8	
58	231.5	
57	234.8	
56	222.4	
55	214	
54	191	
53	184	
52	123	1951-3 doubling time 1.8 years
51	85.0	
50	87.8	
49	92.5	
48	93.2	1946-51 level
47	78.5	
46	86.1	
45	95.5	

Brazil - Oil
1000 bbls. daily

1962	95.4
61	95.80
60	76.9
59	64.63
58	51.85
57	27.58
56	11.09
55	5.54
54	2.71
53	2.51
52	2.05
51	1.89
50	0.93
49	0.30
48	0.40
47	0.27
46	0.18
45	0.22
44	0.16
43	0.13
42	0.09
41	0.008
40	0.006
39	0

1942-62 doubling time 2 years

Colombia - Crude oil
1000 barrels daily

1962	140.6
61	146.0
60	151.0
59	145.0
58	126.0
57	124.5
56	119.6
55	110.9
54	108.6
53	108.9
52	105.8
51	105.7
50	93.1
49	81.2
48	64.9
47	68.4
46	60.6
45	60.5
44	60.9
43	37
42	29
41	67.5
40	69.5
39	65.5
38	59.1
37	55.2
36	51.2
35	47.2
34	47.5
33	35.8
32	45.1
31	49.6
30	55.8
29	55.8
28	54.5
27	41.2
26	17.6
25	2.7
24	1.2
23	1.2
22	0.9
21	0.2

1928-62 doubling time 23 years

1921-28 doubling time 0.8 years

Trinidad - Oil
1000 bbls. daily

1962	133.0	
61	124.6	
60	115.4	1951-62 doubling time 9 years
59	112.1	
58	102.3	
57	93.31	
56	79.0	
55	68.2	
54	64.9	
53	61.0	
52	58.1	
51	57.0	
50	56.4	
49	56.4	
48	55.1	
47	56.1	
46	55.2	
45	58.0	
44	60.9	
43	58.2	
42	60.2	
41	56.2	
40	60.9	
39	52.8	
38	48.5	
37	42.5	
36	36.2	
35	32.0	
34	29.9	1918-40 doubling time 6 years
33	26.1	
32	27.7	
31	26.7	
30	25.9	
29	23.8	
28	21.0	
27	14.7	
26	13.6	
25	12.0	
24	11.1	
23	8.88	
22	6.70	
21	6.48	
20	5.50	
19	5.05	
18	5.50	
17	4.40	
16	2.54	1909-18 doubling time 2.0 years
15	2.05	
14	1.76	
13	1.38	
12	1.20	
11	0.79	
10	0.39	
09	0.16	
08	nil	

Iraq - Oil
1000 bbls/day

1942-62 doubling time 4.5 years

1962	1000.0
61	1180.0
60	1048
59	852
58	826
57	445.8
56	542
55	689
54	627
53	578
52	387
51	178
50	135.9
49	84.8
48	71.6
47	98.5
46	97.8
45	96.4
44	84.9
43	67.9
42	54.0
41	34.6
40	66.2
39	84.4
38	89.3
37	87.4
36	83.2
35	75.1
34	21.1
33	2.51
32	2.29
31	2.28
30	2.50
29	2.18
28	1.95
27	0.93
26	

Algeria - Oil
1000 bbls daily

1963	500	
62	434.0	
61	330.6	1957-62 doubling time 0.5 years
60	160.00	
59	25.18	
58	8.88	
57	0.260	
56	0.653	
55	1.19	1953-57 halving time 1.5 years
54	1.56	
53	1.76	
52	0.96	
51	0.134	
50	0.065	
49	0.005	1951-53 doubling time 0.7 years
48	0.003	

Egypt - Oil
1000 bbls daily

1962	90.0
61	72.0
60	62.6
59	58.4
58	60.3
57	44.2
56	33.3
55	34.7
54	37.8
53	45.3
52	45.2
51	44.8
50	44.8
49	43.9
48	36.7
47	23.6
46	24.8
45	25.8
44	25.9
43	24.5
42	22.7
41	23.3
40	17.8
39	12.8
38	4.34
37	3.27
36	3.49
35	3.57
34	4.23
33	4.57
32	5.19
31	5.59
30	2.72
29	5.06
28	5.03
27	3.45
26	3.26
25	3.36
24	3.04
23	2.89
22	3.26
21	3.44
20	2.86
19	4.16
18	5.60
17	2.59
16	1.11
15	0.56
14	2.06
13	0.27
12	0.57
11	0.058

1940-62 doubling time 10.5 years

1911-18 doubling time 1.2 years

Albania - Oil
1000 bbls. daily

1962	10.994	
61	11.882	
60	11.501	1953-62 doubling time 5.5 years
59	8.77	
58	7.37	
57	5.47	
56	6.66	
55	4.13	
54	4.40	
53	3.84	
52	3.0	
51	3.3	
50	7.68	
49	5.99	
48	4.11	
47	5.48	
46	2.74	
45	0.73	
44	0.93	
43	2.74	
42	4.39	
41	3.65	
40	4.11	
39	2.55	
38	1.69	
37	0.75	1935-40 doubling time 0.7 years
36	0.11	
35	0.026	
34	0.03	
33	0	

Bolivia - Crude Oil
1000 barrels daily

1962	8.2	
61	8.7	
60	9.0	1957-62 halving time 50 years
59	8.7	
58	9.4	
57	9.0	
56	8.7	
55	7.4	
54	4.6	
53	1.7	
52	1.4	
51	1.4	
50	1.6	
49	1.9	
48	1.3	
47	1.0	
46	1.0	
45	1.0	1930-57 doubling time 3.5 years
44	0.9	
43	0.8	
42	0.8	
41	0.75	
1940	0.8	
39	0.6	
38	0.6	
37	0.3	
36	0.3	
35	0.4	
34	0.4	
33	0.3	
32	0.1	
31	0.1	
30	0.1	
29	nil	

Chile - Crude Oil
1000 barrels daily

1962	32.0	
61	25.2	
60	19.8	
59	17.7	
58	15.3	
57	11.9	1950-62 doubling time 2.5 years
56	9.7	
55	7.1	
54	4.8	
53	3.4	
52	2.4	
51	1.8	
50	1.6	
49	0.4	

Mexico - Crude Oil
1000 barrels daily

1962	305.0
61	294.0
60	275.0
59	264.0
58	260.0
57	241.8
56	248.7
55	244.9
54	229.2
53	198.4
52	210.6
51	211.2
50	197.6
49	166.4
48	159.5
47	155.0
46	134.4
45	118.0
44	103.9
43	95
42	93
41	117
40	120.4
39	117.7
38	105.5
37	126
36	110.1
35	110.0
34	104.6
33	93.3
32	90.0
31	90.8
30	108.2
29	122.3
28	137.3
27	176
26	248
1925	315
24	382
23	408
22	498
21	529
20	432
19	238
18	173
17	150.5
16	111
15	90.3
14	72.0
13	70.2
12	45.3

1945-62 doubling time 13 years

1902-21 doubling time 1.8 years

Mexico - Crude oil (cont'd)
1000 barrels daily

1911	34.2
10	10.0
1909	7.4
08	10.8
07	2.8
06	1.4
05	0.7
04	0.3
03	0.2
02	0.1
01	nil

Peru - Crude oil
1000 barrels daily

1962	59.7	
61	52.1	
60	48.4	
59	48.4	
58	53.0	
57	52.7	
56	50.2	
55	47.2	
54	47.0	
53	43.8	
52	44.8	
51	44.1	1939-62 doubling time 32 years
50	41.2	
49	40.5	
48	38.4	
47	35.0	
46	34.2	
45	37.5	
44	39.3	
43	40.0	
42	37.4	
41	32.7	
40	33.1	
39	37.1	
38	43.4	
37	52.1	
36	47.3	
35	46.8	
34	44.6	
33	36.3	
32	27.0	
31	27.6	
30	34.1	
29	36.9	1908-37 doubling time 7 years
28	32.9	
27	27.8	

Peru - crude oil (cont'd)
1000 barrels daily

1926	29.5
25	25.2
24	22.9
23	15.6
22	14.5
21	10.0
20	7.8
19	7.2
18	6.9
17	7.1
16	7.1
15	7.1
14	5.0
13	5.7
12	4.8
11	4.0
1910	3.5
09	3.9
08	2.6
07	2.0
06	1.5
05	1.1
04	0.8

Venezuela - Crude oil
1000 barrels daily

1962	3202.0
61	2915.0
60	2830.0
59	2768.0
58	2600.0
57	2779.2
56	2456.8
55	2157.2
54	1895.3
53	1765.0
52	1803.9
51	1704.6
50	1498.0
49	1321.5
48	1338.8
47	1187.0
46	1064.5
45	887.5
44	702.3
43	500.0
42	412
41	625

1932-62 doubling time 9 years

Venezuela - crude oil (cont'd)
1000 barrels daily

1940	508.0	
39	566.0	
38	515.5	
37	511	
36	418.9	
35	408.2	
34	382.4	
33	320	
32	318	
31	319	
30	374	
29	377	
28	288	
27	191	
1926	100.1	
1925	53.9	
24	24.8	
23	11.5	1917-28 doubling time 1.2 years
22	6.0	
21	3.9	
20	1.3	
19	1.2	
18	0.9	
17	0.3	
1916	-	

Turkey - crude oil
1000 barrels daily

1962	9.8	
61	7.6	
60	7.4	
59	7.3	1955-62 doubling time 6 years
58	6.4	
57	6.1	
56	5.6	
55	4.4	
54	1.1	
53	0.5	
52	0.4	
51	0.3	1949-55 doubling time 1.5 years
50	0.15	
49	0.3	
48	-	

Iran - crude oil
1000 barrels daily

1962	1292.0
61	1180.0
60	1050.0
59	920.0
58	825.0
57	725.0
56	539.0
55	328.9
54	60.3
53	27.0
52	27.7
51	350.4
50	655.4
49	561.8
48	518.5
47	436.4
46	401.1
45	350
44	382.0
43	206
42	206
41	175.8
40	181.0
39	214.0
38	214.7
37	213
36	171.7
35	155.3
34	155.9
33	149
32	135
31	123
30	126
29	115
28	119
27	108
1926	98
25	96.1
24	88.9
23	69.2
22	60.9
21	45.8
20	33.2
19	27.8
18	23.6
17	19.5
16	12.4
15	9.9
14	8.0
13	5.1

1956-62 doubling time 5.5 years

1925-50 doubling time 9 years

1913-24 doubling time 3 years

Angola - crude oil
1000 barrels daily

1962	7.7	
61	1.4	
60	1.3	1958-62 doubling time 1.5 years
59	0.9	
58	2.0	
57	-	

Nigera - crude oil
1000 barrels daily

1962	66.3	
61	43.5	
60	20.0	1958-62 doubling time 1.1 years
59	11.0	
58	5.5	
57	-	

Burma - crude oil
1000 barrels daily

1962	9.2	
61	11.2	
60	11.2	
59	10.4	
58	9.0	
57	7.5	
56	5.0	1948-62 doubling time 4 years
55	3.9	
54	4.1	
53	3.0	
52	2.4	
51	2.0	
50	1.2	
49	0.68	
48	0.94	
47	0.16	

India - crude oil
1000 barrels daily

1962	9.6	
61	8.6	
60	8.6	(1961 data)
59	9.0	
58	8.8	
57	8.8	
56	7.9	
55	7.0	
54	6.1	
53	6.2	
52	5.7	
51	5.3	
50	5.0	
49	5.3	
48	5.3	
47	5.1	(world oil)

1947-62 doubling time 17 years

Indonesia - crude oil
1000 barrels daily

1962	458.0
61	432.0
60	406
59	338.0
58	320.0
57	313.9
56	255.5
55	238.6
54	222.1
53	205.9
52	168.0
51	151.7
50	141.0
49	123
48	87.5
47	22.0
46	5.7
45	20.8
44	61.0
43	132
42	65.9
41	147
40	170.0
39	170.5
38	157
37	155
36	138
35	129
34	128
33	117

1949-62 doubling time 7 years

Indonesia - crude oil (cont'd)
1000 barrels daily

1932	107
31	97.4
30	114
29	107
28	88
27	75
26	58.2
1925	58.6
24	56.0
23	55.5
22	46.9
21	46.5
1920	48
19	42.5
18	34.8
17	35.9
16	34.3
15	32.6
14	31.3
13	30.4
12	29.6
11	33.4
1910	30.2
1909	30.2
08	27.9
07	27.4
06	22.2
05	21.4
04	17.8
03	15.6
02	6.7
1901	11.0
1900	6.1
1899	4.9
98	8.1
97	7.0
96	3.9
95	3.3
94	1.9
93	1.6
92	-

1907-40 doubling time 12.5

1893-1907 doubling time 3.5 years

West New Guinea - Crude Oil
1000 barrels daily

1962	2.5	
61	2.7	
60	4.5	1954-62 halving time 4 years
59	4.4	
58	5.0	
57	6.2	
56	7.2	
55	9.4	
54	10.3	
53	4.8	
52	4.7	
51	4.8	
50	4.8	
49	4.7	
48	0.4	
47	0.03 approx.	
43-6	0	
41-2	0.1 approx. avg.	
40	0	

Ghana - Silver
Fine Troy Ozs

EXPORTS

1962	3,187	
61	7,027	
60	14,160	
59	16,839	1958-62 halving time 1.4 years
58	45,762	
57	25,390	
56	32,966	
55	39,284	
54	48,214	
53	44,949	
52	44,116	
51	52,853	
1950	43,317	
49	40,051	1938-58 level
48	45,553	
47	41,250	
46	54,526	
45	36,666	
44	56,819	
43	50,288	
42	66,580	
41	36,356	
1940	46,021	
39	46,403	
38	42,206	
37	19,000 est	
36	14,000 est	
35	12,000 est	
34	11,000 est	
33	10,000 est	
32	9,000 est	
31	8,900 est	
1930	8,200 est	
29	7,500 est	
28	5,500 est	
27	5,500 est	
26	6,500 est	
25	6,500 est	
24	7,000 est	
23	8,000 est	
22	8,500 est	
21	6,700 est	
1920	8,500 est	
19	10,600 est	
18	11,700 est	
17	12,400 est	
16	13,000 est	
15	13,700 est	
14	13,500 est	
13	13,000 est	

Papua and Australian
New Guinea - Silver
Fine Troy ozs.

Fiscal year ends June 30

1962	24,500
61	30,242
60	33,037
59	36,830
58	25,065
57	38,101
56	42,549
55	44,713
54	49,062
53	58,794
52	63,011
51	60,313
1950	58,884
49	62,120
48	56,288
47	12,520
43-46	nil
42	66,951
41	183,818
1940	210,385
39	176,077
38	186,600
37	135,200
36	101,200
35	92,376
34	87,236
33	59,950
32	36,560
31	21,440
1930	24,060
29	35,160

1949-62 halving time 9.5 years

1929-40 doubling time 3.5 years

Congo (Leo.) - Silver
Fine Troy Ozs.

1962	1,189,577	1960-62 halving time 0.7 years
61	3,472,280	
60	3,989,907 (MY)	
59	4,768,000	
58	3,794,000	
57	3,044,900	
56	3,794,000	
55	4,083,000	
54	4,533,000	
53	4,951,000	
52	4,727,252	
51	3,795,070	
1950	4,459,300	
49	4,549,300	
48	3,805,619	
47	4,051,000	
46	5,048,000	1932-60 doubling time 28 years
46	4,147,000	
44	2,733,000	
43	3,119,000	
42	3,922,000	
41	3,472,000	
1940	3,537,000	
39	2,069,000	
38	3,122,000	
37	2,961,787	
36	2,781,457	
35	3,793,893	
34	3,399,541	
33	2,646,650	
32	1,887,687	
31	2,431,569	

Morocco Silver
Fine Troy Ozs.

1962	858,469	
61	907,905	
60	1,097,273	1958-62 halving time 2.5 years
59	1,234,303	
58	2,411,000	
57	2,411,000	
56	2,250,000	1952-58 level
55	2,315,000	
54	1,929,000	
53	2,251,000	
52	2,283,000	
51	1,865,000	
1950	1,007,900	
49	491,906	
48	386,000	
47	375,000	
46	117,157	1944-52 doubling time 2.5 years
45	107,609	
44	65,427	
43	85,714	
42	84,556	
41	142,588	
1940	297,395	
39	303,953	
38	276,500	
37	241,543	
36	88,252	

Cuba - Silver
Fine Troy Ozs.

1962	n.a.		
61	n.a.		
60	121,415		
59	215,000	Exports to U. S.	1958-60 halving time 1.5 years
58	325,278	Exports to U. S.	
57	252,728	Exports to U. S.	
56	289,202		
55	259,440		
54	164,235		
53	167,895	Exports to U. S.	
52	163,211	Exports to U. S.	
51	172,318	Exports to U. S.	
1950	221,779	Exports to U. S.	
49	157,411	Exports to U. S.	
48	185,216		1945-58 doubling time 9 years
47	146,932		
46	127,222		
45	107,195	Exports to U. S.	

Mexico - Silver
Fine Troy Ozs.

1962	41,249,402
61	40,349,181
60	44,525,563
59	44,075,452
58	47,592,360
57	47,149,514
56	43,078,040
55	47,957,655
54	39,896,467
53	47,886,441
52	50,353,561
51	43,797,735
1950	49,141,445
49	49,454,883
48	57,519,704
47	58,843,864
46	43,263,132

1946-62 halving time 55 years

Bolivia - Silver
Fine Troy Ozs. **EXPORTS**

1962	3,760,383
61	3,901,203
60	4,887,138 (MY)
59	4,503,770
58	6,051,284
57	5,375,090
56	7,543,304
55	5,851,274
54	5,043,680
53	6,787,440
52	7,065,608
51	7,164,118
1950	6,548,110
49	6,637,296
48	7,562,208
47	6,265,505
46	6,106,165
45	6,683,561
44	6,790,000
43	7,300,000
42	8,121,000
41	7,349,000
1940	5,626,000
39	7,241,000
38	6,366,000
37	9,452,000

1944-62 halving time 21.5 years

Chile - Silver
Fine Troy Ozs.

1946-62 doubling time 8 years

1962	2,184,271
61	2,156,768
60	1,434,277
59	1,767,230
58	1,504,365
57	1,672,100
56	2,106,200
55	1,580,200
54	1,525,500
53	1,497,839
52	1,246,356
51	983,491
1950	742,489
49	799,674
48	861,962
47	763,130
46	557,333
45	825,438
44	996,548
43	1,006,677
42	906,381
41	1,248,724
1940	1,506,349
39	1,182,033

Peru - Silver
Fine Troy Ozs.

1946-62 doubling time 10 years.

1962	36,016,676
61	34,161,707
60	30,755,496
59	27,225,216
58	25,918,353
57	24,845,258
56	22,972,258
55	22,947,625
54	20,405,833
53	19,650,695
52	19,179,525
51	17,379,137
1950	14,758,403
49	10,609,649
48	9,288,777
47	10,782,995
46	12,334,249

Philippines - Silver
Fine Troy Ozs.

1962	675,570	
61	812,793	
60	1,133,343	
59	504,085	1948-62 doubling time 8 years
58	497,987	
57	479,216	
56	541,168	
55	502,069	
54	527,160	
53	572,046	
52	693,751	
51	274,602	
1950	216,034	
49	218,433	
48	150,760	
47	6,586	
46	3,600	
45	17,208	
44	n.a.	
43	26,061	
42	231,197	
41	1,260,097	
1940	1,275,384	
39	1,191,739	
38	1,167,612	
37-	719,771	
36	467,885	
35	322,020	1921-41 doubling time 3.5 years
34	226,524	
33	170,042	
32	160,177	
31	104,004	
1930	110,278	
29	101,489	
28	37,427	
27	31,194	
26	45,793	
25	37,776	
24	43,127	
23	48,502	
22	17,831 ?	
21	26,192	

Nigeria - Tin
Long Tons Metal Content

1962	8,210
61	7,779
60	7,675
59	5,491
58	6,154
57	9,534
56	9,067
55	8,159
54	7,926
53	8,228
52	8,303
51	8,539
1950	8,258
49	8,825
48	9,237
47	9,133
46	10,333
45	11,224
44	12,512
43	12,661
42	12,403
41	12,063
1940	12,012
39	9,437
38	6,977
37	10,782
36	9,648
35	6,299
34	5,000
33	3,755
32	4,320
31	6,860
1930	8,331
29	10,734
28	9,132
27	8,056
26	7,417
25	6,256
24	6,200
23	5,860
22	5,123
21	5057
1920	6,168
19	5,718
18	5,904
17	5,820
16	5,731
15	4,837
14	4,300
13	3,872

1940-62 halving time 41 years

1913-40 doubling time 17 years

Malaya - Tin
Long Tons Metal Content

1962	58,603	
61	56,028	
60	51,979	1949-62 doubling time 80 years
59	37,521	
58	38,458	
57	59,293	
56	62,296	
55	61,244	
54	60,690	
53	56,254	
52	56,838	
51	57,167	
1950	57,537	
49	54,910	
48	44,815	1945-49 doubling time 1.0 year
47	27,026	
46	8,432	
45	3,152	
44	9,309	
43	26,000	
42	15,748	

Congo (Leo.) - Tin
Long Tons Metal Content

1962	7,197	
61	6,570	
60	8,900	1956-62 halving time 4.5 years
59	10,320	
58	11,214	
57	14,281	
56	14,764	
55	15,303	
54	15,084	
53	15,293	1941-56 level
52	13,806	
51	13,729	
1950	13,610	
49	13,774	
48	13,215	
47	12,752	
46	14,634	
45	17,524	
44	17,326	
43	17,498	
42	16,200	
41	15,700	
1940	11,800	
39	8,147	
38	9,669	
37	8,133	
36	7,303	
35	6,132	
34	4,356	
33	1,950	
32	689	

Bolivia - Tin
Long Tons Metal content plus metal exported

1962	21,493
61	20,408
60	19,406
59	23,811
58	17,731
57	27,796
56	26,842
55	27,921
54	27,284
53	34,825
52	31,959
51	33,132
1950	31,213
49	34,115
48	37,336 exports
47	32,663 exports
46	37,618 exports
45	42,487 exports
44	38,720 exports
43	40,312 exports
42	38,285 exports
41	42,050 exports
1940	37,940 exports
39	27,215 exports
38	25,371 exports
37	25,127 exports
36	24,091 exports
35	25,002 exports
34	22,638 exports

1940-62 halving time 22.5 years

Burma - Tin
Long Tons Metal Content

1962	950	
61	1,130	
60	1,200	
59	1,200	
58	1,300	
57	694	
56	785	
55	1,114	
54	800	
53	1,361	
52	1,103	
51	1,624	
1950	1,520	
49	1,781	
48	1,147	
47	1,792	
46	342	
42-45	775	Aug.
41	5,000	
1940	5,500	
39	5,964	
38	4,947	
37	4,636	
36	4546	
35	4,102	
34	4,061	
33	3,472	
32	3,168	
31	2,979	
1930	2,990	
29	2,649	
28	1,946	
27	2,447	
26	2,484	
25	1,300	
24	1,375	
23	1,405	
22	218	
21	172	
1920	165	
19	1,078	
18	647	
17	607	
16	439	
15	430	
14	287	
13	303	

1947-62 halving time 17.5 years

1922-39 doubling time 7.5 years

Indonesia - Tin
Long Tons Metal Content

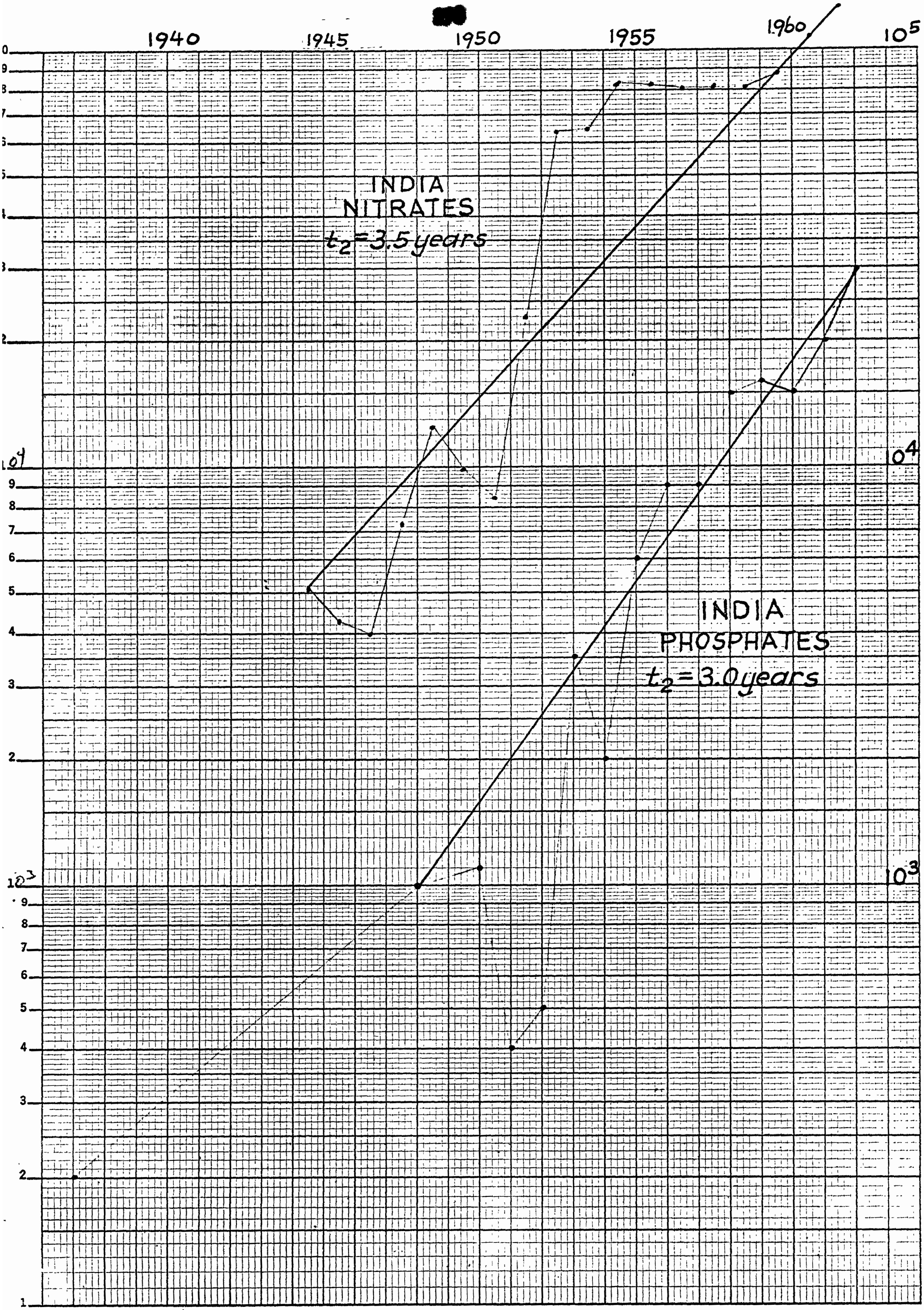
1962	17,583	
61	18,574	
60	22,599	
59	21,613	1954-62 halving time 7.5 years
58	23,200	
57	27,721	
56	30,054	
55	33,336	1948-54 doubling time 12 years
54	35,860	
53	33,750	
52	35,002	
51	30,986	
1950	32,102	
49	29,033	
48	30,562	
47	15,915	
46	6,426	1945-48 doubling time 0.7 years
46	948	
44	6,753	
43	17,632	
42	9,938	
41	51,000 est	
1940	43,886	
39	27,755	
38	27,296	
37	39,165	
36	30,769	
35	20,141	
34	19,358	
33	12,608	
32	16,789	
31	27,245	
1930	35,177	
29	35,920	
28	34,943	
27	33,934	1913-30 doubling time 21 years
26	33,006	
25	32,749	
24	31,558	
23	29,138	
22	27,000	
21	26,382	
1920	21,181	
19	19,350	
18	19,200	
17	20,702	
16	21,258	
15	19,255	
14	19,605	
13	20,541	

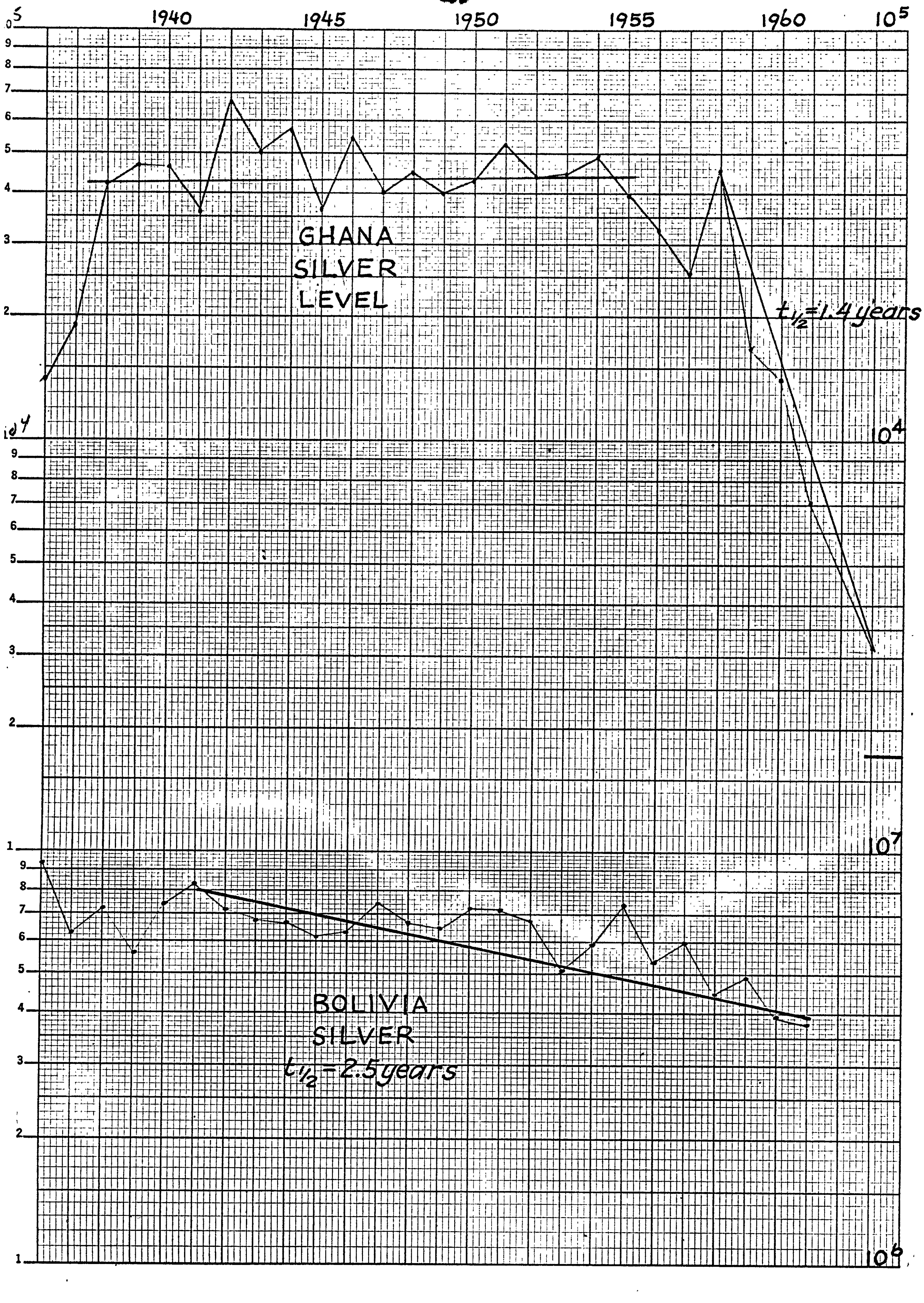
Thailand - Tin
Long Tons of Metal Content

1962	14,680		
61	13,270		
60	12,080		1950-62 doubling time 22 years
59	9,692		
58	7,726		
57	13,528		
56	12,481		
55	11,022		
54	9,776		
53	10,126		
52	9,479		
51	9,503		
1950	10,366		1946-50 doubling time 1.2 years
49	7,815		
48	4,240		
47	1,401		
46	1,056		
46	1,775		
44	3,296		
43	5,840		
42	7,833		
41	15,247	exported	
1940	17,477	exported	
39	15,638		
38	14,704		
37	15,958	exported	
36	12,526	exported	1913-40 doubling time 18.5 years
35	9,737	exported	
34	10,157		
33	10,300		
32	9,276		
31	12,495		
1930	11,526		
29	10,517		
28	7,572		
27	7,584		
26	7,487		
25	8,062		
24	7,793		
23	7,684		
22	6,979	(year ending March 31 of next year)	
21	6,105	"	
1920	6,201	"	
19	8,542	"	
18	8,835	"	
17	9,153	"	
16	8,765	"	
15	8,998	"	
14	6,591	"	
13	6,747	"	

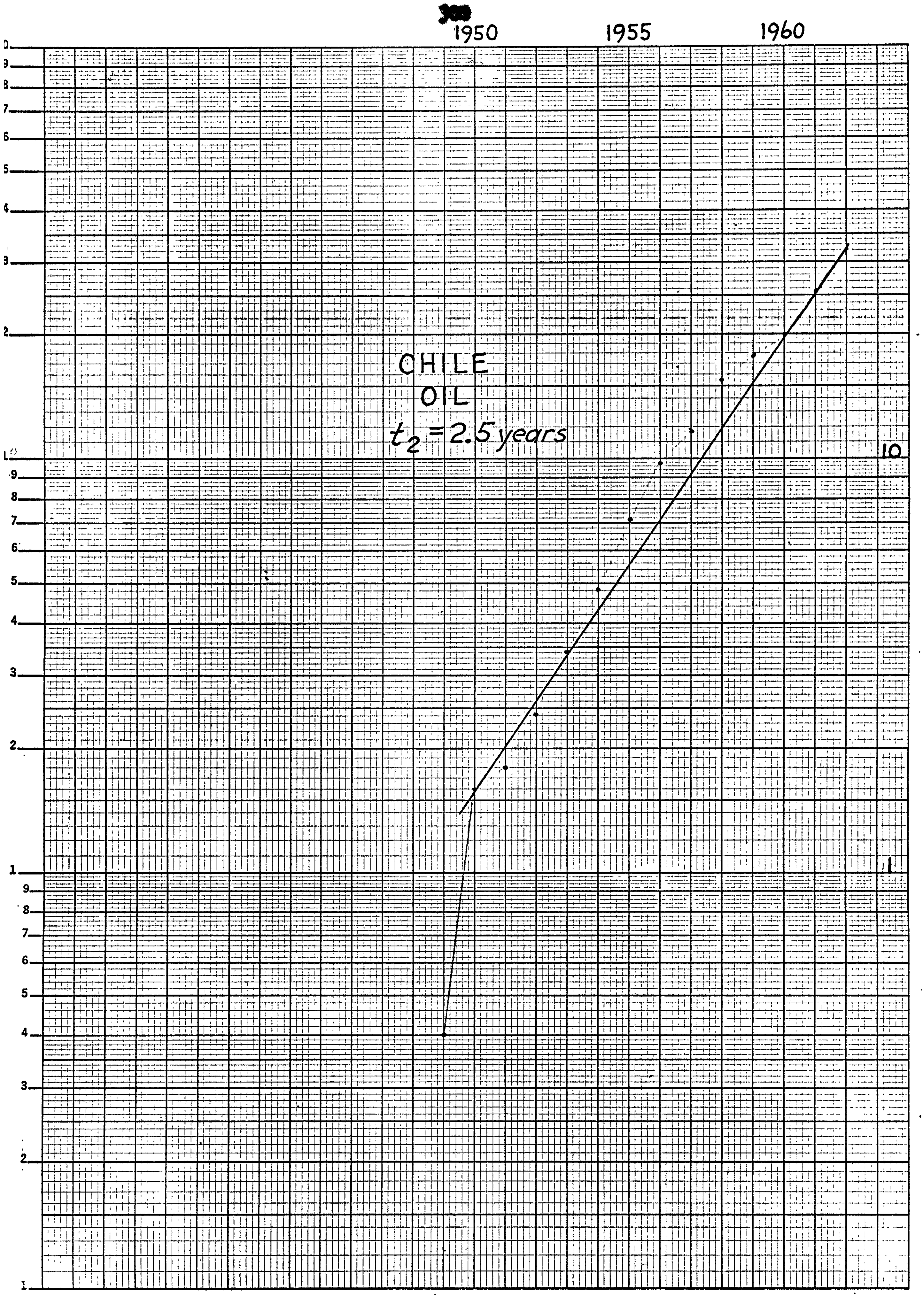
Burma - Silver (Includes India prior to 1935)
Fine Troy Ozs.

1962	1,980,038	
61	1,743,302	
60	1,984,263	1951-62 doubling time 4 years
59	2,041,395	
58	1,961,472	
57	1,526,810	
56	1,500,351	
55	1,537,895	
54	1,278,289	
53	718,333	
52	154,783	
51	280,720	
1950	n.a.	
49	75,200	
48	700,000	(year ending June 30, 1949)
47	n.a.	
46	n.a.	
45	n.a.	
44	n.a.	
43	n.a.	
42	4,289,000	nine months ended March 31, 1942
41	6,363,000	Years end June 30 of year stated.
1940	6,819,000	"
39	6,600,000	"
38	6,950,000	"
37	6,180,000	1930-41 level
36	5,952,000	
35	5,825,913	
34	5,817,524	
33	6,080,241	
32	6,026,737	
31	5,923,005	
1930	7,072,050	
29	7,298,327	
28	7,425,810	
27	6,024,806	
26	5,126,088	
25	4,856,422	
24	5,309,203	1913-28 doubling time 2.5 years
23	4,863,066	
22	4,244,304	
21	3,587,587	
1920	2,906,397	
19	2,165,607	
18	1,971,783	
17	1,581,838	
16	760,374	
15	285,387	
14	236,446	
13	125,209	

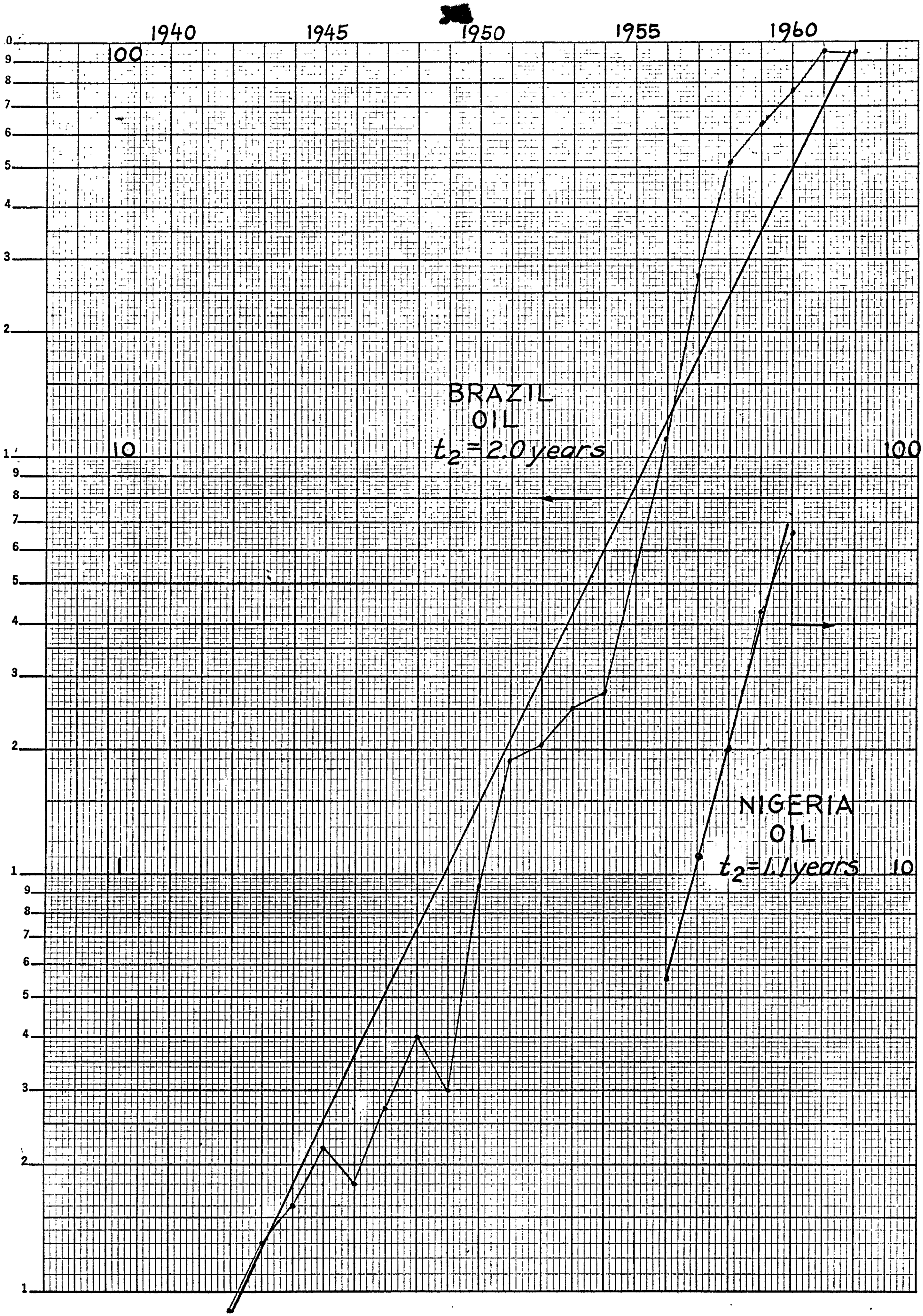

1940
1945
1950
1955
1960
10^5
INDIA
NITRATES
t2=3.5 years
10^4
INDIA
PHOSPHATES
t2=3.0 years
10^3



1940
1945
1950
1955
1960
GHANA
SILVER
LEVEL
t1/2=1.4 years
BOLIVIA
SILVER
t1/2=2.5 years



1950
1955
1960
CHILE
OIL
$t_2 = 2.5$ years
10
1



1940
1945
1950
1955
1960
100
10
100
1
10
BRAZIL
OIL
t_2 = 2.0 years
NIGERIA
OIL
t_2 = 1.1 years

APPENDIX III

FORTRAN FUNCTIONAL SUBROUTINE FOR SHARE PROGRAM BC NONL

FUN 1 - SUBROUTINE FOR Y INDEPENDENT VARIABLES

```
 FUNCTION YCOMP (N, B, Z)
 DIMENSION B(24), Z(100,9)
 YCOMP = B(1)+B(2)*Z(N,2)+B(3)*Z(N,3)+B(4)*Z(N,4)+B(5)/Z(N,5)+
+B(6)*Z(N,6)+B(7)*Z(N,7)+B(8)*(Z(N,8)-B(9))*(Z(N,8)-B(9))
 RETURN
  END
```

FORTRAN FUNCTIONAL SUBROUTINE FOR SHARE PROGRAM BC NONL

FUN 2 - SUBROUTINE FOR Z INDEPENDENT VARIABLES

```
 FUNCTION YCOMP (N, B, Z)
 DIMENSION B(24), Z(100,9)
 YCOMP=B(1)+B(2)*Z(N,2)+B(3)*Z(N,3)+B(4)*Z(N,4)+B(5)/Z(N,5)+
+B(6)*Z(N,6)+B(7)*Z(N,7)+B(8)*Z(N,8)
 RETURN
  END
```

TOTAL

FUNCTIONAL SUBROUTINE FOR SAP ASSEMBLY OF SHARE PROGRAM WL NLI

FUN 1 - SUBROUTINE FOR Y INDEPENDENT VARIABLES

```
        REL
        ORG 0
FUN1    CLA 1,4
        STA X1
        ADD ONE
        STA X2
        ADD ONE
        STA X3
        ADD ONE
        STA X4
        ADD ONE
        STA X5
        ADD ONE
        STA X6
        ADD ONE
        STA X8
        CLA 5,4
        STA ANS
        CLA 3,4
        STA A0
        ADD ONE
        STA A1
        ADD ONE
        STA A2
        ADD ONE
        STA A3
        ADD ONE
        STA A4
        ADD ONE
        STA A5
        ADD ONE
        STA A6
        ADD ONE
        STA A7
        ADD ONE
        STA A8
X8      CLA 0
A8      FSB
        STO TEMP
        LDQ TEMP
        FMP TEMP
        STO TEMP
        LDQ TEMP
A7      FMP 0
        STO TEMP
X6      LDQ 0
A6      FMP 0
        FAD TEMP
        STO TEMP
X5      LDQ 0
A5      FMP 0
        FAD TEMP
        STO TEMP
A4      CLA 0
X4      FDP 0
        CLA TEMP
        STQ TEMP
```

```
        FAD TEMP
        STQ TEMP
X3      LDQ 0
A3      FMP 0
        FAD TEMP
        STO TEMP
X2      LDQ
A2      FMP
        FAD TEMP
        STO TEMP
A1      LDQ 0
X1      FMP 0
        FAD TEMP
A0      FAD 0
ANS     STO 0
        TRA 7,4
ONE     PZE 1
TEMP    BSS 1
        END
```

In using program WL NLI the value of X_8 (Z_b) was always taken as 1/100 the defined value of X_8 (Z_b).

FUNCTIONAL SUBROUTINE FOR SAP ASSEMBLY OF SHARE PROGRAM WL NLI

FUN 2 - SUBROUTINE FOR Z INDEPENDENT VARIABLES

```
        REL
        ORG 0
FUN2    CLA 1,4
        STA X1
        ADD ONE
        STA X2
        ADD ONE
        STA X3
        ADD ONE
        STA X4
        ADD ONE
        STA X5
        ADD ONE
        STA X6
        ADD ONE
        STA X7
        CLA 3,4
        STA A0
        ADD ONE
        STA A1
        ADD ONE
        STA A2
        ADD ONE
        STA A3
        ADD ONE
        STA A4
        ADD ONE
        STA A5
        ADD ONE
        STA A6
        ADD ONE
        STA A9
        CLA 5,4
        STA ANS
X7      LDQ 0
A9      FMP
        STO TEMP
X6      LDQ 0
A6      FMP 0
        FAD TEMP
        STO TEMP
X5      LDQ 0
A5      FMP 0
        FAD TEMP
        STO TEMP
A4      CLA 0
X4      FDP 0
        CLA TEMP
        STQ TEMP
        FAD TEMP
A3      LDQ 0
X3      FMP 0
        FAD TEMP
        STO TEMP
X2      LDQ 0
A2      FMP 0
        FAD TEMP
```

```
        STO  TEMP
X1      LDQ  0
A1      MPY  0
        FAD  TEMP
A0      FAD  0
ANS     STO  0
        TRA  7,4
ONE     PZE  1
TEMP    BSS  1
        END
```

TOTAL

In using program WL NLI the value of X_8 (Z_b) was always taken as 1/100 the defined value of X_8 (Z_b).

Acknowledgement

The author wishes to thank Professor Roland D. Parks for his knowledgeable supervision and for his constructive criticism of almost all phases of this paper. His great knowledge of mineral economics which he generously shared with the author made this project possible. The author is indeed grateful.

Biographical note

John Michael Saul was born in New York City on July 11, 1937. His primary education was in the New York public school system and he obtained his secondary education at the Phillips Exeter Academy in Exeter, New Hampshire. From September 1955 to June 1964 he attended the Massachusetts Institute of Technology, receiving an S.B. degree and an S.M. degree in Geology and Geophysics in June 1960.

He has had two opportunities to do geological field work in West Africa and has published "Fauna of the Accraian Series (Devonian of Ghana) including a revision of the gastropod Plectonotus", Journal of Paleontology, Vol. 37, No. 5, September 1963, pp. 1042-1053, pls. 135-138, (senior author) and The Accraian Series, Journal of the West African Science Association (in press). In addition he has recently submitted a manuscript on the homalonotid trilobites of the Horlick Mountains, Antarctica, to the Arctic Institute of Ohio State University at the request of that institute.

John Saul is a full member of the Society of the Sigma Xi.