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9. ABSTRACT The size and structure of the manufacturing sector in Rhodesia has grown rapidly and diversified greatly over the past decade. This paper describes these changes in a historical context and examines the proximate causes of the changes. It examines how the pattern of Rhodesian manufacturing development was affected by the declaration of independence and the resulting sanctions; and it speculates on the international competitiveness of Rhodesia's manufactures, especially the production in the recently introduced or expanded sectors. Comments are offered about the value and problems that Zimbabwe will inherit in its manufacturing sector; Zimbabwe will inherit a large, growing, and flexible manufacturing sector. The recent growth is not sudden but part of a longer term trend. Some exporting eastward and southward has occurred despite the sanction induced encouragements to prefer the internal market. There is evidence that there have been few import substitution excesses in the sanctions period. Even if the overall industrial legacy to Zimbabwe is sound, however, it would be surprising if particular plants and even sectors did not prove unviable. This is an area where the new government must be careful. Plans can be made to support these firms but plans should also be made for their demise if they appear to become permanent detractors from the Zimbabwe budget.			
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The University of Michigan  
CENTER FOR RESEARCH ON ECONOMIC DEVELOPMENT

Fifth Floor, 426 Thompson Street  
Mailing Address: Box 1248, Ann Arbor, Michigan 48106 U.S.A.  
Telephone: (313) 764-9490 Cable Address: CREDMICH

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FINAL REPORT

RHODESIAN MANUFACTURING AND UDI

by

Richard C. Porter and Jacqueline R. Sherman

The University of Michigan

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## RHODESIAN MANUFACTURING AND UDI

The size and structure of the manufacturing sector in Rhodesia has changed considerably since UDI. Quite contrary to naive expectations about the impact of economic sanctions on the sector, it has grown rapidly and diversified greatly over the past decade. The purpose of this paper is three-fold: 1) to describe these changes in an historical context and to examine the proximate causes of the changes; 2) to examine how the pattern of Rhodesian manufacturing development was affected by UDI and the resulting sanctions; and 3) to speculate about the international competitiveness of Rhodesia's manufactures, and especially the production in the recently introduced or expanded sectors. Finally, in a brief section, some comments are offered about the value and problems that Zimbabwe will inherit in its manufacturing sector.

### I. History

Only a broad picture of Rhodesia's manufacturing growth is offered here since the details are well documented in readily accessible sources elsewhere.<sup>1</sup> Very little that could be called manufacturing existed in Rhodesia before World War II.<sup>2</sup> The profitable agricultural and small-scale mining sectors provided cheap and adequate foreign exchange earnings with which to purchase abroad the needed industrial products. In the 1930s, however, the government began to take steps towards expanding the infrastructural facilities necessary for industrial development. Public works projects were undertaken on a large scale. Several state enterprises were begun by the 1940s: electricity-supply commission power stations, the Rhodesian iron and steel commission foundries and mills, and the

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See Thompson and Woodruff (1954), Tow (1960), Girdlestone (1976), and the many sources cited in this last publication.

2

See Hall (1939) for a description of it.

cotton industry board mills, ore-processing plants, and a sugar industry board.

Manufacturing received a double fillip during the war: supply shortages, as experienced everywhere, and demand growth, owing to the dramatic increase in British military bases and spending in Rhodesia. The results can be seen in Table 1.<sup>1</sup> Value added in manufacturing grew more than eleven-fold -- a per-annum growth rate of 17 percent -- and diversified considerably.

The second great stimulus to the growth of Rhodesian manufacturing was the formation of the Federation with Northern Rhodesia and Nyasaland in the mid-1950s. As is well documented here and elsewhere,<sup>2</sup> the formation or growth of free-trade areas most benefits the manufacturing sector of the already most industrialized country. The growth of Rhodesia's manufacturing over 1955-1975 is shown in Table 2.<sup>3</sup> Over 1955-1963, that is, up to the end of the Federation, the gross output grew at over 10 percent per annum. Moreover, the diversification accelerated -- the most rapid growth rates occurred in the initially (i.e. in 1955) relatively small sectors, clothing and footwear, paper and printing and publishing, and chemical and petroleum products. The contribution of manufacturing to national income rose from 9 percent in the late 1930s to 15 percent in the early 1950s to over 18 percent in the early 1960s. Other changes were occurring as well. Industry passed from small, family-owned shops to large-scale, corporation-owned factories. Over one-third of the 50 largest British manufacturers came to have direct interest in Rhodesia. By the mid-1960s, multinational corporations were present in almost every sector

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<sup>1</sup>  
From Tow (1960), Table 8, p.13.

<sup>2</sup>  
See, for example, Porter (1974).

<sup>3</sup>  
Taken from C.S.O. (1976), p.23.

TABLE 1  
Value Added by Industrial Category<sup>a</sup>

Item	1938	% Total Manufacturing <sup>b</sup>	1953	% Total Manufacturing <sup>b</sup>
Food Manufacturing Industries	£ 393,843	16.9	£ 3,118,351	11.8
Beverage Industries	201,341	8.6	2,271,874	8.7
Tobacco Manufactures	303,915	13.0	2,625,432	9.9
Textiles and Wearing Apparel	54,518	2.3	3,110,212	11.8
Wood Manufactures incl. Furniture	121,109	5.2	1,638,020	6.2
Non-metallic Mineral Production	163,461	7.0	2,337,741	8.9
Manufacture of Rubber Products	11,765	0.5	117,767	0.4
Manufacture of Chemicals	123,609	5.3	1,358,794	5.2
Metal Manufactures	196,233	8.4	3,871,664	14.9
Manufacture and Repair of Trains, Equipment and Vehicles	442,004	18.9	3,427,297	13.0
Paper Manufactures and Printing and Publishing	252,311	10.8	1,570,840	6.0
Miscellaneous Manufacturing Industries	67,779	2.9	635,659	2.4
<b>Total Manufacturing</b>	<b>2,331,888</b>		<b>26,083,651</b>	

<sup>a</sup>Southern Rhodesia, Central African Statistical Office, Thirteenth Report on the Census of Industrial Production, 1938-53 (Salisbury: 1955), pp. 13-18.

<sup>b</sup>Percentages computed to nearest tenth.

TABLE 2

## VALUE OF GROSS OUTPUT BY MANUFACTURING GROUPS

Rs million

Year	Foodstuffs	Drink and Tobacco	Textiles including Cotton Ginning	Clothing and Footwear	Wood and Furniture	Paper and Printing and Publishing	Chemical and Petroleum Products	Non-Metallic Mineral Products	Metals and Metal Products	Transport Equipment and Workshops	Other Manufacturing Groups	All Manufacturing Groups
1955	41.4	12.8	12.0	10.7	8.3	7.4	10.0	10.4	20.9	17.1	3.1	154.1
1956	45.5	17.5	13.2	12.1	9.0	9.3	9.7	12.4	23.0	18.8	3.7	174.1
1957	55.3	18.6	14.3	15.3	11.8	11.0	11.4	13.7	30.2	23.2	5.1	207.9
1958	56.7	22.4	13.4	15.4	11.8	12.4	13.7	14.3	29.3	23.4	5.6	218.4
1959	64.6	23.8	15.6	18.7	11.9	13.5	16.9	13.8	32.0	22.9	6.4	250.1
1960	70.2	22.8	18.8	16.3	12.4	15.2	26.8	14.0	39.2	18.4	2.3	256.4
1961	69.4	25.2	20.2	19.5	12.2	15.8	31.4	12.6	43.2	27.6	2.3	279.4
1962	80.0	27.8	19.8	20.6	12.2	18.2	46.6	9.8	51.4	33.4	3.8	321.6
1963	82.7	29.2	22.4	24.0	12.7	18.9	49.3	9.3	51.6	36.6	4.2	340.9
1964	93.0	33.7	25.2	26.1	13.5	20.4	53.9	8.8	59.3	36.9	5.2	375.9
1965	103.4	35.8	29.9	27.7	15.5	21.9	71.3	10.1	66.4	42.7	6.0	430.6
1966	105.1	33.4	29.6	29.3	15.6	22.0	52.8	11.7	63.9	33.5	5.9	402.8
1966	105.1	33.4	29.5	29.0	14.5	22.0	55.6	11.6	64.8	30.9	3.0	399.3
1967	104.4	34.3	36.1	33.4	15.9	23.4	57.3	12.9	77.3	25.7	3.9	424.6
1968	118.0	35.1	42.7	34.9	16.6	25.5	66.0	17.4	83.2	25.1	4.4	459.9
1969	123.7	40.8	57.9	38.5	19.4	29.3	76.9	20.0	106.5	33.0	5.2	551.3
1970	145.7	44.3	57.5	45.3	24.1	34.2	89.0	24.6	143.2	35.5	5.9	649.4
1971	161.0	50.0	71.7	52.1	27.3	37.8	105.5	29.1	171.8	44.5	7.1	757.7
1972	181.2	56.7	88.4	59.3	30.4	43.0	120.0	34.9	191.4	50.2	8.5	866.8
1973	222.0	62.3	104.0	68.9	35.0	51.5	128.3	40.4	232.8	57.4	10.3	1 012.9
1974†	234.2	71.7	138.9	83.4	42.5	65.7	178.3	47.6	307.7	63.7	13.8	1 247.5
1975†	259.1	82.5	129.3	84.9	44.3	71.3	215.4	51.2	358.4	77.8	14.7	1 383.9

Notes.—(1) The figures relate to the financial year of each undertaking. Thus gross output for 1972 includes the output of establishments whose financial years ended between 30th June, 1972 and 29th June, 1973.

(2) Figures for 1955 to 1959 were collected on a technical unit basis. From 1960 the basis of collection is the establishment.

(3) Prior to 1962, figures exclude sales of goods not produced on the premises.

(4) Comparability affected by a revision of the industrial classification. Figures for 1966 are given on both the old and revised classifications.

† Provisional.

of Rhodesian manufacturing.

The final stimulus proved ironically to be the economic sanctions whose intent was to bring Rhodesia's industry to a halt. Manufacturing stagnated for a few years, and then grew apace. As Table 2 shows, the "adjustments" to sanctions were made by 1967 or 1968 in most sectors, and the gross output of all manufacturing grew at 17 percent per annum thereafter (i.e. 1968-1975). While inflation in this period erodes the real value of these figures, the growth is nevertheless notable. Within sectors, the differential growth rates no longer reflect so much diversification as the relative hardship imposed by sanctions as to availability of competitive final outputs and necessary intermediate inputs.

By 1973, the latest year for which we have definitive, comparable data, the value added in Rhodesian manufacturing had reached R\$402.9 million,<sup>1</sup> which is over 27 percent of its gross national income (at market prices) of R\$1,484.9 million. This is a high percentage; among LDCs, only a handful produce as much as one fourth of their output by means of manufacture.<sup>2</sup>

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The Rhodesian dollar (R\$) was then worth US\$1.77 (official rate).

2

According to Chenery and Syrquin (1975), only the following in 1965 (when the Rhodesian percentage was 25 percent): Argentina, Chile, Taiwan, Hong Kong, Jamaica, Mexico, South Africa, Egypt, and Uruguay (Table S3, pp. 192-195).

## II. Patterns

It is difficult, if not impossible, to discern the impact of first the Federation and then sanctions on the patterns of Rhodesian industrial growth by reference to absolute figures alone. What are needed are benchmark data that give us some idea about what the patterns would have been in the absence of these unusual phenomena. Such a benchmark is of course unknowable, but a clue is offered by Chenery's work in the "patterns of development" displayed by all LDCs since World War II. From first a cross-section sample<sup>1</sup> and later a pooled cross-section and time-series sample,<sup>2</sup> he has derived, through regression curve fitting, the "normal" pattern of industrialization for an LDC. He fits many equations, of which we have used the following:

A. Chenery (1960). Real value added per capita in manufacturing, and in various subsections within manufacturing, is related to real GNP per capita and population.

B. Chenery and Taylor (1968). The sectoral share of GNP, of all and within manufacturing, is related to real GNP per capita, population, the ratio of gross fixed capital formation to GNP, the ratio of primary product exports to GNP, and the ratio of manufactured exports to GNP.

We have used the actual Rhodesian values of the right-side (i.e., "independent") variables to calculate the "normal" values of the dependent variables for Rhodesia in three years, 1955, 1965, and 1970. We have then compared the actual (i.e. observed) values for Rhodesia with these "normal" values.<sup>3</sup> The ratios of the actual to the normal value added figures are given, for the

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<sup>1</sup>Chenery (1960).

<sup>2</sup>Chenery and Taylor (1968).

<sup>3</sup>The equations, data, "normal" values, and actual values are all explained and displayed in the Appendix.

TABLE 3Ratio of Actual to Normal Value Added for Chenery (1960)

SIC	Sector Title	1955	1965	1970
20-22	Food, Beverage & Tobacco	1.31	1.28	1.15
23	Textiles	1.33	1.36	1.65
24	Clothing, Footwear	1.29	1.53	1.99
25-26	Wood, Furniture	2.91	1.70	1.00
27	Paper	4.71	7.33	9.73
28	Printing	2.68	2.20	2.39
29	Leather	2.11	2.73	2.68
30	Rubber	2.75	5.87	5.93
31	Chemicals	1.88	3.85	4.28
32	Petroleum Products			
33	Nonmetallic Mineral Products	4.84	1.55	2.55
34	Metals, Metal Products	4.00	9.17	12.59
35-38	Machinery & Transport Equip.	6.01	3.99	4.01
20-39	All Manufacturing	1.87	1.72	1.94

TABLE 4Ratio of Actual to Normal Value Added for Chenery and Taylor (1968)

SIC	Sector Title	1955	1965	1970
20-22	Food, Beverage & Tobacco	1.28	1.35	1.11
23	Textiles	.87	.98	1.42
24	Clothing, Footwear	.80	.82	1.36
25-26	Wood, Furniture	2.43	.89	1.97
27	Paper	1.34	2.93	3.49
28	Printing	1.74	1.07	2.45
29	Leather	1.63	3.61	1.95
30	Rubber	.79	1.12	2.67
31-32	Chemical & Petroleum Products	1.34	2.35	3.66
33	Nonmetallic Mineral Products	2.75	.85	1.67
34	Metals, Metal Products	.44	4.01	.94
35-38	Machinery and Transport Equip.	1.10	1.03	.98
20-39	All Manufacturing	1.32	1.34	1.33

Chenery (1960) equations in Table 3, and for the Chenery and Taylor (1968) equations in Table 4.

These tables should be examined from three viewpoints, for the ratios in 1955, for the changes over 1955-1965, and for the changes over 1965-1970.<sup>1</sup>

1955. Rhodesian manufacturing in almost every sub-sector was already above "normal" by 1955 -- especially for the Chenery (1960) equations where value added is well above normal for consumer goods and even higher for "heavy" industry.

1955-1965 (roughly, the Federation years). The growth of industry in this period did not, on average, further deviate from the normal patterns. The ratios grew more often than they fell but they did not move further from unity more often than they moved nearer to it. There is no strong evidence that industry became, in these years, "abnormally" specialized or diversified. Certain sectors clearly grew "abnormally" rapidly, however, namely paper, leather, rubber, chemicals and petroleum products, and metals and metal products. Other sectors grew "abnormally" slowly, namely wood and furniture, printing, non-metallic mineral products, and transport equipment.

1965-1970 (roughly, the first few years of sanctions). The ratios rise for almost all sectors and rise dramatically for many. The declines are readily understood: tobacco and transport equipment were especially hurt by the imposition of sanctions. By 1970, Rhodesia's manufacturing is of above "normal" size in almost every sub-sector and, for all manufacturing, is from

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<sup>1</sup> Ultimately, of course, as data become available, the changes after 1970 must also be examined since, as Section I indicated, rapid manufacturing growth did not resume after UDI until 1967 or 1968.

one third above to nearly double the "normal" size, depending upon which equation is used.

We can look at the differences between the pre-UDI and post-UDI growth patterns in another way, developed by Lewis and Soligo (1965). This technique allocates the growth rate of value added to its proximate causes by differencing a basic identity.<sup>1</sup> The results are shown in Table 5. There is one similarity between the two periods: import substitution contributes about half of the growth in both periods. Otherwise, the proximate causes differ greatly: 1) the importance of exports declines after UDI and, indeed, becomes a negative force for growth; 2) domestic demand growth becomes more important, absolutely as well as relatively; and 3) the rising ratio of value added to gross output contributes significantly, if somewhat inexplicably, after UDI.<sup>2</sup>

These results are interesting.<sup>3</sup> Contrary to the common belief, post-UDI manufacturing growth was no more driven by import-substitution than was growth before 1965. The declining force from export growth did occur, but in itself caused a drop in the per-annum value-added growth rate of but one and one half percentage points. Post-UDI growth was buoyed by two hitherto neglected forces: 1) more rapid growth of domestic demand, and 2) more rapid rises in the value-added-to-gross-output ratio.

It is difficult to draw many definitive conclusions from these figures without time for disaggregation and reflection. But one thing stands out:

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<sup>1</sup>See Appendix for mathematical details and for the data used.

<sup>2</sup>"Interactions," also inexplicably, decline in importance after UDI.

<sup>3</sup>And suggest that a similar analysis by sub-sector of manufacturing might prove worthwhile when time and data permit.

TABLE 5SOURCES OF GROWTH IN VALUE ADDED IN MANUFACTURING

	<u>Years</u>	
	<u>1955-1965</u>	<u>1965-1970</u>
Per annum growth rates:		
Value Added in Manufacturing	11.5%	9.9%
Due to:		
Domestic Demand	1.8%	2.5%
Exports	1.3%	-0.3%
Import Substitution	4.9%	2.2%
Other*	3.8%	5.6%
Interactions**	-0.2%	-0.0%

\* Other refers to changes in the ratio of value added to gross output. See Appendix.

\*\* See Appendix. Totals do not add because of rounding.

the fear that Rhodesia has gone too far and too fast in import substitution over the past decade may be quite unfounded. This is reassuring since, if true, it means that Zimbabwe's birth-right may not require much "weeding" to be a viable industrial structure.

### III. Competitiveness

The mere fact of rapid recent industrial growth in Rhodesia proves little about Zimbabwe's potential welfare, unless one takes the naive stance that all industry is "good" for a developing country. Whether the enlarged industrial base will prove a boon or bane depends ultimately upon whether the new plant produces efficiently -- i.e. is competitive internationally. All observers agree that sanctions have been at least somewhat effective in three ways:

- 1) by reducing exports, especially of tobacco, foreign exchange has been made more scarce and hence more valuable;
- 2) some imports have been denied to Rhodesia, especially replacement spares and capital stock in its transport sector and luxury products for which import licensing has been withheld;
- 3) other imports have been made more expensive by forcing Rhodesia to re-route its normal trade through South Africa or illegal channels.

All of these forces raise the effective protection afforded to Rhodesian manufacturing and may have been partly or wholly responsible for the rapid growth and diversification of the sector during the past decade. To the extent that this is true, some of the recent new production may not be viable -- without subsidy -- after sanctions are removed. And finally, what is not viable will be of no benefit to Zimbabwe; in fact, it may even prove to be a "white elephant," if the new government feels compelled to protect it through subsidies of one kind or another in order to prevent loss of employment or "independence."

It is critical to an assessment of Zimbabwe's industrial transition problems, therefore, to examine the international competitiveness of Rhodesia's manufacturing establishment. This is especially needed for the new production of the past decade; but it also needed for the new production of the previous decade, since it is highly unlikely that Zimbabwe will ever receive the privileged access to markets in Zambia and Malawi that Rhodesia did during the Federation period.

A careful analysis of international competitiveness would involve examination of costs and production relations. This is clearly not feasible in the time and at the distance involved. What we had hoped to do, but have only been able to begin so far, is the following, a more indirect test of efficiency. Only two natural trade partners of Rhodesia have failed to implement any sanctions on their manufactured imports from Rhodesia during the post-UDI sanctions period, namely, South Africa and Malawi. Our plan was to examine the detailed micro breakdown of their manufactured imports from Rhodesia and the unit-values of such imports, relative to their imports and unit-values of the same products from elsewhere. These data, plus knowledge of the nature and extent of Rhodesia's export subsidization, would indicate whether Rhodesia's (old and) new manufactures were, or were becoming, internationally competitive. To do this methodically and accurately takes more time than we have had, but some clues emerge from a quicker scan.

One such clue is that Rhodesia's exports of manufactured goods, as well as tobacco, declined absolutely in the years following UDI.<sup>1</sup> Another such clue is that, over the five-year period from 1967-1968 (averaged together)

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<sup>1</sup>See Table 5.

through 1972-1973, Malawi's total imports grew 100 percent but its imports from Rhodesia grew by only 60 percent. The problem is that there is a logical and plausible alternative to faltering competitiveness as an explanation of these figures. The very increases in effective protection that induced the dramatic post-sanctions growth of manufacturing also induce the substitution of internal markets for exports. Since our data do not extend into the 1970s period of active export promotion in Rhodesia, such simple aggregates on export trends should not be taken at face value.

A glimpse into the micro data provides a more sanguine outlook for Rhodesia's new manufacturing. Two of the most rapidly growing sectors have been textiles and footwear<sup>1</sup> and these have experienced such excellent export success in relatively more advanced South Africa that, at the very moment when it most earnestly supported Rhodesia, it introduced quota restrictions against the import of such products from Rhodesia.

A second piece of sanguine evidence, admittedly still only impressionistic, is that Rhodesia has fared as well in Malawi's markets with its recently, rapidly growing manufactured sectors as with its older sectors, which presumably are now well past their "infant-industry" pains. Of course, only further careful work will indicate whether this 1) is correct and 2) is not explained by differential export-subsidy policies.

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<sup>1</sup>See Tables 3 and 4 and the Appendix.

#### IV. Manufacturing Prospects

There can be no doubt that Zimbabwe will inherit a large, growing, and flexible manufacturing sector. Whether it will prove efficient when the country is once again opened to the post-sanction winds of trade is not so certain.<sup>1</sup> But there are hints that it will be viable. The recent growth is not sudden, but is part of a longer-term trend; some exporting eastward and southward has been occurring despite the sanction-induced encouragements to prefer the internal market; the "industriousness" of Rhodesia, while well above "normal" for such an economy, has not drastically diverged from its long-run proclivities during the sanction years; and there is evidence that there have been few import-substitution "excesses" in the sanctions period.

Nevertheless, even if the overall industrial legacy to Zimbabwe is sound, it would be surprising if particular plants, and even sectors, did not prove unviable. It is here that the new government must be careful; while it may be sensible to support such firms during the transition period, their ultimate demise must be planned if they are not to become permanent parasites to Zimbabwe's budget.

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<sup>1</sup>There is also the question, explored elsewhere, whether the levels of efficiency can be maintained if there is exodus of white manpower.

## APPENDIX ON EQUATIONS AND DATA

The Data

Population: Obtained from Rhodesia, C.S.O., Monthly Digest of Statistics, May 1976.

GNP/Capita: Obtained from "The U.N., Statistical Yearbook, and from the U.N., Yearbook of National Accounts Statistics.

## Gross Capital

Formation: Obtained from the U.N., Statistical Yearbook, and from the U.N., Yearbook of National Accounts Statistics.

## Exports/

Imports: Obtained by perusing the statistics published in the U.N., Yearbook of Trade Statistics and deciding arbitrarily which were primary products and which were manufactured, and then summing.

## Actual value

added: Obtained from the Rhodesia's (C.S.O.), Census of Mining, Manufacturing, Electricity, and Water Supply.

(See Table A1)

Notes:

1. Data were converted from current to constant dollars (or vice versa) using the implicit GNP deflators for the U.S., found in the Appendix of the "Report to the President 1973" by the Council of Economic Advisors.
2. The exchange rates used for conversion to U.S. current dollars were \$2.80 U.S./R\$ and \$1.40/R\$.
3. There is an important inconsistency between pre-1965 data and post-1965 data. The figures for the years before 1965 in some cases include S. Rhodesia, Nyasaland (Malawi) and N. Rhodesia (Zambia). Post-1965 figures are always for Southern Rhodesia only. In certain instances, as noted, an attempt was made to make the series consistent (for example, we assumed that copper was entirely manufactured and exported in Zambia).
4. Because of the imposition of economic sanctions in 1965, no statistics were thereafter published on the composition of exports and imports to and from Rhodesia. When it was necessary to have a figure for a year after 1965 we made an estimate by subtracting tobacco production (both unprocessed and processed) from the export figures of 1965. The adjusted percentages of primary product and manufactured exports in 1965 were assumed to apply for 1970.

TABLE A1The Basic Rhodesian Data

Population (in millions)	3.270	4.490	5.310
GNP/Capita 1953 US\$	\$151.70	\$188.82	\$185.88
GNP/Capita 1960 US\$	\$177.41	\$220.78	\$217.39
GNP deflators to 1953\$	.9086	.7968	.6531
to 1960\$	1.0625	.9317	.7638
Total Exports (million current R\$)	90	284	213.6
Primary Exports (million current R\$)	40	162	77
Manufactured Exports (million current R\$)	50	122	136.6

The Equations

(A) Chenery (1960).

Chenery estimates the following regression equation with cross-section data for 38 countries:

$$\log V_i + \log B_{i0} + B_{i1} \log Y + B_{i2} \log N$$

where  $V_i$  = per capita value added in 1953 U.S. \$

$Y$  = GNP/capita in 1953 U.S. \$100

$N$  = population in 10 millions.

The regression coefficients can be found in Chenery (1960), page 633.

Table A2 includes 1) the value added per capita that results from using Rhodesian time series data with the Chenery (1960) coefficients, representing what Chenery would call the "Normal Pattern of Growth" for an industrializing economy with income and population equal to Rhodesia's; and 2) actual Rhodesian value added/capita, in 1953 U.S. \$. The "actual" figures were calculated from the Census of Industrial Production (published by the Central Statistical Office), and converted from Rhodesia £ and \$ dollars using the aforementioned conversion factors.

(B) Chenery and Taylor (1968). They divided their data into countries of different sizes and within the small country group, further divided into industrial countries whose exports were largely primary product oriented. There seemed to be some confusion as to where Rhodesia belonged. In one table (Chenery and Taylor, 1968, Table II, p. 414), it is classified as "Small,

TABLE A2  
SECTORAL VALUE ADDED, NORMAL AND ACTUAL, USING THE CHENERY (1960) EQUATION

SIC	TITLE	1953 U.S. \$					
		1955		1965		1970	
		Normal	Actual	Normal	Actual	Normal	Actual
20-22	Food, Beverage, Tobacco	6.85	9.00	8.66	11.08	8.52	9.77
23	Textiles	1.17	1.56	1.82	2.48	1.90	3.14
24	Clothing, Footwear	.94	1.21	1.39	2.13	1.36	2.70
25-26	Wood, Furniture	.67	1.95	1.01	1.72	.99	1.98
27	Paper	.07	.33	.15	1.10	.15	1.46
28	Printing	.53	1.42	.82	1.80	.82	1.95
29	Leather	.18	.38	.26	.71	.25	.89
30	Rubber	.08	.22	.15	.88	.15	.89
31-32	Chemical and Petroleum Products	.81	1.45	1.28	4.62	1.31	5.26
33	Nonmetallic Mineral Products	.64	3.10	.96	1.49	.96	2.45
34	Metals, Metal Products	.40	1.60	.65	5.96	.66	8.31
35-38	Machinery & Transport Equip.	.69	4.15	1.35	5.38	1.39	5.58
	All Manufacturing	15.77	29.43	23.10	39.69	22.85	44.29

Industrially Oriented," but in the graphs on p. 398, Figure 3, it appears to have been included in the calculations of the "Small Primary Product Oriented" countries. (This discrepancy appears for four other countries as well.) We chose to base our analyses on the primary-oriented regressions since it seemed more likely that it actually belonged there.

The following regression equation was used on cross-section data for 18 countries

$$\ln X_i = a + \beta_1 \ln Y + \beta_2 (\ln Y)^2 + \gamma \ln N$$

$$+ \delta \ln k + \epsilon_1 \ln e_p + \epsilon_2 \ln e_m$$

$X_i$  = sectoral share of GNP

$Y$  = GNP/capita in 1960 U.S. dollars

$N$  = population in millions

$e_p$  = primary product exports/GNP

$e_m$  = manufactured exports/GNP

$k$  = gross fixed capital formation/GNP

The coefficients of the regression equation

$$\ln V_i = A + \beta_1 \ln Y + \epsilon_1 \ln e_p + \epsilon_2 \ln e_m$$

where  $V_i$  = per capita value added in 1960 U.S. \$

$Y$  = GNP/capita in 1960 U.S. \$

$e_p$  = primary exports/GNP

$e_m$  = manufactured exports/GNP

TABLE A3

SECTORAL VALUE ADDED, NORMAL AND ACTUAL, USING THE CHENERY-TAYLOR (1968) EQUATION

SIC	TITLE	1960 U.S. \$					
		1955		1965		1970	
		Normal	Actual	Normal	Actual	Normal	Actual
20-22	Food, Beverage, Tobacco	8.20	10.52	9.60	12.96	10.29	11.42
23	Textiles	2.10	1.83	2.96	2.91	2.58	3.67
24	Clothing, Footwear	1.77	1.42	3.05	2.50	2.32	3.16
25-26	Wood, Furniture	.94	2.28	2.27	2.01	1.17	2.31
27	Paper	.29	.39	.44	1.29	.49	1.71
28	Printing	.96	1.67	1.98	2.11	.93	2.28
29	Leather	.27	.44	.23	.83	.40	.78
30	Rubber	.33	.26	.92	1.03	.39	1.04
31-32	Chemical and Petroleum Products	1.26	1.69	2.30	5.40	1.68	6.15
33	Nonmetallic Mineral Products	1.32	3.63	2.04	1.74	1.71	2.86
34	Metals, Metal Products	4.24	1.87	1.74	6.97	10.34	9.72
35-38	Machinery and Transport Equip.	4.40	4.85	6.39	6.29	6.63	6.52
	All Manufacturing	26.08	34.42	34.52	46.42	38.93	51.80

were estimated using small primary product oriented country data to obtain value added per capita in each sector of manufacturing; they can be found on page 407 of Chenery and Taylor (1968). Table A3 shows the value added/capita that would be the "normal" pattern Chenery and Taylor would expect for a country having the income and export characteristics of Rhodesia, and the actual value added per capita in 1960 U.S. \$ for the Rhodesian manufacturing sectors. The actual figures were computed from the Censuses of manufacturing production for 1958 and 1972.

(C) Lewis and Soligo (1965). There are many ways of decomposing changes in value added in manufacturing into proximate causes. We have used a variant of what is known as the Lewis-Soligo approach. Define:

$V_t$  = value added in manufacturing in t,

$D_t$  = domestic demand in t,

$M_t$  = manufactured imports in t,

$E_t$  = manufactured exports in t, and

$X_t$  = gross output of manufacturing in t.

Let:

$$(A-1) \quad V_t = \alpha_t X_t \quad (0 < \alpha_t < 1), \text{ and}$$

$$(A-2) \quad X_t = D_t + E_t - M_t, \text{ and}$$

$$(A-3) \quad M_t = \mu_t (X_t + M_t) \quad (0 < \mu_t < 1).$$

Equations (A-1) through (A-3) yield:

$$(A-4) \quad V_t = \alpha_t (1 - \mu_t) (D_t + E_t),$$

which through differencing yields:

$$(A-5) \quad \begin{aligned} \Delta V &= \alpha(1-\mu)\Delta D + \alpha(1-\mu)\Delta E \\ &\quad -\alpha(D+E)\Delta\mu + (1-\mu)(D+E)\Delta\alpha \\ &\quad + (\text{interactions of } \Delta \text{ terms}). \end{aligned}$$

Thus, the change in value added is pictured as the sum of the effects of changes in 1) domestic demand ( $\Delta D$ ), 2) exports ( $\Delta E$ ), 3) import substitution ( $\Delta \mu$ ), 4) "other," which really reflects the rising ratio of value added to gross output ( $\Delta \alpha$ ), and 5) interactions of  $\Delta$  terms which are finite for other than infinitesimal values of the  $\Delta$ s. The coefficients of the  $\Delta$  terms are valued at the average of their values at the initial and end years (e.g., for  $\Delta D$  over 1955-65,  $\alpha(1-\mu)$  is the average of .29(.17) and .40(.45); see Table A5). The absolute effects on  $\Delta V$  are converted into contributions to the per-annum growth rates in Table 5 of the text.

TABLE A5

COMPONENTS OF VALUE ADDED

<u>Variable</u>	<u>1955</u>	<u>Δ</u>	<u>1965</u>	<u>Δ</u>	<u>1970</u>
V	75.7	148.0	223.7	136.4	360.1
X	271.6	290.1	561.7	129.2	690.9
M	367.4	-95.6	271.8	-39.2	232.6
E	74.4	84.7	159.1	-13.0	146.1
D	554.6	119.8	674.4	103.0	777.4
α	.279	.119	.398	.123	.521
μ	.575	-.249	.326	-.074	.252

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