

THE USE OF
A MODIFIED INPUT-OUTPUT SYSTEM
FOR AN ECONOMIC PROGRAM
IN ZAMBIA

by
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In a paper for the International Association for Research in Income and Wealth Conference at Corfu in 1963,¹ I described an accounting system that had been used by the planning offices in Jamaica and Trinidad. The paper argued the case for disaggregation in an economy dependent on exports of primary products; but it concluded that, partly because of the difficulties of preparing a full input-output matrix, a simplified version is usually preferable.

Since that paper was written, the system advocated has been used by the United Nations Economic Mission to Zambia² as a basic framework for its economic policy recommendations, and I will here restate the case in the light of this Zambian experience, with some of its results and problems.³

1. The need for a Modified Input-Output System in Developing Countries

Some degree of disaggregation is essential for any economy of this type because the prime movers consist of a few leading export sectors (often only one). To understand such an economy one needs to see the relations between these leading sectors and the remainder; a development plan consists essentially of changing the economic structure and developing new sectors. Aggregative accounting systems are thus of only limited use, and we must look toward Leontief rather than Keynes for our tools of analysis.

Yet the normal procedures of the interindustry operator need to be modified. First, the accounting frame has to be adapted to local circumstances. Because of lack of data, one probably cannot allocate the sales of all the economically significant sectors which produce intermediate products to each of the industries which buy them. On the other hand, more detail

* I am grateful for comments by Mr. Bjerve, Director of the Statistical Office of Norway, Mr. Eleish of the U.N. Economic Commission for Africa, and Mr. Jolly, formerly Research Fellow at Makerere College, currently Ministry of Overseas Development Fellow at Cambridge, on loan as adviser on manpower planning to the government of Zambia. This paper is, of course, a purely personal contribution, based on work before I took up my present post.

1 "An Accounting System for Projections in a Specialised Exporter of Primary Products" (unpublished, 1963).

2 "The Economic Development of Zambia" (Government of Zambia, 1964). The planning office of Tanganyika (as it then was) also made use of the system in drawing up the country's development plan.

3 The appendixes to this paper have been adapted from the report of the United Nations Mission to Zambia.

+ This entire text, plus a comment by Paul G. Clark, formed Chapter 8 of The Theory and Design of Economic Development, Irma Adelman and Erik Thorbecke, eds., The Johns Hopkins Press, Baltimore, 1966, in cooperation with the Center for Agricultural and Economic Development of Iowa State University (AMES).

is needed than for developed countries. The payment of various sectors to the government should be broken down to show the main taxes separately because their incidence varies greatly between sectors; export industries and subsistence production may need to be split off from the rest of the agricultural sector; and it may be necessary to allow for the income and consumption of various racial groups because of different patterns of consumer behaviour and (possibly) different official employment objectives.

Second, several of the functions describing the development of the matrix may be significantly nonlinear. Thus, export duties, income taxes on foreign companies, and marketing board profits usually increase more rapidly than exports. Moreover, the process of development involves the appearance of new industries and changes in the input coefficients of many already in existence.

Third, in these economies production is rarely determined endogenously. The output of the leading export sector or sectors is largely determined by economic developments elsewhere; it has to be estimated from projections of world demand when there is a fairly competitive world market, or from company plans when the market is highly imperfect. A large fraction of the supply of nearly all other products is imported, often even cement and electricity; so output is usually estimated on the basis of what is physically feasible, imports being shown as a residual.

These modifications are needed in an economy dependent on exports of a few commodities: they would not (particularly the last one) apply with such force to a diversified economy, such as Argentina. But one of the great merits of an input-output system is that it is highly flexible, and its construction and operation can be adapted to the type of economy and the data available.

II. A Practical Example: Uses in Zambia

The methods of constructing and projecting the matrix for Zambia are discussed in the attached Appendix A;⁴ one of the projections is also shown, to illustrate the construction of the system. It will be seen that this was a very crude do-it-yourself business. We did not start out with a model for testing. We had four months to carry out a statistical exercise to throw light on the policy issues faced by the Mission.

Some policy issues, such as the future of the copper royalties (under which a large portion of the value of copper exports was lost to the economy) were big issues which needed as much statistical illumination as could be provided. We started by constructing a set of projections on the assumptions that taxes and royalty arrangements remained unchanged. We could then see that if the government's objectives were to be achieved without undue stress on the balance of payments, certain increases in taxes and changes in royalty arrangements would be needed. We estimated that these would ensure a sum of public and private savings sufficient to finance the necessary scale of capital development. We also concluded that in the case of Zambia, if policies recommended in the fiscal field (and in others) were carried out, there would be no net need for foreign capital over the next five years; foreign reserves would be built up at the beginning and could be run down later. This naturally had a profound effect on the thinking of the Mission and, I believe, on subsequent government economic policy. The point is not only that a disaggregated system indicates

⁴ This was prepared for the Mission's report by Mr. Belai Abbai, an Ethiopian economist on the staff of the Economic Commission for Africa, who was the research officer on the mission, in charge of projections work.

the magnitude of such "gaps" to be filled by policy. Realistic projections cannot be derived in any other way, especially in a period of structural change. Mere extrapolation of past trends in global aggregates would be of little value.

Secondly, it helped us grasp quite quickly the economic structure and the method of operation of Zambia. This was partly because we did not use a computer. Those who project a matrix by hand get accustomed to the relative magnitudes of the outputs of various sectors and of their factor and material requirements, and they really grasp (in a more profound sense than that of understanding a set of functions) how the structure might be expected to change during the development process. Many problems of economic change are also thrown up in the course of using the system.

The third virtue of this system (or of any that is sufficiently disaggregated) is that a strategy can be devised which is internally consistent and which satisfies the main objectives of government policy. The contributions of the members of the Mission and its consultants, about twenty people can all be integrated more easily with the help of such a framework.⁵ Appendix B, an extract from the report, summarizes the main features of the strategy devised for Zambia. It brings out inter alia the interaction between development in agriculture and in industry; nobody who has worked with such a system is likely to take sides in the a priori argument whether, in general, agriculture is more important than industry.⁶

The projections had further uses which may be more novel, at least for developing countries. As Appendix C shows, they throw light on the likely pattern of money flows between the main sectors of the economy, pointing the way toward the basic financial strategy needed.⁷ They were also used to bring out the manpower needs of the program.⁸ Another major conclusion of the Mission was that the shortage of high-level manpower would be the main constraint (and an increasingly serious one) on the country's economic growth. The

5 Another way of trying to ensure integration was by arranging meetings at which all those working on this exercise were invited to comment on each draft chapter.

6 In Trinidad, the projections showed that increases in exports of manufactures were a necessary condition of fast growth; in Zambia increases in exports of minerals and farm products.

7 The method of extending the projection into the financial field was due to Dr. Pøtter Bjerve, and the work was carried out by a Swedish associate expert in economics, provided under the United Nations technical assistance program, Mr. Esaiason.

8 This work was carried out by Mr. Richard Jolly. Following one of the recommendations of the Mission, a Manpower Planning Unit has been set up in Zambia, under Mr. Jolly, to guide manpower and educational policy. This unit has refined the original manpower projections in several ways, though still within the framework of the input-output matrix. In the first place, a major survey of the skilled and educated labor force was undertaken in both the private and public sectors to provide a firmer base for future projections. Secondly, employers were asked about their future needs for manpower in relation to the programs for expansion, thus providing information which can be used to calculate sectoral employment-output ratios. Thirdly, these manpower data have been put on tape, so that future projections can be projected by a computer program. The parameters for their projections are the sectoral growth rates derived from the matrix, and the program forecasts the numbers required in particular occupations for each combination of education and training. The computer makes it possible to run quickly a number of alternative projections, which is particularly useful for coordinating manpower planning with the day-to-day process of planning the economy as a whole.

admittedly crude projections indicated the magnitude of the problem, making it easier for us to show what could be expected in a few years' time and thus to reach and present clearly the policy implications. These included proposals for accelerating educational and training programs, for taking measures to retain and attract expatriates in professional fields, and for avoiding complex direct controls (see Appendix D).

III. Problems Encountered in Zambia

We encountered a number of problems in Zambia which, to a varying degree, must be faced in all similar exercises for developing countries.

In the first place, those making a set of projections of this kind are tempted to adopt an excessively mechanical approach to development programming, and we may not have completely avoided this trap. Anyone using a matrix should not ignore the social changes involved in development or the political and administrative assumptions. But economists are very prone to do this anyway, and there is a real danger that anyone operating this (or any similar) model will become so absorbed in its manipulation that they will look on it as the core of development strategy, instead of the basis from which the strategy can be derived. To choose a few examples, the following repercussions may be overlooked: investment in housing and health services raises productivity; the adoption of social targets (such as universal primary education) affects public support for development and thus incremental capital-output ratios, as well as the extent of public cooperation in wage and fiscal policy; large programs in certain sectors may raise insoluble problems of project preparation and management, causing labor productivity to decline. Those of us who belonged to the United Nations Mission were uneasily aware that we made many tacit social assumptions, especially in the fields of agriculture and wages policy. Some work was done on these questions (by consultants Mr. Ngrobo and Mr. Vilakazi), but there was no time to explore the social aspects thoroughly.

Another failing of economists, not attributable to use of a matrix but possibly aggravated by it, is the tendency to overlook physical realities, especially those affecting other sectors. In a large, developed economy, one can ignore the effects of any particular project, but this is impossible if a big plant is built in Zambia. One project under consideration for manufacturing fertilizers, for example, will have a different effect if it is built in Livingstone, where there is spare hydroelectric capacity, than if it is built elsewhere; there is also some margin of choice over the type of fertilizers to be produced which would have implications for the extent to which the needs of the mining industry for explosives could be met (and thus affect the import bill).

The Zambian work also suffered from some more basic deficiencies. Many problems were slurred over by jumping from a base-year pattern to one projected for several years later. The pace of development is generally not uniform. Nor does it have the same content throughout; unless certain types of development materialize in the early years, others will lag later. Using widely separate years permits, if it does not encourage, the economist to overlook the phasing of the development process. We also lost a good deal by failing to disaggregate sufficiently. Some of the sectors used especially in manufacturing, are large and heterogeneous. It may not be true for all the industries in a given sector that production is supply-determined. The failure to allocate inputs in detail meant, moreover, that the projected increases in consumption of various intermediate products did not fully reflect the different rates of growth of different sectors.

Our treatment of fixed-capital investment was perfunctory. For two sectors, mining and industry, an attempt was made to work out the approximate implications of the projected change in output. But elsewhere the methods were very crude. In the case of construction (mainly for the government and

housing sectors) our starting point was the maximum rate of expansion in the period. Then we asked: Could the investment be financed? Was the increase in capital approximately what was needed? The limit to construction was admittedly little more than a hunch; it was based on an assessment by our building consultant⁹ of how fast the construction industry might be expected to grow, taking into account the shortage of skilled building workers and of engineers and architects capable of preparing and carrying out projects. Some experts criticized us for over-estimating this limit, but preliminary indications are that we may have under-estimated it because contractors are bringing in their own skilled personnel. The uncertainty in the rate at which construction could be expanded is serious, especially for Zambia at present, where neither savings nor foreign exchange is the dominant constraint. Had we felt that fixed investment could be expanded more quickly, we would have proposed a bigger development program.

Some of the statistics we used were very rough. The base itself was weak, especially on imports into various sectors, largely because the only firm trade statistics then available were for the Federation of Rhodesia and Nyasaland as a whole. (A new matrix which has been constructed for 1964 is very much better in this respect because trade returns for Zambia itself are at last available).

In addition, the coefficients may be wrong. The estimates of future productivity changes were little better than guesses; the data on past trends are not helpful, partly because in many sectors activity has fallen, and partly because the composition of the labor force is changing quite rapidly. We do not place much confidence in the income-elasticities of demand either, though the results do not seem very sensitive to the assumptions made for these coefficients.

Future values of "exogenous" variables are subject to wide error. It is hard to pick a plausible price for copper in view of (1) the political uncertainties in each of the main Southern Hemisphere producers, and (2) the economic uncertainties in each of the main Northern Hemisphere consumers. (The problem is complicated by the unrepresentative nature of the London Metal Exchange quotation). Similar though less severe uncertainties exist for the volume of copper sales, rail and shipping tariffs, and others. Our assumption of constant domestic prices is a serious weakness; although the copper price could fall to the rather low figure we used, wage changes are irreversible. Parallel increases in wages and import prices would not matter greatly, but wage increases in the past year have already been big enough to imperil our projections, especially of the volume of imports and employment.¹⁰ The output of some sectors is hard to project; the future course of agricultural production is the domain of the sociologist rather than the economist.¹¹

These problems reflect inevitable sources of error and inescapable uncertainties about the future when one is dealing with a country at such a low level of economic development. It would be helpful to call in the help

9 Mr. Turin, then an adviser to the Economic Commission for Africa.

10 Wage increases have a much more serious effect on employment in a developing country than in one already industrialized. I tried to show how this works in the most obvious case, a petroleum economy, in "The Mechanism of an Open Petroleum Economy," Social and Economic Studies (March, 1964).

11 For example, a central question is whether means can be found for inducing "subsistence farmers" to use fertilizers and better techniques of planting maize.

of a computer in due course, after turning the system into an explicit model, and to recalculate the projections for 1970 on a number of assumptions (using the new 1964 base); they might well show quite wide differences.

IV. Is an Input-Output Matrix Worth Constructing?

In view of all these difficulties, it is natural to ask whether the input of the man-years of scarce labor that are required, even for a rough set of projections such as we made, was worthwhile, and, in particular, whether the policy recommendations are soundly based.

I agree in general with those who argue that it is dangerous to advocate the use of sophisticated programming methods in developing countries. There is a tragic, though understandable, tendency for young economists from developing countries to want to apply the latest techniques without inquiring whether they would be useful and feasible under local conditions, particularly whether the statistics would bear the analysis. In most countries, the result of proposing highly sophisticated systems (more complex than the one we used) is only too often to divert statisticians from more essential tasks and to encourage economists and even planning officials to live in a world so fanciful that "planning" is reduced to a set of functions and real policy issues are bypassed. Unfortunately, such tendencies are encouraged by some of those teaching "development economics".

My own view, which was, I believe, shared by my colleagues who worked with the matrix (see previous footnotes), is that the general pattern of Zambia's future development shows up so strongly that the projection system described was helpful and that the main policy conclusions were sufficiently well based.

An exercise like the one described above is not really one of "forecasting"; projecting a matrix is essentially making a "hypothetical" statement. If the mainly foreign-determined variables (export sales, import prices) behave in certain ways and the output of various goods and services changes and wages have a certain trend, then the objectives of the government carry certain implications.

Some version of this system could be used for central policy advice in almost any developing country. Most countries have fairly complete trade statistics and output figures covering some of the main products. Any input-output table, constructed in this way, acts as a convenient working sheet for gathering statistical information and for devising aggregative accounts for households, savings and investment, and so forth.

Its central uses, however, are to help the economist gain insight into the working of the economy, especially its future potentialities, and to focus attention on the key issues of policy. A forward look for both the government budget and the balance of payments will be needed. Projections of imports, for example, and thus of import duties are greatly improved, if allowance is made for the different rates of growth of different types of final and intermediate demand.

More important, this is the only way to assure consistency between expansion programs in various sectors. There is really no other way of assessing whether any industrial or agricultural policy is likely to be supported by sufficient increases in domestic demand, allowing for government objectives in other fields and likely trends in exogenous variables. Even if some of the base-year figures have to be guessed, and very rough coefficients used, a simple matrix should be constructed. Provided the users are not naive, a disaggregated system can only be an improvement on a 'global' one. With further work, some of the weaknesses mentioned above can be made less serious.

APPENDIX A

(Adapted from Appendix A of the Report of the United Nations Mission to Zambia)

The Design of the Matrix

The basic frame for the projections is an adapted input-output table. It contains fewer input columns than a table of this sort normally does because it only attempts to allocate certain basic inputs (imports, electricity, transport, and distribution) directly to the purchasing sector, while the rest are lumped together in one column. This is done because the statistics do not permit a finer breakdown and the table would have been unwieldy. The table also contains more columns than an input-output table would, in that it identifies the strategic policy variables, including direct and indirect taxes and nonwage incomes payable at home and abroad; it also distinguishes between imports of intermediate products consumed by a sector and imports of finished products similar to those produced by the same sector. The matrix includes the standard national accounts for households, government revenue and expenditure, saving and investment, and foreign payments.¹²

Two dominant features of Zambia which were considered are that Zambia is a primary exporter of minerals and that it has a nonhomogeneous social structure (Africans and Europeans). The analysis of mineral sales and of the incomes generated by this sector is central to the table; it is possible to trace the implication of a given rise in copper sales for employment incomes, tax receipts, royalties, and dividends arising from the industry. Employment incomes and consumption have been shown separately on the table for Africans and non-Africans; this separation is also appropriate for Zambia, since the consequence of a given rise in incomes for the pattern of consumption is different for the two racial groups. This also makes it possible to use different assumptions about the growth of population and employment for the two groups, which is particularly relevant during the period of transition.

The Base Year, 1961

A table analogous to Table 1 was constructed for 1961 by Mr. Osborn.¹³ It shows, in the rows marked 1 to 9 (condensed from 31 rows originally prepared), the productive sectors of the economy; below the horizontal line appear the main national income accounts, except for line 10 which shows the supply and use of intermediate products (other than those given separately in columns 1 to 6). Items are shown as positive where they are payments by the accounting entity concerned, negative when they are receipts. Columns 24 to 32 show the origin of the receipts of each productive sector, the total appearing in column 23; the other columns show how the supply is built up between imports (column 20) and domestic output (column 19), the latter being split again into inputs (columns 1 to 7) and value added, divided to show the income created (columns 8 to 18).

One problem arose out of the constitutional change after 1961, the base year. It was solved by including under "Government" not only the receipts and payments of the territorial government and the local authorities, but also the receipts by the federal government of taxes arising in Zambia (and the corresponding payments of federal departments that have now reverted to Zambian control). This made it possible to use the table as a base for projections into the post-federal period.

¹² Naturally the balance of payments shown here treats all other countries as "foreign", including Malawi and Southern Rhodesia.

¹³ Of the statistical office of Rhodesia.

Table 1. A Projected Matrix for Zambia, 1970

(£ million) (at 1965 prices and 1963-64 tax and royalty rates)	Basic Inputs							Total Inputs
	Imports	Import Duties	Electricity	Transport	Distribution	Other		
	1	2	3	4	5	6	7	
Mining	1	26.3	0.7	11.4	2.1	0.1	6.1	46.7
Agriculture	2	3.3			0.2	0.8	3.7	8.0
Manufacture	3	18.1	0.5	0.7	1.4	0.7	22.7	44.1
Food and beverages	a	5.6	0.3	0.1	0.3		11.0	17.3
Textiles	b	2.5					2.6	5.1
Nonmetallic minerals	c	0.5			0.2		1.8	2.5
Metal manufacturing	d	6.6	0.2	0.3	0.9	0.7	3.6	12.3
Other manufacturing	e	2.9		0.3			3.7	6.9
Construction	4	12.6	0.6		1.6	3.8	14.0	32.6
Electricity and water	5	1.1		1.6	0.1			2.8
Transport and communications	6	1.9				0.1	2.9	4.9
Distribution	7			0.2	7.1		2.4	9.7
Government services	8							
Other services	9			0.1			1.4	1.5
Intermediate products	10			-14.0	-12.5	-5.5	-53.2	-85.2
Rest of world	11	-63.3						-63.3
Government current account	12		-1.8					-1.8
Households non-African	13							
Households African	14							
Savings/Investment	15							

(£ million) (at 1965 prices and 1963-64 tax and royalty rates)	Composition of Supply					Total Supply/ Demand
	Gross Output	Imports fincl. CIF	Distribution	Indirect Tax		
	19	20	21	22	23	
Mining	1	171.1	0.1	0.1		171.3
Agriculture	2	59.3	2.0	7.9		69.2
Manufacture	3	75.2	91.1	26.0	8.9	201.2
Food and beverages	a	23.6	25.0	6.2	3.8	58.6
Textiles	b	3.5	14.1	5.3	1.8	29.7
Nonmetallic minerals	c	8.0	0.8			8.8
Metal manufacturing	d	23.9	38.6	10.7	1.8	75.0
Other manufacturing	e	11.2	12.6	3.8	1.5	29.1
Construction	4	60.6			0.2	60.8
Electricity and water	5	7.3	9.1			16.4
Transport and communications	6	23.9	1.1			25.0
Distribution	7	37.9	1.1		0.5	39.5
Government services	8	30.2				30.2
Other services	9	27.8	11.1		1.5	40.4
Intermediate products	10	-85.2		-34.0		-119.2
Rest of world	11	-67.6	-115.6			-183.2
Government current account	12	-44.9			-11.1	-56.0
Households non-African	13	-67.4				-67.4
Households African	14	-121.4				-121.4
Savings/Investment	15	-106.3				-106.3

Table 1 continued

Value Added										
Non- African	Employee Income African	Subsistence	Direct Tax	Mixed		Property Income Payments		Transfers	Savings and Depreciation	Total Value Added
				Non- African	African	Home	Abroad			
8	9	10	11	12	13	14	15	16	17	18
18.6	15.1		30.1				25.4		35.2	124.4
1.2	3.3	30.9		3.8	12.1					51.3
4.4	7.3		5.2	1.7	0.9	0.1	2.1		9.4	31.1
0.9	0.8		1.4			0.1	0.1		3.0	6.3
0.1	1.4		0.6				0.6		0.7	3.4
0.5	1.2		1.2				0.2		2.4	5.5
2.2	2.0		1.5	1.7	0.9				3.3	11.6
0.7	1.9		0.5				1.2			4.3
5.1	11.7		2.0	2.2	2.5		0.9		3.6	28.0
0.5	0.4					1.6	0.3		1.7	4.5
5.2	3.9		2.5	0.6	1.1	0.5	2.3		2.9	19.0
7.2	6.3		1.7	7.5	2.6	0.5	0.1		2.3	28.2
13.4	16.8									30.2
4.7	5.8	7.0	1.2	4.3	1.3				2.0	26.3
							-31.1	+1.0	+ 25.8	- 4.3
			-49.4	- 4.0		-0.9		+2.0	+ 9.2	- 43.1
-60.3			+ 5.4	-16.1		-1.8		-3.0	+ 8.4	- 67.4
	-70.6	-37.9	+ 1.3		-20.5				+ 6.3	-121.4
									-106.8	-106.8

Composition of
Demand

Sales to Other Sectors	Exports	Non-African Consumption	African Subsistence	Other African Consumption	Government Consumption	Capital formation		Change in Stocks
						Government	Other	
24	25	26	27	28	29	30	31	32
- 2.0	-156.6	- 2.0		- 1.0	- 0.2		- 6.5	-3.0
- 10.8	- 15.9	- 3.6	-30.9	- 5.8	- 1.2		- 1.0	
- 32.9	- 2.2	-37.9		-68.6	-13.2	- 3.8	-42.6	
- 1.3		-16.8		-37.6	- 2.9			
- 3.0	- 0.2	- 7.1		-18.3	- 1.1			
- 8.6		- 0.2						
- 13.6	- 0.3	- 7.3		- 5.6	- 1.8	- 3.8	-42.6	
- 6.4	- 1.7	- 6.5		- 7.1	- 7.4			
- 4.4					- 6.5	-26.3	-23.6	
- 12.4		- 2.3			- 1.7			
- 12.0	- 7.4	- 1.0		- 1.1	- 3.0			
- 39.5								
					-30.2			
- 4.7		-21.7	- 7.0	- 7.0				
-119.2								
	182.1	+ 1.1			+56.0			
		+67.4						
			+37.9	+83.5		+30.1	+73.7	+3.0

Mr. Osborn warned us that the table for 1961 was very approximate. All appropriation accounts in the publishing national accounts had been completed at the federal level only; a number of indirect methods using incomplete data, of various degrees of reliability, have been used in estimating transfer flows between sectors. Consumption estimates for the years 1954-62 were only reliably made at the federal level; the estimates of private consumption are either derived from budget survey data or federal estimates broken down to the territorial level, largely on the basis of comparative disposable incomes. Only sketchy information was available for federal government expenditure in Northern Rhodesia. The detail shown in the published Government Estimates and Auditor General Reports was inadequate to provide a reliable commodity analysis of government consumption. Finally, and most serious, trade statistics were not available at the territorial level for the years of federation. There was no great problem in the export side, but all the import figures were derived figures. It was possible to complete the table for 1961 only because satisfactory production data have recently become available through the completion of the census of industrial production for 1961. The table was therefore unique in its construction; usually consumption or production are the derived figures, but here imports into each sector are fundamentally the residuals.

Coefficients Used

Work also proceeded - mainly in the Ministry of Finance, Lusaka - with a view to establishing the basic coefficients to be used in the projections. Accordingly, income and expenditure elasticity coefficients (for Africans and Europeans separately) were computed, using the family budget studies that already exist for Zambia. Estimates of trends in productivity per worker were made, based on the available production census and employment data. The incidence of direct taxation on companies was also computed for mining and other sectors. (Tax receipts had already been classified by the Central Statistical Office, Salisbury, by originating sector; allowance was made for recent changes in tax rates).

It was assumed as a starting point that input-output ratios and components of total supply remain as in the base year. This assumption was modified when price and wage changes were introduced and when import substitution was expected to take place. When projecting the consumption of electricity by the copper industry, allowance was also made for additional electricity inputs due to the changing composition of copper production, that is, the increase of electrolytic relative to blister copper. Inputs into agriculture were largely treated as a function of the monetary component of agricultural production.

Assumptions and Procedures: Projections for 1965 (Taxes Assumed Unchanged)

The 1965 matrix was projected in two stages. Stage One involved projections from 1961 to 1965 at 1961 prices. Stage Two involved the introduction of estimated wage and price changes between 1961 and 1965.

In finalizing the 1965 projections, account was taken of the fact that the faster increase assumed in wages than in import prices causes the volume of imports and consumption to increase. The initial projection of consumption at fixed (1961) prices had thus to be roughly adjusted.

Finally, the test for a normal consumption function for the two racial groups was separately applied; namely, that gross incomes, personal taxes, personal savings, and consumption expenditure bear reasonable relationships to one another, judged by past experience, allowance being made for changes in average earnings.

Projections for 1970 (Taxes Assumed Unchanged)

The 1965 table was then carried forward to 1970, keeping the same prices, wage rates, and tax rates. In projecting for 1970 considerable care was taken to establish the basic assumptions to be made concerning (1) the level of copper sales and production, (2) the scope for import substitution, and (3) the level of government investment and current expenditure.

The Mission was fortunate in having access to a number of independent studies (projections) concerning the future demand for copper. It also conferred with the authorities concerned regarding the expected changes in the domestic capacity to produce.

The industry experts had assembled a complete inventory of existing projects and their current capacity utilization, as well as a list of additional projects expected to materialize between 1965 and 1970. The first exercise in this case was to estimate the capacity utilization of existing projects by 1965 and the additional projects expected to materialize between 1963 and 1965. Estimates were made of gross output of the additional projects expected to materialize between 1963 and 1965. Then estimates of gross output of the additional projects expected to materialize between 1965 and 1970 were made. The additional gross output by sectors was further broken down into consumption, intermediate sales, investment, and exports. As a result a separate matrix for intermediate sales was constructed, showing the additional output of intermediate sales by producing and consuming sectors. This matrix showed the additional intermediate products to be produced by domestic industry, above 1965 levels (at 1965 prices).

The additional gross output and intermediate sales by sector were added to the 1965 levels. The gross output of commodity sectors being exogenously determined, the implication for total inputs was traced by first assuming no import replacement. Domestically produced inputs thus projected were then compared with the input-output matrix for intermediate sales, and the balance was used to adjust imports of intermediate sales. Account was also taken of the additional electricity inputs for metal manufacturing, the fertilizer plant, and other manufacturing plants. The relevant total input requirements were accordingly adjusted. These estimates were sufficient to determine the balance of intermediate products in the input-output matrix, and accordingly the gross output of electricity, transport and distribution.

Total investment (both government and private) was arbitrarily estimated in the first instance on the basis of what it should be to play a leading role in activating the economy and creating big rises in employment; later it was adjusted by reference to the total investment implied in the sector programs. This task was made relatively easy since sector investment requirements were elaborated in some detail, particularly for agriculture, industry, power development, education, and housing. The allocation of investment between the public and the private sector was made after the exercise on sector programs was completed, in the light of programs for which the government would be responsible.¹⁴ The projected increase in government services in real terms reflected primarily the program of increasing the number of teachers.

Employment was estimated on the basis of productivity estimates for each sector... If employment were assumed to be homogeneous, the level of employment corresponding to given levels of output could be derived by making specific

¹⁴ It should be noted that government investment is carried out by government departments and does not include transfers to the private sector (e.g. through the Industrial Development Corporation).

assumptions about changes in productivity. The levels of employment incomes could be regarded as providing an employment index. Total employment (African and non-African together) having been derived from target values of value added and assumed changes in labor productivity, specific assumptions by sector, regarding the increase in non-African employment, are needed to determine the level of African employment separately. Non-African employment is assumed to remain unchanged between 1965 and 1970 for the economy as a whole, but to decline in the mining section, which would be compensated by corresponding increases in the nonmining sectors, particularly in government and manufacturing.

However, the consequent sharp rise in the African share of employment creates an interesting technical problem, because it is impossible to assume that average earnings remain unchanged for any sector's labor force as a whole, and for each race. If wages are unchanged for each given job, the average will rise for Africans (because they advance up the ladder) and also for non-Africans (because their less skilled jobs are lost to Africans); the working assumption was made that the effect of the change in composition was to increase the average earnings for both races in the same proportion, for any sector.

Consumption was estimated for each race separately on the basis of coefficients mentioned above and imports were again obtained as a residual, except for agriculture, where exports were considered to be whatever would not be consumed locally.

What then emerged was that these various developments would cause a big deficit in the balance of payments for 1970, assuming existing royalty arrangements and tax rates. Table 1 brings this out. The policies required to close this gap are discussed in Appendix C.

APPENDIX B

Use of the Matrix to Show the Economic Strategy Required (Adapted from the Mission's Report, Chapter I, Paragraph 74 to 84)

For the year 1970, we sketched the sort of economic structure that would satisfy the following conditions:

1. to provide at least 150,000 more jobs than there are in 1964;
2. to imply significant improvements in living standards, more specifically, a rise in average African real consumption per head by at least one quarter;
3. to be compatible with a balance in foreign payments;
4. to contain no excess of purchasing power with inflationary implications;
5. to act as a base for further and faster advances in the 1970's (implying a high rate of investment).

These constitute an economic expression of the government's major political objectives. It should be clearly understood at the outset that while it is a relatively simple exercise to sketch out an economic program, its achievement will require a tremendous effort by the government to mobilize the will and the abilities of the people. The structure projected here for 1970 is therefore not to be considered a forecast, but rather as the sort of economic situation which would meet the requirements indicated above, especially the rise in employment. The methods are described in Appendix A.

The whole set of projections adds up to a comprehensive program. The rise in copper revenues would finance increased government services (such as education) and government construction; this would expand incomes, leading to higher consumption, which would in turn widen the market for manufactured consumer goods and for foodstuffs, providing a bigger demand for agricultural products; the rising flow of goods would require more transport and provide more work for those engaged in distribution and other services; the general economic boom would stimulate private construction in offices, houses, shops, and the like.

The program is internally consistent. If the industrial expansion were slow, it would be difficult to find markets for the food; if agricultural output lagged, there would be heavier imports of food and agricultural materials than the country could pay for.

The Projected Rise in Demand

Table 2. Gross Domestic Expenditure at Factor Cost by Type, 1961 (actual, 1965 (projected), and 1970 (projected at 1965 prices) (£ millions)

	1961 Actual	1965 Projected	1970 Projected
Non-African consumption	52	56	67
African consumption subsistence	26	33	38
African consumption cash	36	51	84
Government consumption	25	37	56
Government investment	9	17	30
Private fixed investment	29	36	74
Change in stocks	+ 9	- 5	+ 3
Export surplus (goods and services)	25	35	4
Minus indirect taxes	<u>-7</u>	<u>-9</u>	<u>-13</u>
Gross domestic expenditure at factor cost	204	251	343

Source: See Appendix A

The main objectives of this strategy being the creation of employment, the basic quantitative targets refer to manpower, not to the national income... However, we will start from conventional categories of national income analysis. Table 2 shows how the increases in demand would be injected in the economy. The impetus would come from government consumption and government investment, which would rise by about 50 and 75 per cent respectively between 1965 and 1970. This would impart an upward momentum to the whole economy, enabling employment (especially African) to grow. Largely because of higher employment, African cash consumption would rise by 65 per cent. Taking subsistence output into account the total increase in African consumption would be 45 per cent; that is, average levels of living would rise about 25 per cent, allowing for the population increase. Non-African consumption would also rise, mainly due to the fact that the Europeans in Zambia in 1970 will be a more highly skilled and professional body than today. But the proportionate rise could be smaller, so the inequalities in levels of consumption would become less marked (apart from the effect of tax changes which will be considered below). On the assumptions made, investment overseas (the export surplus) will fall sharply.

Private investment should react sharply, however, more than doubling, from levels which will still be relatively low in 1965. Altogether, fixed investment (excluding stocks) would rise from 21 per cent of gross domestic expenditure to 30 per cent, a very high figure by international standards, and providing an excellent point of departure for the 1970's.

The Projected Rise in Output

The necessary output of the different sectors of the economy by 1970, to meet the rise in demand, is indicated in Table 3.

Table 3. Gross Domestic Product by Sector, 1961 (actual), 1965 (projected), and 1970 (projected at 1965 prices) (£ millions)

	1961 Actual	1965 Projected	1970 Projected	Per cent change 1965 to 1970
Mining	96	108	124	15
Agriculture ^a				
Commercial	9	10	20	100
Subsistence	21	27	31	15
Manufacturing	10	16	31	97
Construction	9	14	28	100
Distribution	14	17	23	65
Government services	13	20	30	30
Other ^b	<u>32</u>	<u>39</u>	<u>50</u>	<u>28</u>
Gross Domestic Product	204	251	343	37

Source: See Appendix I.

^a Includes fishing and forestry.

^b Electricity and water, transport and communications, miscellaneous services.

A rise in demand on the scale indicated would involve a big increase in imports. It would therefore require a big increase in copper exports; output of copper should rise from 680 thousand short tons in 1965 to at least 800 thousand in 1970, or by at least 18 per cent. Study of the possibilities of commercial agriculture and manufacturing indicates that in both these sectors output could double. Output in subsistence agriculture would rise with the help of extension services, but more slowly - about 1 per cent faster than the population living off agriculture. The increase in construction is necessary to spur the economic expansion and to make it possible. The increase in government service is needed to provide both more teaching and more administration, as will be required in a planned economy. Changes in output in other sectors would be induced by the increases just described.

Altogether the rise in the domestic product of 37 per cent would be equivalent to over 6 per cent a year, about twice as fast as the population is rising (implying a growth of some 3 per cent a year in income per head of the population).

The Projected Rise in Employment

Table 4 and Figure 1 show the effect that this program would have on employment by 1970. Company information is that employment will, if anything, fall in the mines because of mechanization. There will also be small increases in employment in agriculture; much of the increase in commercial output will come from farmers who count as "self-employed" (and are therefore not included in the table). The rises in employment in the other sectors reflect the changes in output discussed above, with allowance for expected improvements in productivity.

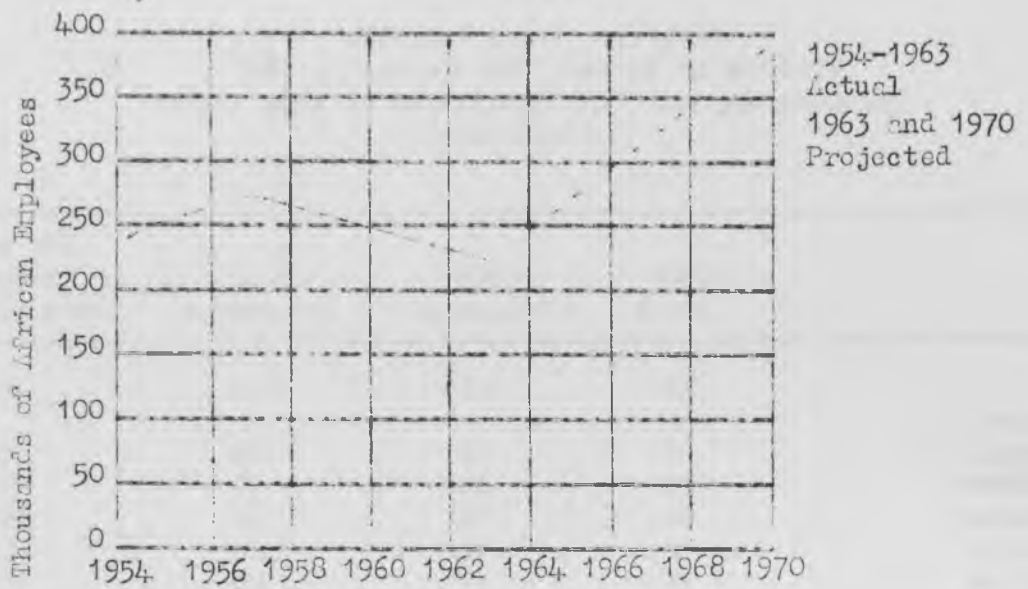


Figure 1. African Employment (Source: Monthly Digest of Statistics and Mission Projections)

Table 4. Employment by Race and Sector, 1961 and 1963 (actual); 1965 and 1970 (projected)^a
(thousands)

	African				Non-African				Total			
	1961	1963 ^b	1965 Projected	1970 Projected	1961	1963 ^b	1965 Projected	1970 Projected	1961	1963 ^b	1965 Projected	1970 Projected
Mining	42	41	42	42	8	8	8	6	50	49	50	48
Agriculture ^{c, e}	33	34	39	43	1	1	1	1	39	35	40	49
Manufacturing	19	16	21	36	2	3	3	3	21	19	24	39
Construction ^d	30	24	33	60	2	2	3	3	32	26	36	63
Distribution ^d	15)		22	37	7)		5	5	22)		27	42
Government services	35)	109	59	92	6)	18	7	8	41)	127	66	100
Other	59)		60	73	6)		6	7	65)		66	80
Total	238	224	276	308	32	32	33	33	270	256	309	421

Source: 1961 and 1963, Monthly Bulletin of Statistics; 1965 and 1970, Mission projections.

^a Excludes those working for African employers outside the main towns, estimates in the census report at 41 thousand males in 1963.

^b On the basis of figures for March, June, and September.

^c Includes forestry and fishing.

^d Includes finance.

APPENDIX C

Use of the Matrix to Show the Financial Policies Required (Adapted from the Mission's Report, Chapter VIII, Paragraph 121 to 133).^a

An attempt has been made to illustrate quantitatively the prospective need for foreign borrowing by means of projections of changes in assets and liabilities over the period. These projections suggest that the development plans for 1964-70 may not require much net foreign borrowing, provided that both budget and credit policy are pursued as indicated here. If copper prices rise relatively more than the level of import prices, which is not unlikely, the need for foreign borrowing will be correspondingly smaller.

Table 5. Projections for Government Account, Nation's Capital Account, and Balance of Payments for 1970, on Alternative Assumptions on Tax Rates and Government Expenditures (£ million)

	X	Y
Government account		
Net taxation	65	87
Expenditure on goods and services	86	86
Surplus (deficit = -)	-21	1
Fixed gross capital formation	30	30
Gross saving	9	31
Nation's capital account		
Personal saving	15	14
Corporate saving	57	51
Private saving	72	65
Government saving	9	31
Total saving	81	96
Net foreign borrowing	26	11
Gross real investment	107	107
Government gross fixed capital formation	30	30
Increase in stocks	3	3
Private fixed capital formation	74	74
Balance of payments		
Export surplus of goods and services	4	11
Net transfers abroad	30	22
Net foreign borrowing (balance of payments deficit)	26	11

Source: See Appendix A.

^a Alternative X: Assuming for taxes and royalties at 1963-64 rate (see Appendix A, Table 1).

Alternative Y: The following changes are assumed:

1. All mineral royalties transferred to government;
2. Tax of 5 per cent on export value of copper;
3. Duties on imports from Southern Rhodesia raised;
4. Duties and indirect taxes for a number of non-essential goods increased by an average of 30 per cent as compared with present rates;
5. Personal income tax increased, the effect being to raise the average rate on non-Africans from 6.4 per cent to 11.6 per cent of total income and for Africans from 1.5 per cent to 5.1 per cent.

* Minor changes result from deletion of tables.

To illustrate quantitatively the rough order of government expenditure and the level of taxation required by 1970, two alternative projections are presented in Table 5. Alternative X assumes implementation of the development plans suggested for government consumption and government gross capital formation, while tax rates are assumed to be maintained as in 1963. This alternative is identical with the projection presented for 1970 in Appendix A. Alternative Y assumes that government expenditure on goods and services is the same as in alternative X, but that tax rates are increased as indicated in the footnotes to Table 5.

As might be expected, alternative X shows large deficits both on government account and on the balance of payments. Although projects of this kind may have large margins of error, they clearly indicate the need for tax increases. If a policy in line with alternative X were pursued, the result would also be a relatively strong wage and price increase which again would further adversely affect the balance of payments.

Alternative Y is intended to represent an approximate illustration of the level of taxation needed to avoid harmful wage and price increases and to prevent the deficit on the balance of payments from becoming too large. The balance-of-payments deficit of \$11 million generated in this alternative appears not to exceed the volume of foreign capital supply possible and the use of exchange reserves justifiable at this stage of development. However, the figures in the table must be conceived as illustrations only. Final decisions on the level of taxation in years to come must, of course, be taken on the basis of all currently available information. The situation will no doubt be rather different from that described in alternative Y; one conclusion can be drawn with certainty, though, that the implementation of development programs requires on the assumptions made a very substantial increase of tax rates.

It will be noted that the entire increase of total saving in alternative Y as compared with alternative X is due to increased government saving, while corporate saving shows a substantial decline, due to the tax on copper exports.

Table 6 shows figures for the government account, the nation's capital account, and the balance of payments for the entire period 1966-70. Figures for 1966 to 1969, which are implied in the totals for 1966-70, have been estimated by interpolation between the projections for 1965 and 1970. Under the assumptions made, a government surplus of \$16 million would accumulate in this period, and the balance-of-payments surpluses in the first years would be offset by deficits in the later years. The government's surplus would decline from \$6 million in 1965 to \$1 million in 1970, and the balance of payments would deteriorate from a surplus of \$17 million in 1965 to a deficit of \$11 million in 1970. The estimates for 1970 are made at 1965 prices. If copper prices should develop more favorably than prices for Zambian imports, which is not unlikely, both the budget surplus and the balance of payments would be correspondingly more favorable. The projections for each of the years within the period (not all included in the table) show that Zambia, under the assumptions made, would have a surplus on its balance of payments until 1968 inclusive, but from then there would be increasing deficits up to 1970 and later. This illustrates the need for accumulating exchange reserves for the purpose of financing deficits on the balance of payments which may emerge in a few years, as a consequence of the development program. Increased government revenues and budget surpluses are the means by which this can be achieved.

Table 6. Projections for Government Account, Nation's Capital Account, and Balance of Payments in Total for the Period 1966-70 (£ millions at 1965 prices)

	1965	1970	Total 1966-70
Government account			
Net taxation	60	37	377
Government expenditure on goods and services	54	36	361
Surplus, net lending	6	1	16
Fixed gross capital formation	17	30	122
Gross saving	23	31	133
Nation's capital account			
Personal saving	10	14	60
Corporate saving	32	51	216
Private saving	4.2	65	276
Government saving	23	31	133
Total gross saving	65	96	414
Net foreign lending	17	-11	-
Gross real investment	48	107	414
Government gross fixed capital formation	17	30	122
Private gross fixed capital formation	36	74	279
Increase in stocks	- 5	3	13
Balance of payments			
Export surplus of goods and services	36	11	104
Net transfers abroad	19	22	104
Net foreign lending	17	-11	-

Applying the method described above, under the assumptions underlying Tables 5 and 6, projections have been made of total credit supply to the private sector and the increase in private financial assets over the five-year period 1966-70. According to these projections the credit supply to the private sector would have to be not less than £82 million in the period to achieve the speed of development aimed at, and this credit expansion would create an increase of private claims amounting to £66 million. An attempt at allocating the credit supply by lending sectors and the increase in private claims by type of assets suggests that more than half of the total credit supply would come from credit institutions, primarily agricultural credit institutions, commercial banks, and building societies. Moreover, more than half of the increase in private financial assets would take the form of increased deposits.

Furthermore, separate projections for 1970 seem to indicate that the total credit supply in this year, under the assumptions made, would be as much as £28 million and the increase in private claims would be £16 million. As the government surplus would be only £1 million, practically the entire difference is assumed to be obtained by a reduction of exchange reserves and by borrowing abroad.

To provide the credit expansion needed to implement the development plans it appears that the government would have in 1970 to supply the private sector (credit institutions and the public) with loans at an amount significantly larger than its budget surplus. Thus, while government and the central bank in 1964-65, as we have seen, would have to play an active role to reduce liquidity of the private sectors, they would by 1970 have to do the opposite,

supply loans (or buy securities) to increase liquidity. This is due to the fact that under the assumptions made, holdings of foreign assets by the central bank would significantly increase in the former period, whereas in the latter they would not change... The activity of credit institutions would have to be considerably increased, which illustrates the desirability of rationalizing the Zambian credit system to enable it to cope with the expanded tasks imposed upon it by the development program.

Concluding Remarks

The projections made in this Appendix are intended to serve three purposes. In the first place, they demonstrate a method by which broad financial aggregates can be projected to provide the framework within which a detailed financial plan could be prepared by the Ministry of Finance... Second, they serve to illustrate the kind of financial thinking which the Mission believes is essential in development planning - that the single purpose of a financial plan is to show how budget and credit policy can and should be applied to implement the real development plan. Third, it is hoped that the projections express a rough approximation of some of the magnitudes of the main financial transactions discussed in this report.

APPENDIX D

The Use of the Matrix to Devise the Targets for Manpower and Educational Policy (Adapted from the Mission's Report, Chapter VI, Paragraph 42 to 48)

The development of Zambia's human resources must be guided by manpower needs... Using estimates from various sources for the stocks of high-level manpower in each sector in 1961, rough projections of needs were made for five-year intervals until 1980. For the years 1965 and 1970, these estimates were made on a sectoral basis, increasing the present stocks according to the projected output for each sector (see Appendix A).

In global terms, these projections, rough as they are, indicate beyond doubt that Zambia's need will far outstrip local supplies for many years. Even ignoring the needs of the educational system, the demand for "administrative and professional personnel"¹⁵ is likely to rise from about 3,000 in 1961 to over 4,000 in 1965 and over 6,000 in 1970. Most of these must be graduates or professionally qualified. Second-level manpower, usually with school certificates and some training, will be required in much greater numbers; needs will rise from nearly 11,000 in 1961 to about 15,000 in 1965 and to over 23,000 in 1970. In addition, the educational system itself will absorb many school certificate holders, some as teachers but most as students at the higher levels; the educational plans suggested would require in total about 2,300 school certificate holders in 1965 and 5,500 in 1970. This would raise the gross needs for school certificate holders (or above) from almost 22,000 in 1965 to 39,000 in 1970. The Mission would not claim that these are accurate estimates and repeats its conviction that a thorough manpower survey must be undertaken as soon as possible, nor is education the sole qualification for high-level work. But, as orders of magnitude, these rough estimates establish the dimensions of the educational task facing the country.

It must be the explicit purpose of the educational system, and of other institutions of training, to provide the people of Zambia with the education and skills they need to build and develop the country.

¹⁵ Precise definitions of each category of manpower are given in a survey by Taylor and Pearson.