

---

This work is licensed under a  
Creative Commons  
Attribution – NonCommercial - NoDerivs 3.0 Licence.

To view a copy of the licence please see:  
<http://creativecommons.org/licenses/by-nc-nd/3.0/>

(831)

Makere Institute of Social Research

EDRP No. 56  
P.G. Clark  
30.11.64

INSTITUTE  
OF  
DEVELOPMENT  
STUDIES  
LIBRARY

THE TANGANYIKA PLAN: A STATISTICAL PROJECTION MODEL

A. Introduction

A statistical projection model of an economy can be a highly useful instrument for development planning. It can provide a comprehensive and internally consistent framework for an intermediate-term projection of economic developments during the plan-period which is customarily a central feature of the planning process. The model should specify a network of significant links between desired economic objectives and the development expenditures and policies subject to government decision, recognising that certain activities and relationships in the economy have a continuity and life of their own. Of course many elements of judgment, hunch, and hope must be combined with the statistical framework. But the model can be used to provide important tests of mutual consistency and feasibility for the plan.

Such a model has been prepared for the Uganda economy, and then used to analyse its structure and trends, and to project structural changes implied by a goal of doubling per capita income over the next fifteen years.<sup>1</sup> The model was designed to fit available statistical series in East Africa, and hopefully to be applicable with minor modifications to the Tanganyika and Kenya economies. The purpose of this paper is to present the results of applying the model to the Tanganyika economy, and using it to examine the implications of the new Tanganyika development plan.<sup>2</sup> Another paper at this Conference considers the applicability of a model of this kind to the Kenya economy and development plan.<sup>3</sup>

B. Nature of the Model

The statistical projection model employed is presented systematically in algebraic form in Appendix II. I shall not attempt in this paper to discuss the rationale of the model in detail.<sup>4</sup> However, let us note some of its general characteristics.

- 1 P.G. Clark, The Rationale and Use of a Projection Model for Uganda, EDRP 39, 10.7.64; P.Clark & B. Van Arkadie, Development Goals for the Uganda Economy in 1981, EDRP 42, 29.7.64.
- 2 The work of fitting the model with Tanganyika data, and then deriving from the published development plan the guidelines needed to use the model for projection, has been done largely by John Kinyunyu, economist at the Tanzania Directorate of Development Planning. I am greatly indebted to him for his help and cooperation. At the same I must assume responsibility for the design of the analysis, and particularly for all of the interpretations of the results presented in this paper. Since the model was applied only to the mainland part of Tanzania, the former name Tanganyika is used throughout.
- 3 H.Karani & C.Howe, The Kenya Plan: A Statistical Projection Model.
- 4 Readers interested in working through the algebra may note that the first section defines the 37 variables in terms of items in published statistical series; the second section presents the model proper, including 11 accounting identities, 5 autonomous variables, and 21 functional equations; the third section shows the method of calculating the parameters for any given year; and the fourth section shows how GDP, government revenue, and imports depend ultimately on the five autonomous variables and linear combinations of all the parameters. The model is discussed in detail in EDRP 39, cited above.

Book  
Number

IN

Classi  
catio

First, it is a sector model distinguishing six producing sectors of the economy, seven kinds of imports, two classes of exports, four forms of capital formation, four kinds of government taxes, and certain other variables. Thus it embodies substantially more specific information than a purely aggregative model but still much less detail than is involved in planning development actions within ministries. Second, it portrays an economy in which everything depends, by way of the structural relationships among its parts, upon five autonomous factors: the real quantity of agricultural exports, the prices of those exports, the value of manufactured exports, import substitution in manufactured products, and central government current expenditures. In particular, it specifies that required capital formation is derived within the model from implied increases in domestic production. Third, the parameters describing the structural relationships among parts of economy must each be projected into the future. Some are assumed to remain unchanged or to follow a time-trend, while others are assumed to be adjustable by government policy. Fourth, it is a linear model; capital formation, though in principle non-linear, is represented by a linear approximation depending on a tentative initial estimate of rate of growth. Fifth, the model is designed to emphasize three potential constraints on development expenditures and policies: the balance of trade, which depends mainly on the various import parameters; the government budget surplus or deficit, which depends mainly on the tax revenue parameters; and the required saving, which depends mainly on the capital formation parameters.

The conception of the development process in East Africa which is embodied in the model has the following major emphases. Various producing sectors, particularly agricultural and non-agricultural, have differential effects on imports, investment requirements, and tax revenues. What happens domestically is greatly influenced by agricultural export quantities and prices. Required capital formation both public and private depends on the rate of growth of domestic production, and the import bill is quite sensitive to variations in capital formation. Import substitution in manufactures is a prime potential source of structural change. Government development actions can affect significantly government current expenditures, the share of public investment, tax revenue coefficients, and the extent of import substitution, but not other structural parameters of the economy. Finally, progress in development is limited by one of the three potential shortages - foreign exchange, government finance, and generalised saving.<sup>1</sup>

### C. Structure of the Tanganyika Economy as Expressed in the Model, Compared with the Uganda Economy

Once a statistical projection model has been fitted with data for a country's economy, it can provide an illuminating picture of the economic structure, either for changes over time or in comparison with other countries. Tables 1, 2, and 3 in Appendix I present a number of characteristics of the structure of the Tanganyika economy, compared to that of Uganda.

Certain major features of the two economies are reflected in the principal variables of the model and ratios among them, as summarised in Table 1. The Tanganyika economy is about a fifth larger than Uganda's, and during the years 1958-62 grew about twice as fast in real terms. This can be partly explained by the induced domestic effects of a more favourable trend in export prices (shown by difference of GDP and GDP\*), but real exports also expanded more rapidly. Tanganyika has a higher import content in her domestic product, and correspondingly a much smaller surplus on merchandise account, though both differences would

1 The fact that the model does not explicitly treat specialised manpower as a potential constraint is an obvious weakness. Manpower needs can be examined, however, in a supplementary analysis. See E.R. Rade\* & A.R. Jolly, The Demand for Manpower in an East African Study, EDRP 44, 21.8.64.

be reduced if Uganda's invisible payments to Kenya for transport and trade margins on imports were allowed for. Tanganyika's investment rate is notably higher than Uganda's, and has declined only slightly in recent years, whereas investment in Uganda has fallen sharply; Tanganyika has also attained a lower capital-output ratio. Both countries collect a similar proportion of GDP in tax revenues, but Tanganyika's lower government expenditures left a larger amount for budgetary saving to finance investment. The fall in Uganda's budgetary saving 1958-62 was much affected by her unfavourable export price trends, however, since she depends more largely on export taxes. Both countries' urban product grew more rapidly than the rest of the economy, but in neither country sufficiently to prevent a decline in employment.

More specific details of the Tanganyika and Uganda economic structures are set forth in Table 2, in terms of the parameters of the model. The last three columns, showing the actual Tanganyika parameters calculated for 1962, those adopted for the 1970 Tanganyika projection discussed in section D below, and those adopted for a previous "moderate" projection for Uganda, are the most germane for inter-country comparison. The sectoral gross product parameters, from a1 to h, are much affected by definitional and estimating differences in the two countries' national accounts; the only difference that I feel confident reflects a real difference is the higher transport parameter for Tanganyika. The import parameters from c1 to j2, on the other hand, show some meaningful differences. Tanganyika's higher import content in 1962 is shown to be concentrated in her imports of food, manufactured consumer goods, and construction materials. At the same time, the Tanganyika projection, following the guidelines of the official plan, assumes a higher future degree of import substitution than does the "moderate" (and unofficial) Uganda projection. The investment parameters, from k' to p2, reflect a lower capital-output ratio in Tanganyika, but a higher planned rate of growth of urban product, and a smaller proportionate reliance on private investment. Finally, the tax parameters from r1 to r4 bring out the much smaller reliance on export taxes in Tanganyika, and the lower average rate of customs duties on her mix of imports, including inter-territorial goods. Overall, Tanganyika appears to have a tax structure which is distinctly less income-elastic than Uganda's.

The ultimate impacts on the two economies of changes in real agricultural exports or import substitution cannot, of course, be determined simply from the individual parameters. The direct and indirect effects of such changes depend on all the parameters and the entire network of relationships expressed in the model. Table 3 presents some of the most interesting of these "multipliers", i.e. the ultimate effect of a £1 change in each of the autonomous variables upon GDP, government revenue, and imports. For both countries the GDP multiplier for real agricultural exports is higher than for any other autonomous demand, and is in the order of 2.0, with the others ranging down to about 1.5. Tanganyika's GDP multipliers are consistently lower than Uganda's, representing a smaller dependence of output on domestic incomes. Tanganyika's direct and indirect revenue yields are also distinctly below Uganda's, reflecting the lower income-elasticity of her tax structure noted above. They are still in the order of a third, however; i.e., additional government expenditures (provided the required investment can be financed by borrowing) ultimately "pay for themselves" to this extent. The two country's direct and indirect import requirements are remarkably similar, though of course for Tanganyika these assume the high degree of import substitution projected in the official plan. If we adjust for her lower GDP multipliers, Tanganyika's import requirements are even slightly above Uganda's. But perhaps most significant is the absolute level of the import "multipliers": for both countries direct and indirect import requirements appear to be in the order of 60% for real agricultural exports and government expenditures, jumping to about 80% for manufactured exports and import substitution. Thus allowing for induced domestic incomes and rising investment requirements, quite

large fractions of additional demands emerge ultimately as imports. This is a quite significant observation in weighing the ultimate impact of development projects.

D. Application of the Model to Analyse the Tanganyika Development Plan

An intriguing exercise is to use the model to make a 1970 projection, trying to make the same assumptions about autonomous demands and parameter changes as in the official plan, and then to compare the model projection with the 1970 estimates in the published plan. The new Tanganyika plan was actually constructed without using a model of the sort discussed in this paper. As is commonly done in practice, it was actually constructed by successive approximations, working simultaneously from the supply and the demand sides, and employing two main statistical tables to check for consistency - a uses-resources table for a list of major products and sector outputs, and an aggregative income-expenditure table.<sup>1</sup> The interconnections among the sector output projections to 1970, the estimated 1970 balance of payments, the investment needs over the five fiscal years 1964/65-1968/69, and government recurrent revenues and expenditures in 1968/69 are not given in detail in the published plan.<sup>2</sup> In principle, a statistical projection model of the sort presented here should permit a more comprehensive and explicit test of internal consistency. In practice, given the imperfections of the model, I can only hope that comparing the model with the plan will be informative and suggestive.

The assumed conditions for the model projection are summarised in Table 4, along with certain implications for their orders of magnitude, in comparison with the past. These assumed conditions are extracted in so far as possible from the published plan, though to get them in the form needed for the model involved a variety of inferences, some of which may be doubtful. The projections for real agricultural exports, agricultural export prices, government expenditures, and mineral exports are reasonably straight-forward. They imply, as in the plan, that the volume of agricultural exports will grow in line with the past, that prices will be comparatively favourable, that the rate of rise of government expenditures will be restrained, and that mineral exports will grow more slowly than in the past.

The assumed conditions for import substitution were more difficult to establish on the basis of the published plan. The plan provides a detailed list of expected manufactured products in 1970, specifying both value of output and value added, but after allowing for present output and guessed inter-territorial exports from some major projects like the Land Rover plant, the remaining output still implied what seemed an implausibly high degree of import substitution. In particular, the expected output of intermediate goods appeared to involve more than 100% substitution for this category of imports. Therefore in the model projection import substitution in intermediate goods has been assumed to be (only) 40%. For other categories of substitutable imports the corresponding proportions are 40%, 33%, or 20%, which are roughly consistent with the expected outputs of those products listed in the plan.

The investment parameters adopted for the model projection imply that capital formation must rise to about 32% of real GDP by 1970 - half again as high a proportion as in the recent past. This is in line with the plan. It may be noted, however, that because the plan projects a gradual rather than an abrupt rise in the share of investment, the implicit capital-output ratio during the five fiscal years 1964/65

1 Tanganyika's Five-Year Plan 1964/65-1968/69: A Brief Methodology (mimeographed), Ministry of Development Planning, Dar es Salaam, 20.2.64.

2 United Republic of Tanganyika and Zanzibar, Tanganyika Five-Year Plan for Economic and Social Development, 1964.

to 1968/69 is noticeably below that in the past.<sup>1</sup> On the other hand, the tax parameters used in the model projection are consciously set higher than those indicated in the plan. The published document does not give any revenue estimates, but suggests in the text that revenue is likely to rise at only about two-thirds the rate of growth of GDP. If this assumption were adopted, the model would surely project an excessively large expansion of private income and demand. For the projection, therefore, it is assumed that effective rates of customs duties continue to go up in line with the recent trend, while the other tax parameters are unchanged.

Turning now to the results of the 1970 projection, the projected values for most of the variables of the model are set forth in Table 5, with comparisons wherever available to the official plan. Generalising very broadly, the model gives a similar picture of expected developments in the Tanganyika economy by 1970, if the assumed conditions stated in the plan are realised. This is hardly surprising, unless either the plan or the model were very ineptly put together. Let us examine the comparison in more detail, however, to see if any suggestive points emerge.

First, the model projection indicates a somewhat higher GDP than does the plan, even though the plan already specifies an 8.5% rate of growth. Since GDP in the model is fundamentally a measure of demand, this suggests that the anticipated 1970 investment rate and import substitution (even after the latter has been pruned as indicated above) may be so high as to threaten excess demand pressure. This prospect is made more likely on the supply side by the implicit low capital-output ratio over the entire interval between 1962 and 1970 (also noted above), though present underutilisation of capacity would account partly for the low ratio. If this implication should prove correct, what would be needed to bring demand and supply into closer balance would be either less import substitution and greater foreign capital inflow, or more severe tax constraint on private consumption demand.

Second, the model projection suggests somewhat greater divergence among sector rates of growth outside agriculture than does the plan. In particular, I think it is probably a valid inference that the construction sector will have to grow more rapidly than the plan projects, if the share of investment in GDP is raised as much as assumed, and particularly if government investment expands more rapidly than private investment. In many respects this leading role for construction can be helpful in the development process. Expanding construction doesn't demand great technological innovation, does open up opportunities for domestic production of construction materials, and is likely to have a comparatively favourable effect on employment opportunities.

Third, the composition of imports (which is specified in the model projection but not in the published plan) is likely to change dramatically under the combined influence of differential import substitution and differential growth of domestic demand for the various categories of goods. Thus the share of the three categories of consumer goods imports may be expected to drop from two-thirds to half of the total, the share of intermediate goods (despite extensive import substitution) to rise, and the share of capital equipment imports to jump from 15% to 25%. In addition to our intrinsic interest in the composition of imports, we may note that this shift from presently high-duty imports to presently low-duty imports will raise a need for adjusting the customs structure substantially, if tax revenue from this source is to be maintained and indeed increased relative to total value of imports.

Fourth, 1970 total exports, total imports, and balance of trade in the model projection are remarkably similar to those in the published plan. They imply an increased need for inflow of foreign capital, net of changes in invisibles and carrying charges on past inflows, of

1 G. Karmiloff, "Plan Implementation in an Underdeveloped Setting", East African Economics Review, forthcoming. The gross capital-output ratio stated there is 2.7; allowing for a retirement rate about 7% of GDP, the net ratio is 2.2.

less than £10 million. If excess demand pressure rises, however, and import substitution is less than hoped, the needed capital inflow would be larger.

Fifth, because of the altered assumptions about tax parameters (noted above), the model projection indicates much larger 1970 tax revenue than is suggested by the text of the plan. Whereas the model projects a slight rise in the share of tax revenue in GDP, the elasticity of about two-thirds mentioned in the text of the plan would imply a fall in the share from 19% to 14%. Correspondingly, the model projects a substantial rise in government saving out of tax revenues, and a residual rise in government borrowing of something less than £10 million, roughly in line with the negative shift in the balance of trade. On the other hand, the implication of a revenue elasticity of only two-thirds is that government borrowing would have to rise to the range of £20-25 million, and the government's financial deficit would be much larger than the economy's trade deficit. It seems clear that if the plan is to succeed the government will have to take action to raise the elasticity of the tax structure substantially.

#### E. Conclusion

The statistical projection model presented here provides a number of insights into the Tanganyika economy and the new Tanganyika development plan. It permits explicit comparison of the economic structure with that of Uganda, offers a means of estimating direct and indirect effects of given economic changes, points up the assumed conditions for the new development plan, and suggests certain questions about the expected economic adjustments between now and 1970. Though the model has many imperfections, I hope it may at least illustrate the nature of the contributions which a statistical projection model can make to the development planning process.

## APPENDIX I: TABLES

Table 1. Major Features of Tanganyika and Uganda Economies

	1962 Features <sup>a</sup>		Changes 1958-62 <sup>b</sup>	
	Tang.	Uganda	Tang.	Uganda
Real gross domestic product (GDP*) <sup>c</sup>	£124.7	£105.6	+5.2%	+2.6%
Gross domestic product (GDP)	£125.5	£106.4	+5.9%	+0.0%
Private income (Y)	£100.4	£84.5	+6.7%	+0.0%
Real agricultural exports (Ea*) <sup>c</sup>	£46.8	£37.7	+2.5%	+1.0%
Imports: ratio to GDP (M/GDP)	.42	.32	.44-.42	.32-.32
Export surplus: ratio to imports (E-M/M)	.04	.32	.04-.04	.51-.32
Investment (K+Q)	£26.8	£15.3	+4.2%	-5.9%
Investment: ratio to real GDP (K+Q/GDP*)	.21	.14	.22-.21	.18-.14
Capital-output ratio ( $\Sigma(K+Q-Ret)/\Delta GDP^*$ )			2.7 <sup>d</sup>	3.7 <sup>d</sup>
Gov. current expenditures (G)	£19.6	£22.0	+3.2%	+3.6%
Gov. revenue: ratio to GDP (R/GDP)	.19	.20	.21-.19	.20-.20
Gov. saving: ratio to revenue (R-G/R)	.16	-.01	.16-.16	.13-(-.01)
Urban gross product (U)	£66.8	£52.6	+6.1%	+4.0%
Non-agricultural employment <sup>e</sup>	196 <sup>f</sup>	160	-3.2%	-1.6%

## Notes:

- In £ million, or ratios.
- In average annual percentage changes, or as ratios in initial and final years.
- Real GDP is corrected for changes in agricultural export prices, so that agricultural exports and agricultural product are at 1960-62 prices.
- 1954-62, including some excess capacity in later years.
- In thousands. Includes construction employment.
- 1961.

Table 2. Tanganyika Parameters 1954-62, and Assumed Parameters for Tanganyika and Uganda 1970 Projections

	Tanganyika Parameters			Tanganyika	Uganda
	1954	1958	1962	"Model" Projection <sup>n</sup>	"Moderate" Projection <sup>o</sup>
a1 (assumed)	1.0	1.0	1.0	1.0	1.0
a3 (assumed)	.3	.3	.3	.3	.3
a2 = $Pa^* - a1 Ea^*$ - $a3(Lm+Sm)/Y$	.0269	.0153 <sup>j</sup>	.0158	.0200	.131
g = $Pg/G$	.534	.654	.883	.920 <sup>a</sup>	.740 <sup>a</sup>
m2 (assumed)	.5	.5	.5	.5	.5
m1 = $Fm - m2(Em+Sm)/Y$	.101	.130	.112	.112	.0649
s = $Ps/Y$	.216	.206	.183	.183	.513 <sup>a</sup>
t = $Pt/Pa^* + Fm$	.222	.221	.241	.241	.132
h = $Pk/K$	.327 <sup>i</sup>	.486	.567	.650 <sup>a</sup>	.546 <sup>a</sup>
c1 = $Ma/Y$	.127	.115	.102	.068 <sup>e</sup>	.0558 <sup>b</sup>
c2 = $Mm/Y$	.224	.172	.188	.126 <sup>e</sup>	.141 <sup>b</sup>
c3 = $Mv/Y$	.034	.035	.034	.023 <sup>e</sup>	.0331
i5 (assumed)	.2	.2	.2	.2	.2
i1 = $Mi - i3(Lm+Sm)/GDP$	.0192	.0129	.0167	.0100 <sup>f</sup>	.0221 <sup>b</sup>
i2 = $Mf/GDP^*$	.0359	.0405	.0310	.0250 <sup>g</sup>	.0217
j1 = $Mk/K$	.285	.314	.300 <sup>k</sup>	.180 <sup>f</sup>	.178 <sup>b</sup>
j2 = $Mq/Q$	.629	.696	.604	.604	.689
k' = $K/U$	.276 <sup>i</sup>	.238	.211	.320 <sup>h</sup>	.285 <sup>c</sup>
q' = $Q/U$	.252	.193	.191	.270 <sup>h</sup>	.215 <sup>c</sup>
p1 = $Kp/K$	.443	.427	.372	.372	.458
p2 = $Qp/Q$	.715 <sup>i</sup>	.873	.879	.879	.944
r1 = $Rd/y$	.099 <sup>i</sup>	.070	.058	.058	.0467
r2 = $Re/Ea$	.001 <sup>i</sup>	.001	.021 <sup>m</sup>	.021	.139 <sup>d</sup>
r3 = $Rm/M$	.127	.157	.179	.230 <sup>a</sup>	.308 <sup>a</sup>
r4 = $Ri/Y$	.106	.108	.083	.083	.090 <sup>a</sup>

## Notes:

- a. Assumes trend continues  
b. Assumes 10% import substitution

- c. Assumes as first approximation 7% average annual rate of growth of urban gross product, compared to about 8% in 1954-58 and 4% in 1958-62. Derived from  $k = K/\Delta U = 3.5$ ,  $q = Q/\Delta U = 1.5$ , Ret K = .04U, Ret Q = .11U.
- d. Assumes 1963 parameter of .160 will decline at 1.5 times 1% per year price fall.
- e. Assumes 33% import substitution
- f. Assumes 40% import substitution
- g. Assumes 20% import substitution, recognising large crude oil content of local refining.
- h. Assumes as first approximation 10% average annual rate of growth of urban gross product, as in Plan. Derived from  $k = K/\Delta U = 2.8$ ,  $q = Q/\Delta U = 1.6$ , Ret K = .04U, Ret Q = .11U.
- i. 1955
- j. 1959
- k. 1961-62 average
- m. 1963, including new taxes on sisal and coffee.
- n. See section D below, and Tables 4 and 5.
- o. See EDRP 39, cited above.

Table 3. Some Significant Multipliers in the Models of The Tanganyika and Uganda Economies

<u>Increase in</u>	<u>GDP</u>		<u>Revenue (R)</u>		<u>Imports (M)</u>	
	<u>Tang.</u>	<u>Ug.</u>	<u>Tang.</u>	<u>Ug.</u>	<u>Tang.</u>	<u>Ug.</u>
<u>Per unit increase in:</u>						
Real ag. exports (Ea*)	1.94	2.07	.37	.53	.57	.59
Export prices (T) <sup>b</sup>	1.51	1.80	.28	.46	.44	.54
Mfd. exports or import substitution (Em, Sm)	1.68	1.83	.37	.44	.79	.83
Gov. expenditures (G)	1.66	1.60	.34	.36	.65	.60

Notes:

- a. With the parameters indicated in Table 2.
- b. Represents an increase in agricultural export prices sufficient for a unit increase in value of exports, with quantity constant.

Table 4. Assumed Conditions for Tanganyika 1970 Projection  
Using Model

<u>Condition</u>	<u>Implications</u>
1. <u>Real agricultural exports</u> increase in volume as stated in Plan for production of 8 major crops, less estimated domestic use of sisal and cotton; other ag. exports projected in same proportion.	Rate of increase 5.7% p.a., compared to 2.5% 1958-62, 5.7% p.a. from 54/55 ave. to 62/63 ave.
2. <u>Agricultural export prices</u> remain above 1962 for 8 major crops, as stated in Plan. Fall of 1% p.a. assumed for other ag. exports.	Price index for 8 major crops is 106, above 1962 for all but cotton. Compares with no significant price trend 54/55 to 62/63.
3. <u>Government expenditures</u> increase 4.6% p.a. from 64-65, as stated in Plan.	Rate of increase over entire period is 6.7% p.a., because of marked increases in last two years.
4. <u>Manufactured exports</u> increase as stated in Plan for production of minerals; other exports, largely inter-territorial, assumed from Plan figures for major industrial projects.	Rate of increase 6.8% p.a., lower than 58-62 because of limited known mineral resources, despite assumed inter-territorial exports of manufactured products.
5. <u>Import substitution</u> replaces 33% of imports of food, manufactured consumer goods, vehicles; 40% of construction materials, intermediate goods; 20% of fuels; none of equipment. Based on output values of manufactured products stated in Plan, reduced for intermediate goods to assumed maximum 40% substitution, reduced for fuels to reflect large crude oil content of local refining.	Substitution compares with roughly 12% for all imports combined over eight years 54-62. Imports replaced are about £13 mil. at 1962 level of GDP, about £27 mil. at 1970 level; note includes inter-territorial as well as foreign imports.
6. <u>Capital formation</u> increases to 32% of real GDP by 1970. Based on relationships approximating a capital-output ratio of 2.7 around 1970, and a retirement rate of 7% of GDP.	Share of capital formation compares with 21% in 1962, 29% in 1954, 33% for 1970 stated in Plan. Capital-output ratio is same as 2.7 54-62. Because share of capital formation rises gradually, implicit capital-output ratio during five years of Plan 64/65 to 68/69 is about 2.2.
7. <u>Tax rates</u> rise in line with trend for customs duties (about 30% rise), are raised by 1965 sisal and coffee export taxes, are unchanged for direct and indirect taxes.	Share of revenue in GDP rises slightly, compared to Plan assumption that revenue rises about 2/5 of rate of GDP.

Table 5. Comparison of 1970 Projection Using Model and Official Tanganyika Plan

	Model Projection		Plan	Rates of growth <sup>c</sup> or shares of appropriate totals (%)	
	1962 (mil.£)	1970 (mil.£)	1970 (mil.£)	Model Projec.	Plan Projec.
GDP, monetary economy	125.3	286.9	264.6 <sup>b</sup>	+9.9	+ 8.8
Real GDP <sup>a</sup>	124.7	282.1	259.8	+9.5	+ 8.5
Agric. product <sup>a</sup>	48.5	94.6	86.5	+7.7	+ 7.3
Non-agric. product	76.2	187.5	173.3	+10.5	+ 9.2
Construction product	8.0	32.3 <sup>d</sup>	e	+16.7	+ 12.7
Manufacturing product	15.4	46.6	e	+13.1	+ 11.1
Services product	18.4	42.0	e	+9.6	+ 8.4
Government product	17.3	32.6 <sup>d</sup>	e	+7.3	+ 8.0
Transport product	15.7	31.0	e	+7.9	+ 8.5
Gross investment	26.8	91.6	85.0	+14.6	+ 14.6
Construction	14.1	49.7	f	+15.0	f.
Equipment	12.7	41.9	f	+14.2	f
Government investment	10.4	36.5	32.0	+14.9	+ 18.4
Gross invest./Real GDP	(21%)	(32%)	(33%)		
Real agric. exports <sup>a</sup>	46.8	77.4	f	+5.7	f
Agricultural exports	45.4	82.2	f	+6.8	f
Manufactured exports	8.2	14.8	f	+6.8	f
Manufactured import substitution <sup>g</sup>		27.1	f		
Food imports	10.2	15.6	f	20-15%	f
Mfd. consumer imports	18.9	28.9	f	37-28%	f
Vehicle imports	3.5	5.3	f	7-5%	f
Intermediate imports	3.7	11.2	f	7-11%	f
Fuel imports	3.9	7.1	f	8-7%	f
Constr. mat. imports	3.7	8.9	f	7-9%	f
Equipment imports	7.6	25.3	f	15-25%	f
Total exports	53.6	97.0	95.0	+6.8	+ 6.8
Total imports	51.5	102.3	100.0	+ 8.0	+ 7.5
Balance of trade (E-M)	+ 2.1	-5.3	-5.0		
Imports/GDP	(±2%)	(36%)	(38%)		

Table 5. (cont'd)

	Model Projection		Plan	Rates of growth <sup>c</sup> or shares of appropriate totals (%)	
	1962 (mil.£)	1970 (mil.£)	Projec. 1970 (mil.£)	Model Projec.	Plan Projec.
Direct tax revenue	5.8	13.5	f	25-23%	f
Export tax revenue	0.1	1.7	f	0-5%	f
Customs revenue	9.2	23.5	f	39-41%	f
Indirect tax revenue	8.3	19.0	f	35-33%	f
Gov. current expenditure	19.6	35.4	35.0	+6.7	+5.6
Total tax revenue	23.4	57.6	37.9	+10.5	+5.5
Gov. saving (R-G)	3.8	22.2	2.9		
Gov. borrowing (I-(R-G))	6.7	14.1	29.1		
Revenue/GDP	(19%)	(20%)	(14%)		
Consumption & other uscs <sup>h</sup>	74.7	165.2	145.1	+9.2	+7.4

Notes:

- a. Agricultural exports at 1960-62 prices.
- b. Calculated from real GDP by adding additional value of agric. exports due to higher prices, as estimated in Model.
- c. Rates of growth for Model are calculated as if over 9 years, for closer comparability with Plan. Because of new base-year estimates, Plan figures for 60-62 average are close to previous official figures for 1962 used in Model. Model Projection largely uses absolute figures from Plan in projecting autonomous variables, so its projection 62 to 70 is comparable to Plan projection 60-62 to 70.
- d. Projects continuing rise in share of value-added in value of output.
- e. Absolute figures within non-agriculture aren't comparable because of differences in base-year estimates and definitions. Rates of growth are presumably less affected by these base-year differences.
- f. Not specified in published Plan.
- g. Defined only for changes from 1962.
- h.  $GDP+M - E - I - G$ .

APPENDIX II

A PROJECTION MODEL FOR UGANDA, ADAPTED TO AVAILABLE STATISTICS

A. Variables

- GDP = gross domestic product = monetary gdp at factor cost
- Pa = gross product of agriculture = agriculture, cotton ginning, coffee curing, sugar manufacture, forestry, fishing, hunting
- Pm = gross product of manufacturing = mining, manufacture of food products, miscellaneous manufacturing
- Pk = gross product of construction = construction
- Pt = gross product of transport = transport, communication, electricity
- Ps = gross product of services = commerce, miscellaneous services (private), rents
- Pg = gross product of government = government administration, miscellaneous services (public), local government
- M = imports = net imports, interterritorial imports
- U = urban gross product = Pg + Pm + Ps + Pt
- Ma = imports of food = SITC 0, 1, 4
- Mm = imports of consumer manufactures = SITC 5 (part), 6 (part), 7 (part), 8 (part), 9 (part)
- Mv = imports of consumer vehicles = SITC 6 (part), 7 (part)
- Mi = imports of intermediate goods = SITC 2 (part), 5 (part), 6 (part), 8 (part), 9 (part)
- Mf = imports of fuel = SITC 3
- Mk = imports of construction materials = SITC 2 (part), 6 (part), 7 (part), 8 (part)
- Mq = imports of equipment = SITC 7 (part), 8 (part)
- E = exports = domestic exports, inter-territorial exports
- Ea = agricultural exports = SITC 0, 1, 2, 4
- Em = manufactured exports = SITC 3, 5, 6, 7, 8, 9
- T = terms of trade adjustment = Ea (1960-62 prices) less Ea
- Ea\* = real agricultural exports = Ea + T
- Pa\* = real gross product of agriculture = Pa + T
- GDP\* = real gross domestic product = GDP + T
- K = construction investment = gross capital formation: government construction plus private construction
- Kg = government construction = central government buildings, local government, common services organization
- Kp = private construction = remainder: urban building, rural industrial building and construction
- Q = equipment investment = gross capital formation: government equipment plus private equipment

- ~~Qg = government equipment - central government, plant, equipment, and vehicles~~
- Qp = private equipment = remainder: plant, equipment, and vehicles
- G = government current expenditures = actual recurrent expenditures, less public debt transactions, pensions and gratuities, overseas addition, for fiscal year beginning in any calendar year
- R = government revenue = actual recurrent and non-recurrent revenue, less public debt transactions, reimbursements, and grants from abroad, for fiscal year beginning in any calendar year
- Rd = revenue from direct taxes
- Re = revenue from export taxes
- Rm = revenue from customs
- Ri = revenue from indirect taxes = excises, licences and fees, rents and interest, miscellaneous, contributions from local funds
- Y = private income = gross domestic product less government revenue
- Sm = import substitution in manufactures = decrease in imports of food, consumer manufactures, intermediate goods, and construction materials compared to what imports would be with unchanged import coefficients

B. The Model

$$Pa + Pg + Pm + Ps + Pt + Pk = \text{GDP}$$

$$Pg + Pm + Ps + Pt = U$$

$$Ma + Mm + Mv + Mi + Mf + Mk + Mq = M$$

$$Ea + Em = E$$

$$Ea + T = Ea^*$$

$$Pa + T = Pa^*$$

$$\text{GDP} + T = \text{GDP}^*$$

$$Kg + Kp = K$$

$$Qg + Qp = Q$$

$$Rd + Re + Rm + Ri = R$$

$$\text{GDP} - R = Y$$

$$Ea^*, T, Em, Sm, G = \text{given}$$

$$Pa^* = a_1 Ea^* + a_2 Y + a_3 (Em + Sm)$$

$$Pg = g G$$

~~$$Pm = m_1 Y + m_2 (Em + Sm) Tm$$~~

$$Ps = s Y$$

$$Pt = t (Pa^* + Pm)$$

$$c2 = Mm/Y$$

$$c3 = Mv/Y$$

$$i1 = \frac{M1 - i3(E1 + S1)}{GDP^*}$$

$$i2 = Mf/GDP^*$$

$$j1 = Mk/K$$

$$j2 = Mq/Q$$

$$k1 = (\text{Sum } K - \text{Sum } k2 \text{ } U)/dU$$

$$q1 = (\text{Sum } Q - \text{Sum } q2 \text{ } U)/dU$$

$k2 = .04$      Note:  $k2$  and  $q2$  are estimated assuming approximately a 40-year life for construction and a 10-year life for equipment, with both stocks growing at an average annual rate of about 5%, and with the ratio of investment to gross product in the past about the same as in the 1950's.

$$q2 = .11$$

$$p1 = Kp/K$$

$$p2 = Qp/Q$$

$$r1 = Rd/Y$$

$$r2 = Re/Ea$$

Note:  $r2$  for projection is adjusted separately for change in terms of trade adjustment ( $T$ )

$$r3 = Rm/M$$

$$r4 = Ri/Y$$

Values of  $k'$  and  $q'$  for various annual rates of growth of urban gross product

	<u>3%</u>	<u>5%</u>	<u>7%</u>	<u>9%</u>	<u>11%</u>
$k'$	.145	.215	.285	.355	.425
$q'$	.155	.185	.215	.245	.275

Note: Assumes capital-output ratios  $k = K/dU = 3.5$  and  $q = Q/dU = 1.5$ .  
Assumes retirement rates  $Ret K = .04U$  and  $Ret Q = .11U$ .

D. Some Key Relationships

$$b1 = a1(1 + t + hk't)$$

$$b2 = a3 + (m2 + ta3 + tm2)(1 + hk')$$

$$b4 = g(1 + hk')$$

$$b5 = a2 + (m1 + s + ta2 + tm1)(1 + hk')$$

$$b6 = r2 + r3ta1(j1k' + j2q')$$

$$b7 = r2 - r3(i1 + i2)$$

$$b8 = r3i3 + r3(m2 + ta3 + tm2)(j1k' + j2q')$$

$$\begin{aligned}
 b_{10} &= (r_3) (g) (j_{1k'} + j_{2q'}) \\
 b_{11} &= (r_1 + r_4) + r_3(c_1 + c_2 + c_3) + r_3(m_1 + s + ta_2 + tm_1)(j_{1k'} + j_{2q'}) \\
 &\quad + r_3(i_1 + i_2) \\
 b_{12} &= 1 + (r_1 + r_4) + r_3 (c_1 + c_2 + c_3) \\
 &\quad + r_3 (m_1 + s + ta_2 + tm_1)(j_{1k'} + j_{2q'}) \\
 b_{13} &= ta_1(j_{1k'} + j_{2q'}) \\
 b_{14} &= i_1 + i_2 \\
 b_{15} &= i_3 + (m_2 + ta_3 + tm_2)(j_{1k'} + j_{2q'}) \\
 b_{16} &= g(j_{1k'} + j_{2q'}) \\
 b_{17} &= (c_1 + c_2 + c_3) + (m_1 + s + ta_2 + tm_1)(j_{1k'} + j_{2q'}) + (i_1 + i_2) \\
 b_{18} &= (c_1 + c_2 + c_3) + (m_1 + s + ta_2 + tm_1) (j_{1k'} + j_{2q'})
 \end{aligned}$$

$$GDP = \left[ \frac{1}{b_{12} - b_5b_{12} + b_5b_{11}} \right] \left[ (b_{12}b_1 - b_5b_6) Ea^* \right. \\
 \left. - (b_{12} - b_5b_7)T + (b_{12}b_2 - b_5b_8)(Em + Sm) + (b_{12}b_4 - b_5b_{10})G \right]$$

$$R = \left[ \frac{1}{b_{12} - b_5b_{12} + b_5b_{11}} \right] \left[ (b_{11}b_1 + b_6 - b_5b_6)Ea^* \right. \\
 - (b_{11} + b_7 - b_5b_7)T + (b_{11}b_2 + b_8 - b_5b_8)(Em + Sm) \\
 \left. + (b_{11}b_4 + b_{10} - b_5b_{10})G \right]$$

$$M = \left[ \frac{1}{b_{12} - b_5b_{12} + b_5b_{11}} \right]$$

$$\left[ \begin{aligned}
 & \left[ b_{17}(b_{12}b_1 - b_5b_6) - b_{18} (b_{11}b_1 + b_6 - b_5b_6) \right. \\
 & \quad \left. + b_{13} (b_{12} - b_5b_{12} + b_5b_{11}) \right] Ea^* \\
 - & \left[ b_{17} (b_{12} - b_5b_7) - b_{18} (b_{11} + b_7 - b_5b_7) \right. \\
 & \quad \left. + b_{14} (b_{12} - b_5b_{12} + b_5b_{11}) \right] T \\
 + & \left[ b_{17} (b_{12}b_2 - b_5b_8) - b_{18} (b_{11}b_2 + b_8 - b_5b_8) \right. \\
 & \quad \left. + b_{15} (b_{12} - b_5b_{12} + b_5b_{11}) \right] (Em + Sm) \\
 + & \left[ b_{17} (b_{12}b_4 - b_5b_{10}) - b_{18} (b_{11}b_4 + b_{10} - b_5b_{10}) \right. \\
 & \quad \left. + b_{16} (b_{12} - b_5b_{12} + b_5b_{11}) \right] G
 \end{aligned} \right]$$