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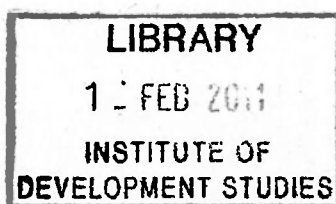
A COMPARATIVE ANALYSIS OF DEVELOPMENT PLANNING

BY

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Views expressed in this paper are those of the author. They should not be interpreted as reflecting the views of the Institute for Development Studies or of the University of Nairobi.

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Prologue

The decade of the 1960s was lauded as the Development Decade by the United Nations. In Tropical Africa it was more appropriately a Political Decade. Most of the countries here gained their independence at the beginning of the decade, and almost immediately they were embroiled by issues in the political arena. Three issues stood out. There were struggles for power among the leaders. The successful leader in a country would grope, often by trial and error, for the suitable political style to carry out the governmental functions. When such a style ultimately emerged with some clarity, there remained the task of rallying popular support and implementing the style in the face of numerous obstacles.

This turn of affairs had a highly unfavourable — and frequently disastrous — effect on economic development. The energies of the leaders and elites were absorbed in the political manoeuvres. Uncertainty and instability, and in some instances the erosion of law and order, inhibited private initiatives. Frequent reversals of government policies undermined the smooth progress of productive ventures and economic services. These were accompanied by disillusionment and cynicism abroad and a general deterioration of the economic cooperation between the developed and the developing nations.

The problem is well illustrated in the area of development planning. During the decade nearly every Tropical Africa country had two or three sets of development plans. But they were economic exercises by a small number of expatriate technicians. Cabinets discussed them, and the head of state endorsed them. But rarely was there a half-hearted effort to implement a plan systematically. In most cases there was not even some government machinery to take charge of the implementation. Far more often plans were abandoned, curtailed, or replaced by new plans. Yet despite all these there were important lessons to be learned from a review of development planning during the decade — because we are forced to raise the basic question again: whether there should be development planning at all. The question is the more relevant as the United Nations is now calling for a "Second Development Decade" and planners everywhere in ~~Tropical Africa~~ are once more back to their grindstones.

The traditional justification for development planning is to point to the weaknesses of a free enterprise economy in the context of economic development. But this is only a necessary condition for planning. Two other conditions are equally imperative. It is necessary to demonstrate that planning in fact represents a superior alternative for resource allocation and resource utilization. It is also necessary that plans are fully implemented, or at least partial implementation represents a second-best situation. Whether these conditions are met in fact can be answered only after a perusal of (1) plan formulation and (2) plan implementation. The present two-part paper is an attempt to provide, subject to the data constraint, a documentation of what actually had happened to development planning in the second half of the 1960s in Tropical Africa. The two imperative conditions just mentioned will be our focal guides.

Plan Formulation

I. General Model:

$$Y = f(X_1, X_2, \dots, \epsilon_p, \epsilon)$$

II. MACRO MODEL

$$Q = C + I + G + E - M$$

(1) Output growth equation:

$$\begin{aligned} \text{Ln } r_Q &= 2.08 + 0.24 \text{ Ln}(r_E) + 0.52 \text{ Ln}(E/Q)_{-1} \\ &\quad (\pm 0.91) \quad (\pm 0.08) \quad (\pm 0.13) \\ &\quad - 0.14 \text{ Ln}(I/Q) + 0.26 \text{ Ln}(D_2) - 0.36 \text{ Ln}(A)_{-1} \\ &\quad (\pm 0.21) \quad (\pm 0.14) \quad (\pm .22) \\ &\quad + 0.17 \text{ Ln}(I_F/I) \\ &\quad (\pm 0.14) \end{aligned}$$

$$R^2 = 0.82 \quad n = 18$$

(2) Investment equation:

$$\begin{aligned} \text{Ln}(I/Q) &= 3.61 + 0.36 \text{ Ln}(PS)_{-1} + 0.35 \text{ Ln}(M/Q)_{-1} \\ &\quad (\pm 0.39) \quad (\pm 0.05) \quad (\pm 0.06) \\ &\quad - 0.65 \text{ Ln}(K) - .10 W_1 - .19 W_2 \\ &\quad (\pm 0.07) \quad (\pm 0.09) \quad (\pm 0.09) \end{aligned}$$

$$R^2 = 0.95 \quad n = 22$$

$$\begin{aligned} \text{(a) } \text{Ln}(I_D/Q) &= 13.12 + 0.54 \text{ Ln}(D_2) - 0.76 \text{ Ln}(K) \\ &\quad (\pm 2.57) \quad (\pm 0.15) \quad (\pm 0.29) \\ &\quad - 0.33 \text{ Ln}(F/Q)_{-1} - 1.09 \text{ Ln}(R) \\ &\quad (\pm 0.165) \quad (\pm 0.28) \end{aligned}$$

$$R^2 = 0.81 \quad n = 21$$

$$\begin{aligned} \text{(b) } \text{Ln}(I_F/Q) &= -9.79 + 0.65 \text{ Ln}(F/Q)_{-1} + 0.89 \text{ Ln}(A)_{-1} \\ &\quad (\pm 4.85) \quad (\pm 0.22) \quad (\pm 0.41) \\ &\quad + 0.17 W_1 - 0.45 W_2 + 0.85 \text{ Ln}(R) \\ &\quad (\pm 0.34) \quad \pm 0.44 \quad (\pm 0.41) \end{aligned}$$

(3) Consumption equation:

$$\begin{aligned} \ln(r_c) &= 1.86 + 0.86 \ln(r_Q) - 0.26 \ln(D_2) \\ &\quad (\pm 2.19) \quad (\pm 0.19) \quad (\pm 0.08) \\ \ln(r_c) &= 0.20 \ln(D_{10}) - 0.28 \ln\left(\frac{C}{Q}\right) - 1 \\ &\quad (\pm 0.04) \quad (\pm 0.28) \\ &\quad - 0.24 \ln\left(\frac{M}{Q}\right) - 1 + 0.37 \ln\left(\frac{E}{Q}\right) - 1 \\ &\quad (\pm 0.10) \quad (\pm 0.08) \end{aligned}$$

$$R^2 = 0.975 \quad n = 15$$

(4) Export equation:

$$\begin{aligned} \ln(r_F) &= 14.65 - 0.40 \ln(D_{14}) - 0.51 \ln(D_{16}) \\ &\quad (\pm 1.88) \quad (\pm 0.27) \quad (\pm 0.07) \\ &\quad + 0.58 \ln(D_2) - 1.17 \ln\left(\frac{E}{Q}\right) - 1 \\ &\quad (\pm 0.15) \quad (\pm 0.19) \\ \ln(r_F) &= 0.47 \ln(D_{13}) \\ &\quad (\pm 0.15) \end{aligned}$$

$$R^2 = 0.91 \quad n = 18$$

(5) Import equation:

$$\begin{aligned} \ln(r_M) &= 2.44 + 2.34 \ln(r_Q) - 2.71 \ln\left(\frac{M}{Q}\right) - 1 \\ &\quad (\pm 2.90) \quad (\pm 1.46) \quad (\pm 0.89) \\ &\quad + 0.26 \ln(D_{15}) + 1.15 \ln\left(\frac{I}{Q}\right) \\ &\quad (\pm 0.23) \quad (\pm 0.85) \end{aligned}$$

$$R^2 = 0.65 \quad n = 18$$

Trade gap versus Investment gap

(All in millions of US dollars)

<u>Country</u>	(1) Investment $(I_F)_t$	(2) $M_t - E_c$	(3) $(I_F)_t / \text{GDP}$
1	86.3	6.49	6.1
2	42.2	17.00	11.9
3	49.1	20.31	12.6
6	34.8	17.03	10.2
7	83.9	28.22	3.8
8	38.3	-12.93	6.9
10	205.5	56.39	9.3
12	62.8	-34.22	3.3
13	222.9	-35.21	14.6
15	129.4	40.7	13.1
18	55.4	16.70	19.4
20	515.2	122.51	6.9
24	128.8	-37.94	7.8
26	83.5	.17	4.3
28	204.0	-148.01	7.8

III. Investment Allocation Model:

MODEL

$$(1) \quad r_{Q_i}^D = f_i(D, r_Q, H)$$

(H : "other factors")

$$(2) \quad r_{Q_i}^S = r_{Q_i}^D$$

$$(3) \quad r_{Q_i}^S = r_{Q_i}^D (K_i)^{\alpha_4} (V_i)^{\alpha_5} \varepsilon_p \varepsilon$$

$$(4) \quad r_{Q_i}^S = \alpha_0 (D)^{\alpha_1} (r_Q)^{\alpha_2} (H)^{\alpha_3} (K_i)^{\alpha_4} (V_i)^{\alpha_5} \varepsilon_p \varepsilon$$

$$(5) \quad \frac{I_i}{I} = \frac{\left(\frac{\Delta Q_i}{Q_i} \cdot \frac{I_i}{\Delta Q_i} \cdot Q_i \right)}{\left(\frac{\Delta Q}{Q} \cdot \frac{I}{Q} \cdot Q \right)} = Q_i^S (K_i)^{-1} (r_Q)^{-1} (K) (V_i)$$

$$(6) \quad \frac{I_i}{I} \times (K)^{-1} = \alpha_0 (D)^{\alpha_1} (r_Q)^{\alpha_2-1} (H)^{\alpha_3} (K)^{\alpha_4-1} (V_i)^{\alpha_5+1} \varepsilon_p \varepsilon$$

$$(7) \quad K_i = S_i^F \quad (S_i: \text{Scarce resource for the } i^{\text{th}} \text{ industry})$$

$$(8) \quad \frac{I_i}{I} \times (K)^{-1} = \alpha_0 (D)^{\alpha_1} (r_Q)^{\alpha_2-1} (H)^{\alpha_3} (S_i)^{\alpha_4-F} (V_i)^{\alpha_5+1} \varepsilon_p \varepsilon$$

Empirical Results:

(1) Investment in Agriculture:

$$\ln \left(\frac{X_1}{K} \right) = 13.02 - 0.19 \ln(D_{13}) - 1.24 \ln(r_Q)$$

$\pm 4.69 \quad \pm 0.12 \quad \pm 0.52$

$$+ 0.196 \ln(r_N) - 0.47 \ln(K_A)$$

$\pm 0.45 \quad \pm 0.18$

$$+ 0.06 \ln(V_1)$$

± 0.41

$$R^2 = 0.55$$

$$n = 22$$

$$\text{est } (\alpha_2) = -0.24 (= -1.24 + 1.00)$$

$$\text{est } (\alpha_4) = +0.53 (= -0.47 + 1.00)$$

(2) Investment in Industry

$$\text{Ln } \left(\frac{X_2}{K} \right) = 7.05 - 0.07 \text{ Ln } (D_{15}) - 0.92 \text{ Ln } (r_Q) \\ (\pm 1.20) \quad (\pm 0.03) \quad (\pm 0.28)$$

$$- 0.53 \text{ Ln } (K_M) + 1.19 \text{ Ln } (V_2) \\ (\pm 0.09) \quad (\pm 0.11)$$

$$R^2 = 0.94$$

$$n = 22$$

$$\text{est } (\alpha_2) = +0.08$$

$$\text{est } (\alpha_4) = +0.47$$

$$\text{est } (\alpha_5) = +0.19$$

Digression: Stock-demand equations:

(i) Roads:

$$\text{Ln } (B_3) = 0.08 + 0.86 \text{ Ln } (B_1) - 1.12 \text{ Ln } (B_2) \\ (\pm 2.49) \quad (\pm 0.23) \quad (\pm 0.22)$$

$$+ 0.40 \text{ Ln } (B_{13}) + 0.44 \text{ Ln } (D_2) \\ (\pm 0.55) \quad (\pm 0.50)$$

$$+ 0.27 U_1 + 0.21 U_2 \\ (\pm 0.43) \quad (\pm 0.64)$$

$$R^2 = 0.83$$

$$n = 22$$

(ii) Railroads:

$$\text{Ln } (B_4) = 5.10 + 0.45 \text{ Ln } (B_{11}) - 1.52 \text{ Ln } (D_2) \\ (\pm 2.15) \quad (\pm 0.22) \quad (\pm 0.47)$$

$$+ 0.80 \text{ Ln } (D_{10}) - 0.05 U_1 - 2.26 U_2 \\ (\pm 0.34) \quad (\pm 0.63) \quad (\pm 0.75)$$

$$+ 2.45 W_1 + 2.25 W_2 \\ (\pm 0.90) \quad (\pm 1.08)$$

(iii) Passenger vehicles:

$$\begin{aligned} \text{Ln } (B_5) &= -4.27 + 0.56 \text{ Ln } (B_{12}) + 0.94 \text{ Ln } (D_2) \\ &\quad (\pm 1.67) \quad (\pm 0.32) \quad (\pm 0.35) \\ &\quad + 0.53 W_1 + 0.39 W_2 \\ &\quad (\pm 0.71) \quad (\pm 0.61) \end{aligned}$$

$$R^2 = 0.58 \quad n = 22$$

(iv) Commercial vehicles:

$$\begin{aligned} \text{Ln } (B_6) &= -4.43 - 0.24 \text{ Ln } (B_3) + 1.40 \text{ Ln } (D_2) \\ &\quad (\pm 1.22) \quad (\pm 0.12) \quad (\pm 0.28) \\ &\quad + 0.19 \text{ Ln } (D_{10}) + 0.38 W_1 + 0.84 W_2 \\ &\quad (\pm 0.23) \quad (\pm 0.61) \quad (\pm 0.63) \end{aligned}$$

$$R^2 = 0.77 \quad n = 22$$

(v) Primary School Enrollment:

$$\begin{aligned} \text{Ln } (B_7) &= 1.24 + 0.17 \text{ Ln } (B_{11}) + 1.08 \text{ Ln } (D_2) \\ &\quad (\pm 1.27) \quad (\pm 0.12) \quad (\pm 0.29) \\ &\quad - 0.22 U_1 - 0.46 U_2 \\ &\quad (\pm 0.29) \quad (\pm 0.39) \end{aligned}$$

$$R^2 = 0.63 \quad n = 22$$

(vi) Secondary School and Higher Level enrollment:

$$\begin{aligned} \text{Ln } (B_8) &= -0.53 + 0.55 \text{ Ln } (D_2) + 0.66 \text{ Ln } (D_{10}) \\ &\quad (\pm 1.50) \quad (\pm 0.32) \quad (\pm 0.25) \\ &\quad + 0.05 U_1 - 0.71 U_2 + 0.55 W_1 + 0.11 W_2 \\ &\quad (\pm 0.46) \quad (\pm 0.54) \quad (\pm 0.65) \quad (\pm 0.73) \end{aligned}$$

$$R^2 = 0.74 \quad n = 22$$

(vii) Literacy:

$$\ln(B_{12}) = 2.13 + 0.23 \ln(B_{11}) + 0.49 \ln(D_2) \\ (\pm 1.03) (\pm 0.12) (\pm 0.23)$$

$$+ 1.05 W_1 + 0.54 W_2 \\ (\pm 0.46) (\pm 0.48)$$

$$R^2 = 0.51 \quad n = 22$$

(viii) Health Facilities:

$$\ln(B_9) = 4.29 + 0.08 \ln(B_{11}) - 0.05 \ln(D_2) \\ (\pm 0.19) (\pm 0.02) (\pm 0.04)$$

$$+ 0.08 \ln(D_{10}) - 0.07 U_1 + 0.15 U_2 \\ (\pm 0.025) (\pm 0.05) (\pm 0.06)$$

$$R^2 = 0.74 \quad n = 22$$

(3) Transportation and Communication Investment

$$\ln\left(\frac{Z_1}{K}\right) = 5.89 - 0.41 \ln(r_Q) - 0.06 \ln(D_3) \\ (\pm 2.16) (\pm 0.43) (\pm 0.22)$$

$$+ 0.22 \ln(D_4) - 0.04 \ln(D_5) - 0.06 \ln(D_6) \\ (\pm 0.14) (\pm 0.04) (\pm 0.28)$$

$$+ 0.38 \ln(V_3) + 0.11 \ln(V_3) \\ (\pm 0.19) (\pm 0.24)$$

$$R^2 = 0.41 \quad n = 22$$

(4) Investment in Education

$$\ln\left(\frac{Z_2}{K}\right) = 1.07 - 0.35 \ln(r_Q) - 0.30 \ln(D_7) \\ \pm 2.97 \pm 0.45 \pm 0.24$$

$$- 0.15 \ln(D_8) + 0.39 \ln(D_{12}) + 0.74 \ln(r_N) \\ (\pm 0.17) (\pm 0.24) (\pm 0.41)$$

$$+ 0.02 \ln(B_{10}) + 0.66 \ln(V_h) \\ (\pm 0.38) (\pm 0.25)$$

(5) Investment in Health

SS = n

CC.3 = R

$$\ln \left(\frac{Z_3}{K} \right) = 13.29 - 0.33 \ln (r_0) - 2.05 \ln (D_9)$$

(± 9.85) (± 0.49) (± 1.90)

$$+ 0.24 \ln (D_8) + 0.14 \ln (V_5)$$

(± 0.25) (± 0.33)

$$R^2 = 0.20$$

$$n = 22$$

(6) Investment in Housing and Urban Development

$$\ln \left(\frac{Z_4}{K} \right) = 3.08 + 0.27 \ln (D_{10}) - 0.29 \ln (D_2)$$

(± 3.03) (± 0.27) (± 0.36)

$$+ 0.46 \ln (F/Q)_{-1} + 0.41 \ln (E_{12}) - 1.11 W_1$$

(± 0.37) (± 0.33) (± 0.74)

SS = n

CC.3 = R

$$- 1.37 W_2 + 0.20 \ln (V_6)$$

(± 0.79) (± 0.48)

$$R^2 = 0.29$$

$$n = 22$$

Appendix A

Variables, Notations and Sources of Data

I. Development Plans included in the study: (22 countries)

Cameroun	1966-71
Central African Republic	1967-70
Chad	1966-70
Congo (Brazzaville)	1964-68
Dahomey	1966-70
Ethiopia	1962-67
Gabon	1963-70
Ghana	1963/4-1969/70
Ivory Coast	1965-70 (Second half of Ten Year Plan)
Kenya	1964-70
Madagascar	1964-68
Mali	1970-72 (Formulation Study only)
Mauritania	1963-66
Niger	1965-69
Nigeria	1962-68
Rwanda	1966-70
Senegal	1965-69
Tanzania	1964-69
Togo	1966-70
Uganda	1966-71
Upper Volta	1967-70
Zambia	1966-70

II. Macro-variables:

Q :	gross domestic product at market prices.
Y :	gross domestic product at factor prices.
I :	gross domestic capital formation.
C :	Private consumption expenditures.
G :	Government expenditures.
E :	Exports of goods and services.
M :	Imports of goods and services.
I _F :	Investment from foreign sources.
I _D :	Investment from domestic sources.

Comment. in plan formulation study the values for these variables have all been converted into U.S. dollars based on the exchange

rates prevailing at the time of plan initiation. In plan implementation study the values for these variables have first been deflated for price changes and then converted into U.S. dollars based on the exchange rate prevailing in 1970. Wherever — and with the exceptions of E and M — the wholesale price index is used. Where wholesale price index is not available, a consumer price index is used as a second choice and a consumer price index for European Residents is used as a third choice. In a few cases (Dahomey, Madagascar and Upper Volta) an implicit GDP price deflator is calculated from the market price GDP per capita and constant price GDP per capita and some interpolation is relied on. For E and M special price deflators for them are used.

Sources: The target values for these variables used in our plan formulation study are taken in many cases from UN/ECA, Planning Newsletter, July 1969. They were supplemented by the data contained in the individual plans (a partial bibliography of these plans is also contained in the Newsletter just mentioned). The actual values of these variables used in our plan implementation study are taken from worksheets made available to the writer by UN/ECA. The price data used for deflation are taken from UN Statistical Yearbook, UN Monthly Statistical Bulletins, UN/ECA Country Studies (Second Year and Third Year Series). The individual country import price and export price deflators are taken from UNCTAD, Handbook of International Trade and Development Statistics (1972).

III. Sectoral Variables (used in plan implementation study):

- Y_1 : value added in the agricultural sector
- Y_2 : value added in the manufacturing sector (including electricity)
- Y_3 : value added in the transport sector
- Y_4 : value added in the Public administration sector
- Y_5 : value added in the Commerce sector
- Y_6 : value added in the construction sector
- Y_7 : a weighted total of school enrollment — used as an index
of education output
- Y_8 : a weighted total of health facilities — used as an index
of health sector output

Comment: Y_1 to Y_6 were actual values deflated for price changes. Capital costs were used to weigh the different components of Y_6 and Y_8 .

Sources: Data for Y_1 to Y_6 are taken from worksheets made available to the writer by UN/ECA. Data for Y_7 and Y_8 were taken from UN Yearbooks and UN/ECA Country Studies. For several countries sectoral deflators prepared by UN/ECA (contained on worksheets) were used for price deflation. In other cases the same price deflators used to deflate the macro-variables have been used.

IV. Investment Allocation Variables (used in plan formulation study):

- X_1 : Investment in the agricultural sector expressed as a percentage of the total investment during the plan period as envisaged in the development plan. Forestry, fishing and rural development are also included.
- X_2 : Investment in the manufacturing sector as a percentage of the total investment.
- Z_1 : Investment in transportation and communications as a percentage of the total investment.
- Z_2 : Investment in education as a percentage of the total investment.
- Z_3 : Investment in health as a percentage of the total investment.
- Z_4 : Investment in housing and urban development as a percentage of the total investment.

Comments: In every case the investment includes both the private and the public sectors. In a few instances some estimation was necessary to complete the figures. "Administrative Expenses", "Miscellaneous Expenses" and "Other Investments" were distributed among the different sectors in the same proportion as the direct investment allocations. The sum of the above categories does not equal to 1.0 because we have left out investment allocations in mining, trade and commerce, electricity generation, and some social services and infrastructures.

Sources: UN/ECA, Planning Letter, July 1969 presents such data for about half of our sample countries. This is supplemented by the data given in the individual country development plans.

V. Exogeneous Variables:

A. Stock Variables:

- B₁ : Population. From UN/ECA: Outline and Selected Indicators for Africa.
- B₂ : Area. From Arthur Banks: Cross-Polity Time Series Data (Cambridge: MIT Press, 1971)
- B₃ : Improved road mileage, in miles of improved roads per square mile of national territory. From Banks, op.cit.
- B₄ : Railroad mileage, in miles of railroad per square mile of national territory. From UN/ECA: Statistical Bulletin for Africa (March 1967).
- B₅ : Passenger vehicles in use per 1,000 population. From UN Statistical Yearbooks.
- B₆ : Commercial vehicles in use per 1,000 population. From UN Statistical Yearbooks.
- B₇ : Primary school enrollment per 1,000 population. From Banks, op. cit.
- B₈ : Secondary and higher education enrollment per 1,000 population. From Banks, op. cit.
- B₉ : "Health Index". A low value of this index represents high health achievement. It is a weighted average of the following: number of doctors per 1,000 population, number of dentists per 1,000 population, number of pharmacists per 1,000 population, number of hospital beds per 1,000 population, percent of animal proteins and percent of starch in food intake, and life expectancy. The index measures the distance of this weighted average from the country with the highest achievement. Calculated and presented in Harbison, Maruhnck and Resnick: Quantitative Analysis of Modernization and Development (Princeton: Princeton University Press, 1970).

- B₁₀ : Teacher student ratio in primary schools. Calculated from data in UN Yearbooks and Banks, op. cit.
- B₁₁ : Population density. Calculated from B₁ and B₂.
- B₁₂ : Number of literates per 1,000 population. From the "latest literacy information" in US/AID: African Growth Trends (1970).
- B₁₃ : Volume of exports as a percentage of GDP. From UN Yearbook of International Trade Statistics.

B. Excess demand and Related variables:

- D₁ : Average calorie food intake per capita. From UN Demographic Yearbooks
- D₂ : Per capita income in U.S. dollars. From Banks, op. cit.
- D₃ : Estimated excess demand for roads. It is the ratio between B₃ and the estimated demand for roads.
- D₄ : Estimated excess demand for railroads. It is the ratio between B₄ and the estimated demand for railroads.
- D₅ : Estimated excess demand for passenger vehicles. It is the ratio between B₅ and the estimated demand for passenger vehicles.
- D₆ : Estimated excess demand for commercial vehicles. It is the ratio between B₆ and the estimated demand for commercial vehicles.
- D₇ : Estimated excess demand for primary schools. It is the ratio between B₇ and the estimated demand for primary school education.
- D₈ : Estimated excess demand for secondary school and higher education facilities. It is the ratio between B₈ and the estimated demand for secondary and higher education.

- D_9 : Estimated excess demand for health facilities. It is the ratio between B_9 and the estimated demand for health facilities.
- D_{10} : Percentage of population living in urban areas of 5,000 or more people. From William Hance: Population, Migration and Urbanization in Africa (New York: Columbia University Press, 1970)
- D_{11} : Building materials as a percentage (in value terms) of total imports. From UN/ECA, Housing in Africa (1965).
- D_{12} : Estimated excess demand for literacy. It is the ratio between B_{12} and the estimated demand for literacy.
- D_{13} : Level of foreign exchange reserve as a percentage of GDP. The foreign exchange reserves (including gold, all in US dollars) are taken from UN Statistical Yearbooks.
- D_{14} : Index of export diversification. It is the percentage of total export value accounted for by the two most important exports of a country in 1967. From Africa: South of Sahara (1971).
- D_{15} : Balance of trade as a percentage of gross domestic product. This is computed by dividing the average trade deficit (surplus) in the five years from 1961 to 1965 by the GDP of 1963. Only the merchandise imports and exports are included in the calculation. We then add the absolute value of the largest deficit in our sample to all the calculated percentages to make the figures positive so that the logarithmic transformation may be carried out. The trade data are taken from UN Yearbooks of International Trade Statistics.
- D_{16} : Export growth rates (one for the period 1960-65 and one for the period 1965-70). From UNCTAD, Handbook of International Trade and Development Statistics, 1972.

D_{17} : Export fluctuation index (one for the period 1960-65 and one for the period 1965-70). From UNCTAD, Handbook of International Trade Statistics, 1972.

C. Cost and Related variables:

K : Marginal output capital ratio implied in the development plans. First the target rate of output growth is multiplied by the initial output to yield the total increases in output expected during the plan period. This increase is then divided by the planned investment to yield the marginal output capital ratio. Data are taken from the individual country development plans and UN/ECA Planning Letters.

K_A : Marginal output capital ratio for the agricultural sector, calculated as for K .

K_M : Marginal output capital ratio for the manufacturing sector, calculated as for K .

V_1 : agricultural sector value added as a percentage of GDP. It is Y_1/Y , and measures either scale economies or "adjustment costs".

V_2 : manufacturing sector value added as a percentage of GDP. It is Y_2/Y .

V_3 : Transportation sector value added as a percentage of GDP. It is Y_3/Y .

V_4 : Government expenditures on education as a percentage of GDP. Data are taken from

V_5 : Government expenditures on health as a percentage of GDP. Data are taken from

V_6 : construction sector value added as a percentage of GDP. It is Y_6/Y .

O : Foreign aid (official) expressed as a percentage of GDP. Based on OECD, Resources for the Developing World: The Flow of Financial Resources to the Less Developed Countries (1956-63) and (1962-68); OECD, Geographical Distribution of Financial Flows to Less Developed Countries (Disbursement), 1960-1964, and UN/ECA, Country Studies (second and third series).

R : Investment in the public sector as a percentage of total investment during the plan period, as envisaged in the development plans. Data are gathered from the individual country development plans.

General Comment: Many of the exogeneous variables — especially the stock variables — are cross section variables with one value for each country for the whole time period (the decade of 1960s). The values of these variables might change over time — where changes are likely to be significant and where data are available we have used the different values for different years. The details are omitted in this appendix, although the more important of these are mentioned in the text of the present paper.

V. Other Variables and Parameters:

r_X : the rate of growth of variable X

A : "Absorption capacity". It is equal to $(Y - Y_1 - \text{"other services"})/Y$

PS : "Thrift". It is equal to $(1 - C/Q)$.

U : Geography parameter. $U_1 = 1$ if the country is in West Africa with coastline. $U_2 = 1$ if the country is in West Africa without coastline. For all other countries $U_1, U_2 = 0$.

W : Colonial heritage parameter. $W_1 = 1$ if the country was a British colony. $W_2 = 1$ if the country was a French colony. For all other countries $W_1, W_2 = 0$.

T : Number of years since independence at the time of plan initiation.

P : Type of regime. $P_1 = 1$ if the regime is characterized by one-party rule with suppression of all opposition parties. $P_2 = 1$ if the regime is characterized by military rule. $P_1, P_2 = 0$ if the regime is characterized by civilian rule with some opposition party activities allowed. The classification is based on the histories for individual countries given in Africa: South of Sahara.

L : Stability of regime. $L_1 = 1$ if there were between zero and one "disturbance" (including assassinations, general strikes, guerilla warfare, government crisis, purge, riot, revolution and anti-government demonstrations) per year

between the year of independence and the year of plan initiation. $L_2 = 1$ if there were one or more such disturbances per year during the time period. $L_1, L_2 = 0$ if there were no incidence of disturbance at all. The classification is based on the data in Banks, *op. cit.* This parameter is also used for the period of plan implementation. L_1 is assigned a value of 1 if there was one serious disturbance mentioned in the country history in Africa: South of Sahara during the period from plan initiation to 1970. L_2 is assigned a value of 1 if there were more than one serious disturbance. Both L_1 and L_2 are assigned values of zero if there were no serious incidents mentioned.

N : Change of governments. $N = 0$ if there was no change of government in the period from plan initiation to 1970. $N = 1$ if there were one or more government changes during this time period. No government change took place through the democratic process. Information is based on the country histories in Africa, South of Sahara.