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REHABILITATION OF THE MANUFACTURING SECTOR IN SIERRA LEONE: A DIAGNOSIS OF THE SUB-SAHARAN DISEASE

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I. INTRODUCTION

THE least developed countries (LDCs) 1991 report [29, 1991 ed.] revealed the lamentable achievement of the African continent. For all forty-seven LDCs, the average per capita GDP (1989 prices) increased only slightly from U.S.$234 (1970) to U.S.$252 (1989), but it decreased in twenty-seven African LDCs. Most of these African LDCs are situated in the sub-Sahara region. What have been the main reasons for the sub-Saharan disease? There have been many debates over various dimensions and in different circles, including United Nations conferences. There was the big push strategy which did not function well. Then the emphasis turned to the agricultural sector and to direct aid for basic human needs. The manufacturing sector was largely neglected. But the economic situation worsened, and the 1970s and 1980s became the lost two decades. The basic philosophy and strategies must now change to prepare new development strategies for the future if the sub-Saharan LDCs are to have a future. In this connection, I undertook a series of studies. I selected three sub-Saharan LDCs, Sierra Leone, Tanzania, and Ethiopia, where I made research trips. This paper reports the model study for Sierra Leone, while I have compiled the results for Tanzania and Ethiopia [10] [9].

Two points are emphasized in the model I have constructed: one is the importance of the manufacturing sector, and the other is the positive contribution of total factor productivity growth (TFPG).

(1) The macroeconometric (ME) model cannot describe the strategic importance of manufacturing sector growth and of TFPG. In the Keynesian model, GNP is determined by the effect of demand, while in the neoclassic model or the computable general equilibrium (CGE) model, GNP is determined by supply. Thus, "the demand multiplier has positive economic effects with the ME model and the increase in technical progress has negative consequences. Strictly the opposite results are obtained with the CGE model" [4, p. 572]. This suggested

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negative influence of manufacturing growth and of TFPG in the ME model underscored the very minor support of donors for industrial rehabilitation in the past.

Riddell [23] pointed out that the average growth rate of manufacturing output in all sub-Saharan countries decreased by 8.8 per cent during 1965–80, and he referred to the manufacturing sector in Africa as a forgotten dimension. In my research I have once again emphasized the importance of the manufacturing sector as the engine of growth. As such I have constructed a two-sector model where the manufacturing sector plays the central role.

(2) In my model, the availability of manufactured goods for domestic use is decided by the sum of domestic output and the net foreign supply (import minus export of manufactured goods). Domestic expenditures such as consumption and investment as well as GDP can expand only with a sufficient supply of manufactured goods. In this scheme, TFPG in the manufacturing sector increases GDP immediately. Thus my model is a revised Keynesian model where GDP is defined as the sum of expenditure items, but TFPG positively contributes to economic growth.

The model proposed in this paper is a pilot model which treats the manufacturing sector as a whole without further disaggregation into heavy, light, agro-industry, and so on. When we discuss the necessary strategy for TFPG, we need a more disaggregated model. But I believe that the aggregate pilot model developed here is applicable to countries suffering from the sub-Saharan disease, and is suitable for discussing basic development strategy.

The remainder of this paper is broken down into the following sections. Section II surveys the main features of the Sierra Leone economy and describes the vicious circle structure. Section III presents the results estimated from my Sierra Leone model based upon data of the 1980s. Sections IV and V compile the results of various simulations until the year 2000 providing an indication of the possibilities for development. Section VI contains the summary and conclusions.

II. OVERVIEW OF THE SIERRA LEONE ECONOMY

The chronic economic stagnation of poor sub-Saharan countries has come to be known as the sub-Saharan disease. Shaw [25, pp. 8–9] classified thirty-nine sub-Saharan countries into three categories based upon various economic and social indicators using 1960–79 data: (1) the low-income group (twenty-four countries), (2) the middle-income oil importers (MIOI) (eleven countries), and (3) the middle-income oil exporters (MIOE) (four countries). The average income and growth rates were as shown in Table I.

Sierra Leone belonged to the low-income group. During 1970–89 the eleven sub-Saharan LDCs were the hardest hit and experienced a decrease in per capita GDP (1989 prices) by more than 10 per cent [29, 1991 ed., A-3]. These results indicate that the sub-Saharan disease started immediately after political independence and has continued for three decades in many sub-Saharan countries. This stagnation came partly from the lack of needed infrastructure and human resource development. Also other structural constraints such as population pressure and the lack of foreign currency to import necessary inputs for growth negatively

TABLE I
AVERAGE INCOME AND GROWTH RATES

Group	Per Capita Income 1979 (U.S.$)	Average Growth Rate 1960–79 (%)
Low-income group	239	0.9
MIOE	532	1.5
MIOI	669	3.2

influenced the manufacturing sector and overall economic growth. In this section I discuss the important structural constraints and the balance of manufactured goods in the 1980s.

Sierra Leone's main exports long consisted of diamonds, coffee, cacao, and bauxite. In 1987 its main export goods were minerals (35.9 per cent), food items (31.4 per cent), and manufactured goods (28.2 per cent). Manufacturing exports mainly consisted of iron ore concentrates and these showed an unstable and declining trend. The main imports in 1987 were manufactured goods (60.4 per cent), food items (25.3 per cent), and fuels (12.1 per cent). Exports in 1988 went primarily to the EEC (51.2 per cent) and North America (19.2 per cent), and imports came mainly from developed countries (48.5 per cent from the EEC, 9.8 per cent from North America, and 9.2 per cent from Japan) and OPEC (11.6 per cent).

Except for 1986, the current balance was negative during the 1980s, but this was offset by the country's positive capital account. The total external debt increased from U.S.$59 million in 1970 to U.S.$420 million in 1980 and to U.S.$692 million in 1988. The ratio of total debt over GDP increased from 46 per cent in 1982 to 98 per cent in 1987, and total debt service payment was U.S.$47 million (the average for 1985–87) [29, 1989 ed., A-66 and A-67]. Merchandise exports and imports in current values in 1987 were U.S.$166 million and U.S.$130 million respectively. Thus the country's debt service payment absorbed its net dollar earnings and became a big burden on the economy. Sierra Leone repeated the upper-*tranche* arrangements with the International Monetary Fund (IMF) in 1979, 1981, 1984, and 1986 [14, Table 7].

I must be careful about the deflators. The terms of trade worsened greatly. The unit value index of imports (1980 = 100) was 104 in 1988 for all LDCs [29, 1989 ed., A-67], and thus was almost stable in the 1980s. But the price of LDC export commodities decreased sharply during the same period. The data in Appendix Table I are largely taken from the African Development Bank report [2]. Thus the foreign resource inflow (*EXS*, imports minus exports) became negative after 1985 but this does not imply the existence of an increasing positive balance in current figures. The values of exports and imports were as shown in Table II.

The trade deficit, imports minus exports, was financed by foreign resource inflow which is called external savings (*EXS*). As manufacturing and nonmanufacturing exports decreased greatly in real terms, the total export or purchasing power acquired decreased from U.S.$252 million in 1980 to U.S.$105 million in

TABLE II

VALUES OF EXPORTS AND IMPORTS

(U.S.$ million in 1980 prices)

Year	Export			Import			*EXS*
	Total	Manuf.	Nonmanuf.	Total	Manuf.	Nonmanuf.	
1980	251	71	181	421	371	50	169
Maximum	252 ('83)	104 ('83)	181 ('80)	421 ('80)	371 ('80)	56 ('83)	169 ('80)
1989	105	15	90	51	43	7	−54

Source: [2, pp. 164–65].

Note: "Maximum" indicates the highest values during the 1980s with the year of that value shown in parentheses below.

TABLE III

POPULATION GROWTH RATES

(%)

Country	1970–80	1980–87
LDCs:		
Sierra Leone	2.1	2.4
Guinea	2.1	2.4
Guinea-Bissau	4.4	2.0
Mali	3.1	3.0
Niger	2.5	2.9
All LDCs	2.6	2.4
All developing countries	2.4	2.3
Developed market economies	0.9	0.6

Source: [29, 1989 ed., A-3].

1989. The bigger decrease in manufacturing and nonmanufacturing imports canceled out the decrease in exports, and the real trade balance became positive in 1989.

Another important structural trend is the population growth. The population growth rate in Sierra Leone was 2.1 per cent during 1970–80, 2.4 per cent during 1980–87, and remained approximately 2.5 per cent during 1987–89.

The trends of population growth in neighboring LDCs differ greatly (Table III). Those in Sierra Leone, Guinea, and Niger are increasing to 2.4 per cent or more. Growth in Guinea-Bissau and Mali is decreasing. Thus it is difficult to judge whether or not demographic growth has peaked in Sierra Leone. In the prediction in the following section, I assumed the continuation of the recent growth and adopted a 2.5 per cent growth for 1990–2000 which has been the average growth rate for the LDCs as a whole during 1970–87.

Thus the total population of Sierra Leone increased by 22.5 per cent during 1980–89 while GDP during the same period increased by 7.5 per cent. In other

TABLE IV

DEMAND AND SUPPLY OF MANUFACTURED GOODS IN SIERRA LEONE IN THE 1980s

A. Absolute terms

(U.S.$ million in 1980 prices)

Year	Supply			Demand		
	Total	Domestic (*MAV*)	Foreign (Import)	Total	Domestic	Foreign (Export)
1980	451	81	371	451	380	71
Maximum	451 ('80)	126 ('82)	371 ('80)	451 ('80)	380 ('80)	104 ('83)
1989	126	83	43	126	111	15

B. Per capita terms

(U.S.$ in 1980 prices)

Year	Supply			Demand		
	Total	Domestic (Per Capita *MAV*)	Foreign	Total	Domestic	Foreign
1980	137.1	24.5	112.6	137.1	115.5	21.6
Maximum	137.1 ('80)	36.9 ('82)	112.6 ('80)	137.1 ('80)	115.5 ('80)	30.1 ('83)
1989	31.1	20.5	10.6	31.1	27.4	3.7

Source: Calculated based on Appendix Table I.

Note: "Maximum" indicates the highest values during the 1980s with the year of that value shown in parentheses below.

words per capita GDP decreased by 12.3 per cent. With the per capita GDP very depressed in Sierra Leone, each household has no ample capacity for saving. Thus the population growth is expected to increase the basic consumption need and decrease savings through the age-dependency effect and investment-diversion effect. The capital-shallowing effect will also arise in the nonmanufacturing sector. Thus GDP may increase in absolute terms but will decrease in per capita terms. I will confirm this result by a simulation experiment in the following section. The control of population pressure remains one of the urgent issues in development planning.

Table IV shows the demand and supply of manufactured goods in Sierra Leone changed in the 1980s. Domestic output and exports of manufactured goods grew in the early 1980s. But in the late 1980s domestic output, imports, domestic use, and exports declined drastically from peak values by 34 per cent, 89 per cent, 71 per cent, and 79 per cent respectively. The per capita values showed more drastic declines of 44.5 per cent, 90.6 per cent, 76.3 per cent, and 87.8 per cent respectively. Similarly, the level of total demand and supply in 1989 fell respectively to only 27.9 per cent (in absolute terms) and 22.6 per cent (in per capita terms) of the 1980 level.

TABLE V

MAIN MANUFACTURING SUB-SECTORS

ISIC Code and Name of Industries	No. of Establishments		No. of Persons Engaged		Structure of Value Added (%)	
	1980–81	1985–86	1980–81	1985–86	1980–81	1985–86
31. Food, beverages & tobacco	33	38	2,363	3,080	47.96	60.32
32. Textile, apparel & leather	19	16	454	489	3.40	0.65
33. Wood products	20	29	1,162	1,424	4.81	15.79
34. Paper, printing & publishing	14	12	652	413	2.34	0.49
35. Chemical inc. petroleum	16	22	875	831	30.05	3.96
36. Nonmetallic products	6	7	179	255	2.28	6.95
38 & 39. Metal & machineries	18	11	909	381	2.17	4.16
9512. Electrical repair	9	5	133	83	0.65	0.43
9513. Repair of motor & other	75	54	1,161	919	4.94	7.25
3 & 951. All industries	210	194	7,888	7,875	100.00	100.00

Source: [26, pp. 19–22].

According to the establishment survey by the Sierra Leone government [26, pp. 19–22], the number of establishments, number of persons engaged, and structure of value added in 1980–81 and 1985–86 were as shown in Table V. The 1980–81 survey covered establishments of six and more workers while the 1985–86 survey covered those of ten and more workers. The coverage was wider in 1980–81, but the number of persons engaged was about the same for both periods. This suggests a big shrinkage of industrial activity during 1980–86. During this period the value-added shares of food, wood and nonmetallic goods, metal products, and the repair of goods increased, and those of textiles, paper, and chemicals decreased greatly.

The value added in 1980–81 and 1985–86 was 58.96 million leones and 222.38 million leones, so the average labor productivity was 7,475 leones and 28,238 leones respectively. The wholesale price index (WPI) was 306.1 in 1981 and 1,534.2 in the first quarter of 1986 (1975 = 100) [27, p. 59] (the Sierra Leone government stopped compiling the WPI from the second quarter of 1986). If we deflate by this WPI, real labor productivity was 2,442 leones and 1,840 leones in 1980–81 and 1985–86 respectively. This implies that real average labor productivity declined by 24.7 per cent during 1980–86. This suggests the emergence of many *X*-inefficiencies and lower utilization of resources. We can reconfirm the lowering of the utilization rate by the decreasing trend of electricity consumption. The electricity generated by the National Power Authority (78.2 per cent of the

TABLE VI

LOCALLY MANUFACTURED COMMODITIES

Commodity	Highest	1987	Unit
Beer and stout	10,208 ('84)	4,935	1,000 liter
Cabin bread	1,399 ('85)	64	Mill sticks
Common salt	36,368 ('84)	1,991	1,000 kg
Soft drinks	27,078 ('84)	3,820	1,000 liter
Knitted fabrics	15.0 ('84)	1.1	1,000 kg
Cooking gas	1,022 ('84)	126	1,000 kg
Cement	42.3 ('83)	24.0	1,000 kg
Metal nails	410.9 ('83)	149.0	Metric ton
Gas, diesel & fuel oils	431 ('83)	64	Million liter

Source: [26, Table 30, p. 37].

Notes: 1. Table 30 in the original source showed: the trends for thirty-two items of manufactured goods for households and factories; twenty-six items showed a decline from their past highest figures; and five items (metal buckets, matches, toilet rolls, soap, and spirit) recorded their highest figures in 1987.

2. Figures in parentheses show the years of the highest values.

TABLE VII

TREND OF CONSUMER PRICE AND MONEY SUPPLY

Year	Freetown CPI (1978=100)	Money Supply (Million Leone)	Commodities (Leone)			
			Rice (100Z)	Beer (Star)	Oil (Gallon)	Eggs (Dozen)
1980	130.3					
1981	160.7					
1982	204.0	242				
1983	343.3	358				
1984	527.6	476	0.55	3.88	6.50	7.54
1985	1,011.1	888	1.14	4.00	9.75	14.17
1986	1,828.7	1,881	2.03	10.04	16.50	29.56
1987	5,096.6	2,939	4.86	19.17	53.33	71.40
1988[a]	6,902.5 (June)	4,546	5.83	30.00	55.00	93.33
1989[b]	10,135.6 (June)		13.21	36.06	55.00	111.67
1990	21,626.5 (June)					

Source: [27]; Memorandum of Central Statistical Office for 1989–90.

Note: Figures are those as of the end of the year.

[a] Figures for the second quarter, 1988.

[b] Figures for the fourth quarter, 1988.

installed capacity in 1986) was 155 million kWh in 1981; this increased to 196 million kWh in 1984 then fell sharply to 81 million kWh in 1987.

Many locally manufactured commodities directed at consumption drastically decreased during 1983–87. Some examples are shown in Table VI. This drastic decrease depressed productive activity through the shortage of materials and parts. The utilization rate in the manufacturing sector decreased from 60 per cent in

1982 to 30 per cent in 1985. It also depressed consumption in general. No doubt it is very important to secure the supply of food and other agricultural goods to maintain the minimum standard of life. But it is also important to supply an adequate amount of manufactured goods as these are indispensable inputs for economic activity and for maintaining a minimum standard of living.

This shortage of basic goods resulted in accelerated inflation. The Freetown consumer price index increased by 7.75 times during 1980–85 and by 21.38 times during 1985–90 (Table VII). The increase in the Freetown consumer price index rose in parallel with the money supply until 1986 but has been growing faster since 1987. The government still controls the prices of basic goods, thus the high inflation is caused by many distortions and difficulties.

The exchange rate was set administratively until market liberalization in 1987 when it increased from 53 leones per U.S. dollar in May 1987 to 165 leones in May 1990 almost in parallel with the trend of prices.

III. CONSTRUCTION OF THE MODEL

In this section I construct a quantitative model for Sierra Leone. I set the basic demand and supply balance of manufactured goods as the center of the model, and analyze the impact of changes caused by two external shocks: foreign capital inflow and population pressure.

This model is a pilot study to describe the basic environment of the manufacturing sector and to analyze the impact of external shocks. For this purpose I constructed a compact model with twelve endogenous variables and five additional per capita values. Many variables in the estimated equations were defined as ratios (manufacturing output over capital stock in production function and per capita values in other equations) to facilitate the comparison of estimated parameters among countries in future studies.

The following variables were used in the model. Appendix Table I shows the data. In principle the variables were measured in 1980 prices (U.S.$ million). I used data processed by the African Development Bank [2] and the United Nations Industrial Development Organization (UNIDO) [30].

Endogenous variables:

$EDMA$ = domestic use of manufactured goods,
XMA = export of manufactured goods,
$IMMA$ = import of manufactured goods,
MAV = domestic output of manufactured goods,
$EMANU$ = manufacturing employment (number of persons),
GDP = gross domestic products,
C = consumption,
I = investment,
K = capital stock,
$NMAGDP$ = nonmanufacturing GDP,
$PCON$ = consumer price index (1980 = 100),
EXR = exchange rate (U.S. dollar per leone),

$EDMAN$ = per capita domestic use of manufactured goods,
$XMAN$ = per capita manufacturing exports,
$IMMAN$ = per capita manufacturing imports,
$MAVN$ = per capita manufacturing output, and
$GDPN$ = per capita GDP.

Exogenous variables:

N = population (million),
YW = world income,
XOT = nonmanufacturing exports,
$IMOT$ = nonmanufacturing imports,
EXS = external savings,
$TIME$ = time trend (1980 = 1, 1989 = 10), and
$D86$ = dummy of specific year (= 1 in 1986, = 0 otherwise).

I defined the world income (YW) as the sum of GDP of six countries (United States, United Kingdom, West Germany, France, Italy, and Japan). The results of the estimations by ordinary least squares method were as shown in Table VIII.

Figure 1 shows the causal relations in the model. First the manufacturing activities are decided, then the macro variables are determined. Equations (1)–(4) determine manufacturing activity: in equation (1), exports are decided by lagged world income, manufacturing output, and effective exchange rate. In equation (2) imports are decided by definition of the balance of payments. In equation (3) the value added depends upon capital stock and manufacturing imports (as inputs of intermediate goods) of the previous year. We implicitly assumed that a fixed portion of investment was directed to the manufacturing sector, so manufacturing capital stock also occupied that portion in total value. In equation (4) the domestic use is determined by definition of demand and supply balance. Equation (5) decides the manufacturing employment by lagged labor productivity, but this does not enter into the production function. Actually manufacturing added value and employment decreased during 1982–89 by 34.2 per cent and 12.4 per cent respectively. During a period of such shrinkage when the utilization rate is going down, the relation between labor input and MAV is not directly related to the production function.

Equations (6)–(10) determine other variables. In equation (6) per capita investment is decided by the demand factor (described by lagged per capita GDP) and supply of manufactured goods ($EDMAN$). According to Khatkhate [16], the real interest rate in developing countries is very often negative. He classified Sierra Leone as one of the countries with severely negative interest rates. This suggests that severe financial repression exists in Sierra Leone, and the real interest rate is not an effective measure of excess demand for investment funds even if suitable statistics exist. Therefore I omitted the interest rate from the investment function. In equation (7) the capital stock is decided by past stock and current investment with an assumed rate of depreciation of 10 per cent. According to the establishment survey by the Sierra Leone government [26, p. 25], depreciation in 1984–85 and 1985–86 amounted to 58 million leones which was 16.3 per cent of the closing value of fixed assets in the manufacturing sector. The depreciation rate

TABLE VIII

MODEL FOR SIERRA LEONE, 1981–89

(1) Manufacturing exports (XMA)

$$\log(XMA/YW_{-1}) = -15.98 + 0.9176 \cdot \log\{MAV_{-1} \cdot PCON_{-1}$$
$$(-1.58)\ (1.51)$$
$$+ [2.516 \cdot (D81 + D82 + D83) - 0.5527] \cdot \log EXR_{-1}\}$$
$$(4.16) \qquad (-3.74)$$
$$+ 0.4377 \cdot (D81 + D85 - D86 + D88) - 0.9452 \cdot D89,$$
$$(8.26) \qquad (-8.75)$$
$$R = 0.9882, \quad S = 0.09542.$$

(2) Manufacturing imports ($IMMA$)

$$IMMA = XMA + XOT + EXS.$$

(3) Manufacturing output (MAV)

$$\log(MAV/K_{-1}) = -2.1633 + 0.2086 \cdot \log(IMMA_{-1}/K_{-1})$$
$$(-54.65)\ (10.95)$$
$$+ 0.1989 \cdot (D82 - D86) - 0.1598 \cdot (D85 + D87),$$
$$(9.24) \qquad (-6.84)$$
$$R = 0.9901, \quad S = 0.0284.$$

(4) Domestic demand (supply) of manufactured goods ($EDMA$)

$$EDMA = MAV + IMMA - XMA.$$

(5) Manufacturing employment ($EMANU$)

$$EMANU/N = 2{,}128.26 + 18.21 \cdot MAV_{-1}/N + 474.9 \cdot D82 + 151.7 \cdot (D87 - D89),$$
$$(29.87)\ (6.53) \qquad (9.92) \qquad (5.01)$$
$$R = 0.9825, \quad S = 42.73.$$

(6) Investment (I)

$$I/N = -3.217 + 0.1963 \cdot EDMAN + 0.09381 \cdot GDP_{-1}/N,$$
$$(-0.30)\ (3.67) \qquad (2.87)$$
$$R = 0.8911, \quad S = 4.101.$$

(7) Capital stock (K)

$$K = 0.9 \cdot K_{-1} + I.$$

(8) Consumption expenditure (C)

$$C/N = 78.31 + 1.077 \cdot EDMAN + 2.089 \cdot IMOT/N$$
$$(2.99)\ (7.25) \qquad (1.81)$$
$$+ 0.4994 \cdot C_{-1}/N_{-1} + 31.99 \cdot (D84 - D86),$$
$$(4.89) \qquad (4.17)$$
$$R = 0.9838, \quad S = 10.76,$$

(9) Definition of GDP (GDP)

$$GDP = C + I + XMA + XOT - IMMA - IMOT.$$

(10) Nonmanufacturing GDP ($NMAGDP$)

$$NMAGDP = GDP - MAV.$$

(11) Consumer price index ($PCON$)

$$PCON/PCON_{-1} = -10.935 + 0.05796 \cdot C/EDMA + 11.83 \cdot N/N_{-1}$$
$$(-1.91)\ (3.09) \qquad (2.11)$$
$$+ 1.220 \cdot D87 + 0.3059 \cdot (D85 - D88),$$
$$(10.00) \qquad (3.62)$$
$$R = 0.9688, \quad S = 0.1141.$$

TABLE VIII (Continued)

(12) Exchange rate (EXR)

$$1/EXR = -0.8802 + 0.008209 \cdot (IMMA + IMOT - XMA - XOT)$$
$$(-4.75) \quad (3.98)$$
$$+0.6835 \cdot PCON + 4.415 \cdot (D87 - D88),$$
$$(134.14) \qquad (18.83)$$
$$R = 0.9998, \quad S = 0.3294.$$

(13) Per capita manufacturing exports ($XMAN$)

$$XMAN = XMA/N.$$

(14) Per capita manufacturing imports ($IMMAN$)

$$IMMAN = IMMA/N.$$

(15) Per capita manufacturing output ($MAVN$)

$$MAVN = MAV/N.$$

(16) Per capita domestic use of manufactured goods ($EDMAN$)

$$EDMAN = EDMA/N.$$

(17) Per capita GDP ($GDPN$)

$$GDPN = GDP/N.$$

Notes: 1. R and S denote the estimates of the multiple correlation coefficient and standard deviation of error corrected by degree of freedom.
2. The figures in parentheses are t-ratios.

for the whole economy was set lower than this figure. In equation (8) consumption is decided on a per capita basis by lagged GDP, other imports and domestic use of manufactured goods. GDP and nonmanufacturing GDP are decided by definition in equations (9) and (10). In equations (13)–(17) per capita values of GDP and manufactured goods demand and supply are defined.

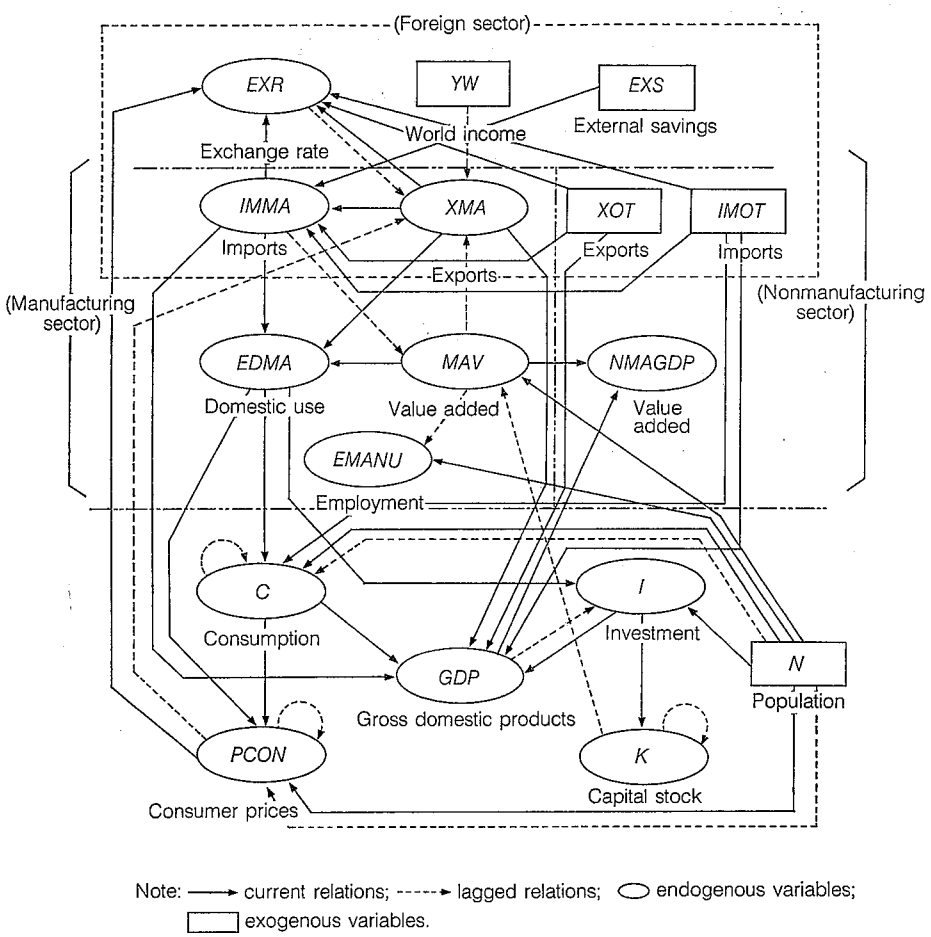
Equation (11) explains the rate of inflation expressed by the growth of consumer prices. Two factors contribute to accelerate inflation: the ratio of consumption expenditure to per capita supply of manufactured goods and the growth in population. When I ignore the dummies and insert a population growth rate of 2.4 per cent, the equation is as follows:

$$\text{Inflation rate} = 0.178 + 0.058 \cdot (C/EDMA).$$

The ratio, $C/EDMA$, was about nine in 1989. Therefore this equation predicts an inflation rate of about 70 per cent. Based upon this equation, the inflation rate cannot become zero, which means that inflation is a chronic disease feeding on the country's heavily suppressed potential demand.

The exchange rate was defined by U.S. dollar per leone and the exchange rate equation (12) explained the inverse, that is, leone per U.S. dollar. In equation (12), the increase in balance-of-trade deficit and inflation results in depreciation of the exchange rate. In the manufacturing export equation (1), the devaluation of the leone had positive effects after 1984. "A new exchange rate system became effective in July 1983, when a single exchange system replaced the previous dual exchange rate system, which involved official and commercial rates" [12, p. 464].

Fig. 1. Causal relations within the Sierra Leone Economy



Thus the dummy variables were introduced for 1981–83 to represent this institutional change. Devaluation negatively influenced exports during this period perhaps due to some distortions in institutions and expectations.

I estimated three equations (5, 6, 8) on a per capita basis. Increasing population influences saving and investment through various channels such as the age-dependency effect, capital-shallowing effect, and investment-diversion effect. "However, empirical research has not sustained these hypotheses, individually or collectively" [13]. Rossi [24] regressed consumption growth to the expected change in the dependency rate for forty-nine developing countries, but he could not find a clear relationship. Nyang'oro [20] emphasized the strong corporatist tendency in African states which might result in a big investment divergence. So I did

not preassume any definite signs for the effects of population increase. The purposes of estimating these functions on a per capita basis are (i) to empirically clarify the signs of effects of population increase by the signs of constant terms and (ii) to facilitate the intercountry comparisons. When I estimated investment and consumption functions, equations (6) and (8), they had negative and positive constant terms. Therefore the increase of population has a strong a posterior investment-diversion effect in my model.

In this model, we have the following identity.

$$(MAV + IMMA - XMA) + (NMAGDP + IMOT - XOT) = C + I.$$

The right-hand side indicates the domestic demand, that is, the sum of consumption and investment expenditures. The left-hand side indicates the domestic use (or supply) of manufactured goods (*EDMA*) and nonmanufactured goods. Because the domestic use of manufactured goods plays a central role in the model, I defined it as an endogenous variable. The *EDMA* is determined from the supply side, and influences the demand side. Domestic expenditures such as consumption and investment can expand only with a sufficient supply of manufactured goods for domestic use. Thus the model consists of two sectors (manufacturing and nonmanufacturing) and the manufacturing sector is the key sector in determining overall economic growth. Thus the TFPG in the manufacturing sector positively influences economic growth. In this sense, the model is not purely demand-oriented although GDP is defined in equation (9) as the sum of expenditure items. Thus the model is a synthesis of Keynesian and neoclassical models and might be called as a revised two-sector Keynesian model.

I understood that the limited supply of manufactured goods for domestic use (*EDMA*) was the basic bottleneck for various economic activities. In this situation, for example, the supply of fuels and spare parts can greatly stimulate production and transport activity. Thus one unit increase of *EDMA* will induce more than one unit of expenditure. The sum of the coefficients of *EDMA* in the consumption and investment equations exceeded unity (1.204) as I did not pose any constraint. The effect will be bigger over time through further repercussions.

In this model, the manufacturing export function has a unity elasticity with world income, and neat-to-unity elasticity (0.9176) with the domestic supply of manufactured goods. Export growth induces the increase of manufacturing imports which induces the increase of domestic use of manufactured goods; this in turn has various development effects on output and expenditure. Thus exports have an accelerating effect on growth through increasing needed imports. There has been a lengthy debate about the positive contribution of exports to growth. Feder [8] argued that export growth accelerates economic growth as the export sector has higher productivities and external effect; therefore he added exports to the aggregate production function. Ram [22] confirmed this for low-income countries (including Sierra Leone) using data for 1960–77. Esfahani reestimated the Feder equation using 1960–81 data for thirty-one countries and concluded that "the positive impact of exports on GDP is likely to be due to the import-shortage reduction rather than the externality effect" [6, p. 111]. Khan-Knight [15], who

used data for 1982–86 from thirty-four developing countries, also proved that import compression restricted export growth. In the case of Sierra Leone, the growth-enhancing effect of exports mainly came from the reduction of import shortages as these studies suggested.

I used dummy variables to eliminate big errors in specific years. Because manufacturing activity was shrinking and showed an unstable trend, I was forced to use some dummies in the manufacturing production, export, and employment functions. The consumption function (equation 8) before using the dummy was estimated as folows:

$$\begin{aligned} C/N = {} & 85.15 + 1.101 \cdot EDMAN + 2.603 \cdot IMOT/N \\ & (1.57)\ (3.58) \qquad\qquad (1.09) \\ & + 0.4637 \cdot GDP_{-1}/N_{-1}, \\ & (2.20) \\ & R = 0.9289, \quad S = 22.29. \end{aligned}$$

The changes in coefficients were small, but the dummy eliminated the big errors in specific years. The trend of investment was unstable, so I was forced to use dummies extensively.

The result of the final test is shown in Appendix Table II which shows the mean absolute percentage error (*MAPE*) in the final three years, and the correlation between actual and estimated values (*COR*) for each endogenous variable. The values of *MAPE* were less than 4 per cent except for investment and manufacturing exports. The values of *COR* exceeded 0.9 except for investment.

I tried to construct a typical compact model within the severe data limitations of LDCs. The main focus was to explain the balance of manufactured goods, thus I did not introduce fiscal and monetary variables. This is the main feature of my model when compared with other models. For example, Haque et al. presented a model which explained the main items in gross national expenditures (GNE), money supply, and interest rate and aimed to "generate representative developing countries' estimates of a set of macroeconomic parameters" [11, p. 538]. My model does not include money supply and interest rate, but treats the balance of manufactured goods more in detail. I utilized time series data and confined myself to an aggregate study. Thus my model can trace the changes over time explicitly, but lacks further sectorial disaggregation like the eleven sector CGE model by Benjamin et al. [3] for Cameroon.

IV. SIMULATION EXPERIMENTS

I made three simulation experiments to assess the effects of population increase and of two important external shocks on capital inflow.

(1) Experiment A. Population increases by one million holding constant age distribution after 1980. This is equal to an increase of population in 1980 by 30.3 per cent. I selected one million for the convenience of comparison among countries.

(2) Experiment B. External savings increase by U.S.$30 million after 1980

TABLE IX

MANUFACTURED GOODS

Year	Total Supply or Demand	Supply		Demand		GDP
		Domestic (*MAV*)	Foreign (Imports)	Domestic	Foreign (Exports)	
Absolute terms:				(U.S.$ million in 1980 prices)		
1981(F)	405.6	104.5	301.0	347.0	58.6	1,299.6
1989(F)	126.4	82.6	43.8	110.6	15.7	1,139.6
1989(A)	129.4	85.4	44.0	113.5	16.0	1,310.7
1989(B)	162.7	91.5	71.2	146.1	16.5	1,213.0
1989(C)	136.5	85.4	51.1	113.4	23.1	1,146.2
Per capita terms:				(U.S.$ in 1980 prices)		
1980(F)	121.0	31.1	89.8	103.5	17.5	387.5
1989(F)	31.2	20.4	10.8	27.4	3.9	282.1
1989(A)	25.6	16.9	8.7	22.5	3.1	260.1
1989(B)	40.2	22.6	17.6	36.1	4.1	300.3
1989(C)	33.7	20.5	11.0	27.4	4.1	282.3

Note: F is the factual (base) result.

which were supposed to finance import increases. Based upon the import share in 1981, other imports and manufacturing imports were increased by 11.39 per cent and 88.61 per cent of this increase respectively.

(3) Experiment C. Devaluation of exchange rate by 10 per cent after 1984, that is, after the realization of a unified exchange rate system. The theoretical value of the U.S. dollar per leone was divided by 1.1.

The impacts on the demand and supply balance of manufactured goods and GDP in the experiment were as shown in Table IX. The main findings were:

(i) Experiment A. Based upon the additional population increase, investment immediately decreased (by U.S.$3 million in 1981, in constant terms in equation 6), and consumption increased (by U.S.$78 million in 1981, because supply of manufactured goods was fixed and demand for investment decreased). GDP increased by the difference (by U.S.$75 million). The decrease in capital stock negatively influenced and the increase in GDP positively influenced the economy after the next year. In 1989, GDP increased by 14.9 per cent, but per capita GDP decreased by 7.9 per cent. *MAV* and domestic use of manufactured goods slightly increased but they decreased on a per capita basis. Thus the population increase primarily increases nonmanufacturing output, but results in decreasing per capita GDP and stagnation of manufacturing activity.

(ii) Experiment B. The increase of *EXS* resulted in the increase of manufacturing imports (88.6 per cent) and nonmanufacturing imports (11.4 per cent) by the same amount. The former increased manufacturing domestic use immediately and stimulated investment and consumption. The latter also stimulated consumption. Thus investment and consumption increased by U.S.$3.2 million and U.S.$35.7 million respectively in 1981. These created indirect expansion effects on GDP and capital stock, and an expanding reproduction process was

TABLE X
ANNUAL FLOW

Discount Rate	Years of Summation	Discounted Sum (U.S.$)
5%	15	413.1
8%	20	392.7
10%	15	312.4
8%	10	279.8

TABLE XI
SHARES IN GDP

(%)

Year	Consumption	Investment	Balance of Trade
1981(F)	97.9	12.3	−10.2
1989(F)	84.7	10.3	5.0
1989(A)	85.7	10.0	4.2
1989(B)	87.0	10.8	2.0
1989(C)	84.7	10.4	4.9

Note: F is the factual (base) result.

created over time. In 1989, GDP increased by 6.3 per cent. Manufacturing output, domestic use, imports, and exports increased remarkably by 10.7 per cent, 32.1 per cent, 62.6 per cent, and 5.1 per cent, though the absolute level was still far below that of 1981.

The economic cost of population increase exceeds the current per capita GDP. The per capita GDP decreased and increased respectively in experiments A and B by U.S.$22.0 and U.S.$18.2 from the figure in the final test. Thus when population increases by one million, the foreign resource inflow must increase by U.S.$36.3 million to maintain the same per capita GDP in 1989. The sum of annual flow is shown in Table X.

The highest per capita GDP was U.S.$404 in 1982 and the recent figure was U.S.$293 in 1989. The sum of fifteen years with a discount rate of 5 per cent has already reached U.S.$413 and exceeds the highest per capita GDP in the 1980s. The current life expectancy at birth is forty-six years. Thus the marginal economic cost of population increase exceeds the current per capita GDP. Further population increase will result in a decrease of per capita GDP.

Beyond this high cost, population increase lowers the relative share of the manufacturing sector in GDP. The share of manufacturing output in GDP was 8.04 per cent in 1981. According to experiments A and B, the share in 1989 was 6.52 per cent and 7.54 per cent respectively. Thus population growth results in a growth pattern with less participation of the manufacturing sector, while the increase of foreign resource inflow slightly accelerates the participation.

The expenditure patterns changed as shown in Table XI. In experiment A the ratios of consumption and investment respectively increased and decreased in 1989

as expected. Population pressure results in a consumption-biased growth pattern. In experiment B, consumption and investment ratios increased by 2.3 per cent and 0.5 per cent respectively as imports increased due to additional foreign resource inflow and the balance-of-payment surplus decreased.

(iii) Experiment C. Devaluation of the exchange rate by 10 per cent after 1984 increased manufacturing exports which induced the increase of manufacturing imports and GDP. In the manufacturing exports function (equation 1), the direct elasticity of manufacturing exports to exchange rate is 0.5527. In 1989 manufacturing exports increased by 5.772 per cent, thus the long-run elasticity is 0.5772 and a bit higher than the short-run value. As exports are measured in terms of U.S. dollars and the elasticity defined in real national currency is greater than unity, the devaluation or adoption of a flexible system is an effective measure in development policy for Sierra Leone. The per capita manufactured goods supply increased by 8.0 per cent which is essentially high compared with the 0.2 per cent increase for Tanzania [9, p. 14].

V. FORECAST UNTIL THE YEAR 2000

In this section, I set out differing forecasts for the economy of Sierra Leone. First I assumed respectively optimistic and pessimistic growth rates for the world economy, foreign resource inflow, and other exports and calculated two forecasts in predictions (1) and (2) (PR1 and PR2). Then I assumed middle growth rates between those in PR1 and PR2, and also additional TFPG by 1, 2, and 3 per cent are calculated in PR3, PR4, and PR5.

The foreign resource inflow (*EXS*) was negative in 1989 (U.S.$54 million), and I could not assume a fixed growth rate for the future. Therefore I adopted the *EXS* for Tanzania as my reference. The per capita *EXS* in Tanzania grew from U.S.$35.0 in 1989 to U.S.$42.0 in 2000. I assumed that *EXS* in Sierra Leone would increase to U.S.$222.5 million in 2000, therefore per capita *EXS* would reach the same U.S.$42.0 level as that of Tanzania in 2000. Accordingly the annual increment will have to be U.S.$27.75 million during the period 1990–2000.

In my pessimistic prediction, I assumed a half. In PR3, PR4, and PR5, I assumed the average of PR1 and PR2. For *EXS* I assumed different values for the annual increments. The future growth rates of exogenous variables were set as shown in Table XII.

In Sierra Leone the population growth rate increased from 1.73 per cent in 1981 to 4.03 per cent in 1986 and decreased to 2.56 per cent in 1989. I cannot judge whether demographic growth peaked in 1986 or if the high growth rate implied a data problem. Thus I assumed 2.5 per cent growth for 1990–2000. The growth rate for other imports (mainly agricultural commodities) is assumed to grow in parallel with population growth.

The GDP growth rate of developed countries in 1989 and 1990 was 3.3 per cent and 2.8 per cent respectively [31, p. 4]. I adopted the average, 3 per cent, as a plausible future growth rate, and assumed 4 per cent and 2 per cent respec-

TABLE XII

VALUES OF EXOGENOUS VARIABLES

(%)

	PR1	PR2	PR3	PR4	PR5
World income (*YW*)	4.0	2.0	3.0	3.0	3.0
External savings (*EXS*)[a]	27.75	13.88	20.81	20.81	20.81
Other exports (*XOT*)	4.0	2.0	3.0	3.0	3.0
Other imports (*IMOT*)	2.5	2.5	2.5	2.5	2.5
Population (*N*)	2.5	2.5	2.5	2.5	2.5
New TFPG (1990–)	0.0	0.0	1.0	2.0	3.0

[a] Increments (U.S.$ million in 1980 prices).

TABLE XIII

GDP

(U.S.$ million in 1980 prices)

Year	PR1	PR2	PR3	PR4	PR5
1981		1,299			
1989		1,139			
2000	1,933	1,601	1,767	1,845	1,891
Average growth rate (%):					
1990–95	5.39	3.25	4.35	4.73	4.93
1995–2000	5.73	4.03	4.93	5.42	5.72
1990–2000	5.56	3.64	4.64	5.08	5.33

tively in my optimistic PR1 and pessimistic PR2. The growth rate of other exports was assumed as equal to the growth rate of the world economy.

As the results of these two predictions showed that the per capita *MAV* in 2000 could not recover to the level of 1981, I assumed a positive TFPG of 1, 2, and 3 per cent respectively in PR3, PR4, and PR5. According to UNIDO [31, p. 82], TFPG in the Republic of Korea was 3.1 per cent during 1966–85. During the same period, *MAV* recorde da high growth rate of 14.2 per cent. For the Korean economy there are many different estimates ranging from 2.2 per cent by Kim Jae-won [17] (for 1971–79) to 6.1 per cent by Dollar-Sokoloff [5] (for 1963–79). I mainly relied upon the UNIDO figure, and judged that TFPG of 3 per cent is possible in the early stage of industrialization with major efforts in the industrial sector accompanied by a suitable institutional framework and improvement in infrastructure. Thus I interpreted 3 per cent as a maximum reference rate, and assumed TFPG of 1, 2, and 3 per cent in predictions.

I first summarize the results of PR1 and PR2.

(1) Future GDP growth was predicted as shown in Table XIII. The growth rate was higher than the growth rate of the advanced countries; 5.5 per cent versus 4.0 per cent in PR1 and 3.6 per cent versus 2.0 per cent in PR2, perhaps due to growing injection of foreign resources. When the world economy grew

TABLE XIV
PER CAPITA GDP

(U.S.$ in 1980 prices)

Year	PR1	PR2	PR3	PR4	PR5
1981		387			
1989		282			
2000	364	302	333	348	356
Average growth rate (%):					
1990–95	2.82	0.74	1.81	2.18	2.38
1995–2000	3.15	1.50	2.37	2.85	3.15
1990–2000	2.98	1.19	2.09	2.51	2.79

TABLE XV
MAV

(U.S.$ million in 1980 prices)

Year	PR1	PR2	PR3	PR4	PR5
1981		104			
1989		83			
2000	140	109	125	159	180
Average growth rate (%):					
1990–95	7.32	4.28	5.94	8.22	9.38
1995–2000	6.11	3.96	5.12	7.58	8.86
1990–2000	6.71	4.12	5.53	7.90	9.12

faster by 2.0 per cent, the Sierra Leone GDP also grew faster by 1.92 per cent. Thus an acceleration of world growth would bring about the same acceleration effect for Sierra Leone in absolute terms, while in relative terms the income gap with the northern countries might widen slightly.

(2) In the two predictions the growth rate of per capita GDP was higher in the late 1990s, and the average for the 1990s was 2.9 per cent for the optimistic prediction and 1.1 per cent for the pessimistic (Table XIV). The past highest figure was U.S.$404 in 1982. Thus although the predictions showed a positive growth in the 1990s, per capita GDP in 2000 would still be lower than the past highest level and also the 1981 level.

(3) The growth of manufacturing added value was remarkable in PR1 and PR2. The average growth rate was 6.7 per cent and 4.1 per cent in the two predictions (Table XV). The past highest *MAV* figures was U.S.$126 million in 1982. In optimistic case, *MAV* was projected as U.S.$140 million; the optimistic prediction exceeded this value while the value of U.S.$109 million in the pessimistic prediction did not reach that level. The difference of growth rates in the two predictions was 2.59 per cent and was bigger than the 1.92 per cent difference between GDP growth rates. Thus a 1 per cent increase in GDP growth rate

TABLE XVI
PER CAPITA *MAV*

(U.S.$ in 1980 prices)

Year	PR1	PR2	PR3	PR4	PR5
1981		31.1			
1989		20.4			
2000	26.4	20.6	23.6	30.1	34.0
Average growth rate (%):					
1990–95	4.71	1.73	3.35	5.58	6.71
1995–2000	3.52	1.43	2.55	4.96	6.21
1990–2000	4.11	1.58	2.95	5.27	6.46

TABLE XVII
SHARE OF MANUFACTURING IN GDP

(%)

Year	PR1	PR2	PR3	PR4	PR5
1981		8.04			
1989		7.25			
2000	7.25	6.48	7.09	8.66	9.54

increased *MAV* growth by 1.34 per cent. There was a tendency for higher economic growth to result in accelerated manufacturing growth.

(4) Per capita *MAV* showed positive growth in PR1 and PR2, although the growth rate decreased in the late 1990s (Table XVI). The past highest figure was U.S.$36.9 in 1982. Thus despite positive growth in the 1990s, per capita *MAV* in 2000 would not recover to the past highest level and the level in 1981.

(5) The share of the manufacturing sector in GDP remained the same in PR1 and decreased in PR2 (Table XVII). The share in 2000 would be lower than the level in 1981 of 8.04 per cent.

(6) Table XVIII shows the balance of manufactured goods. The total supply (or demand) increased vastly from U.S.$126 million in 1989 to U.S.$558 million (PR1) and U.S.$335 million (PR2) in 2000. In PR1, 87 per cent and 13 per cent of the increase was due respectively to import increase and the increase of domestic output. In my optimistic prediction, imports of U.S.$417 mililon in 2000 exceeded the past highest figure of U.S.$371 million in 1980 due to increasing foreign resources, and total supply of U.S.$558 million also exceeded the past highest of U.S.$452 million in 1980.

(7) But the per capita total supply would not reach the past highest level of U.S.$137.2 in 1980 even in my optimistic prediction. Population would increase by 31.2 per cent during 1989–2000. Thus per capita total supply in 2000 of U.S.$105.2 would still be 15 per cent lower than the past highest figure of U.S.$137.2 in 1980. All four items in demand and supply would not recover to

TABLE XVIII
BALANCE OF MANUFACTURED GOODS

Prediction	Total	Supply		Demand	
		Domestic	Foreign	Domestic	Foreign
Absolute terms:				(U.S.$ million in 1980 prices)	
1981(F)	405.6	104.5	301.0	347.0	58.6
1989(F)	126.7	83.0	43.6	111.0	15.7
PR1	558.1	140.2	417.9	520.0	38.0
PR2	335.4	109.6	225.8	310.0	25.4
PR3	446.2	125.4	320.8	414.7	31.4
PR4	487.6	159.8	327.8	449.2	38.4
PR5	512.5	180.6	331.9	470.0	42.5
Per capita terms:				(U.S.$ in 1980 prices)	
1981(F)	120.2	31.1	89.1	103.5	16.8
1989(F)	31.2	20.4	10.8	27.4	3.9
PR1	105.2	26.4	78.8	98.1	7.1
PR2	63.2	20.6	42.6	58.4	4.8
PR3	84.1	23.6	60.5	78.2	5.9
PR4	91.9	30.1	61.8	84.7	7.2
PR5	96.6	34.0	62.6	88.6	8.0

Note: F is the factual (base) result.

the past highest figure even in the optimistic case. Thus the high population pressure would suppress per capita demand and supply of manufactured goods in spite of a remarkable increase in absolute terms.

Turning now to PR3, PR4, and PR5.

(1) In PR1 and PR2, I assumed optimistic and pessimistic world economic growth rates. The results showed a recovery of growth, but per capita GDP, per capita total demand of manufactured goods, and the participation of the manufacturing sector would not achieve the levels of the early 1980s or past highest levels. This suggests that a favorable world growth rate accompanied by increasing inflow of foreign resources will not be sufficient to realize sound growth in the 1990s which can compensate for the decline in the 1980s. Thus there is a strong need to reinvigorate the manufacturing sector to move beyond the increased foreign resource inflow. In PR3, PR4, and PR5, we assumed middle growth rates for the world economy and other exports, and introduced positive TFPG in the manufacturing sector of 1, 2, and 3 per cent in the three respective predictions. This TFPG must come partly from a decrease in X-inefficiency by correcting past distortions, and also from improved productivity in labor and capital through strengthening technology transfer, acquiring managerial and technical skills through suitable training, and by making efforts to learn and adapt appropriate and innovative technologies.

(2) The expected growth rates of GDP and per capita GDP were 4.64–5.33 per cent and 2.09–2.76 per cent respectively. These figures lie between the ones in the optimistic and pessimistic predictions. An increase of TFPG from 1 to 2

per cent resulted in a 0.44 per cent increase in GDP growth rate. Similar acceleration effects were observed when TFPG increased from 2 to 3 per cent, although with marginally decreasing scales.

(3) The effect on the manufacturing sector was remarkable. An increase of TFPG from 1 to 2 per cent increased the growth rate by 2.37 per cent, and increased *MAV* in 2000 by U.S.$34.2 million. Thus *MAV* in PR4 of U.S.$159 million in 2000, exceeded the past highest level of U.S.$125.7 million in 1982. But per capita *MAV* of U.S.$30.1 in 2000 was still lower than the past highest figure of U.S.$36.8 in 1982 due to rapid population increase. When I assumed a TFPG of 3 per cent, per capita *MAV* reached U.S.$34.0 in 2000, which was almost the same as the past highest value. Thus when I assumed a middle growth rate for the world economy, 2 per cent TFPG would be sufficient for a recovery of *MAV* of the past highest level, while 3 per cent TFPG would be necessary for a recovery of the per capita *MAV* level. Also the share of the manufacturing sector in GDP would be higher than the past highest if TFPG were higher than 2 per cent.

(4) In the balance of manufactured goods, the values of *MAV,* imports, and domestic use in PR3, PR4, and PR5 exceeded those of optimistic PR1 in absolute terms. Manufacturing exports increased but did not recover to the past highest value. Thus total supply in 2000 in PR3, PR4, and PR5 also exceeded the past highest. But in per capita terms, only *MAV* in 2000 came close to achieving the past highest level while imports, domestic use, exports, and total supply remained far below the past highest figures. The main reason was the shortage of imports. The value of per capita manufacturing imports was U.S.$89.1 in 1981, but decreased to only U.S.$10.8 in 1989. In PR3, PR4, and PR5, imports recovered to more than U.S.$60 which was still far below the 1981 level. Thus TFPG of 3 per cent with a middle rate of world economic growth would still fall short for a recovery in the supply of per capita manufacturing goods due to high population pressure.

(5) The share of the manufacturing sector in GDP reached the highest level of 9.17 per cent in 1982. Once I assumed a TFPG of 3 per cent, the share in 2000 reached 9.54 per cent thus exceeding the 1982 figure.

(6) The importance of TFPG in promoting the manufacturing sector is clearly shown by the following: per capita GDP and *MAV* in PR1 were U.S.$364 and U.S.$26.4, and in PR5 U.S.$356 and U.S.$34.0. Per capita *MAV* was higher, although per capita GDP was lower in PR5 than in PR1.

Thus when I assume a middle growth rate of 3 per cent for the world economy, along with an annual increase in the inflow of foreign resources by U.S.$20.8 million and a population growth rate of 2.5 per cent, my conclusions are:

(i) TFPG of 2 per cent is sufficient for a recovery of *MAV* to the past highest value.

(ii) TFPG of 3 per cent is necessary for a recovery of per capita *MAV* and the manufacturing share in GDP to the past highest value.

(iii) TFPG of 3 per cent still falls short for a recovery of per capita domestic use and per capita total supply of manufactured goods to the past highest level.

(iv) Recovery from Sierra Leone's lost decade of the 1980s by the end of the 1990s is an important policy target. This is a hard task, especially when I consider the continuous high population growth in the 1990s. The government must achieve two tasks simultaneously: recovery from the 1980s and meeting the demands of the increasing population. Naturally a great deal of effort will be required, and there are many different criteria whether to judge by *MAV*, total supply, or their per capita values. Thus my conclusion is that TFPG of 3 per cent is required. TFPG of 2 per cent for 1990–2000 will maintain the current per capita *MAV*, but the share of the manufacturing sector in GDP will decrease. If TFPG is 3 per cent, per capita *MAV* will increase by U.S.$13.6 during 1989–2000 despite high population pressure, and the share of the manufacturing sector will increase slightly. But a recovery of per capita *MAV* to the 1982 level will require another thirteen years. TFPG of 3 per cent is indispensable for a discernible recovery of the manufacturing sector in the 1990s, though it would still not be sufficient for a quick recovery back to the 1980 level. A higher growth in the world economy and accompanying increase in foreign resources will surely accelerates GDP growth but with less participation of the manufacturing sector when TFPG increase in the manufacturing sector is lacking.

To promote TFPG, it is necessary to eliminate existing inefficiencies and create new technical capacity. Kwon [18] showed that TFPG in the Korean manufacturing sector was 2.95 per cent during 1961–80, and the shift of cost function, economies of scale, and increase of capital utilization contributed 44.6, 38.1, and 17.3 per cent respectively. Existing inefficiencies in Sierra Leone are due partly to price distortions and partly to the lack of appropriate technology. As the get-price-right policies work in a limited manner in Africa, "the current conditions of early industrialization in Africa militate in favor of simultaneous attention to the generation of technological competence" [21, p. 1]. Thus to promote TFPG, suitable efforts must be made at national, industrial, and firm levels. To discuss this matter thoroughly, we need another larger model with sufficient subsectoral disaggregation and with explicit introduction of the fiscal sector and price formations (such as the CGE multisectoral model for Cameroon [3]).

The UNCTAD Secretariat projected Sierra Leone's per capita GDP in the year 2000. Based upon the historical growth rate during 1970–89, the per capita GDP of U.S.$232 (1989 prices) would decline to U.S.$210 in 2000. When a targeted growth rate of 7 per cent is projected in accordance with the international development strategy for the fourth United Nations development decade, the per capita GDP in 2000 would reach U.S.$363 [29, 1991 ed., A-3]. If prices are converted to 1980 prices, these figures correspond to U.S.$255.2 and U.S.$441.2. Thus my projected figures ranging from U.S.$302 (PR2) to U.S.$364 (PR1) are between the two figures by UNCTAD. The targeted growth rate of 7 per cent is highly desirable but very ambitious if the current trend is considered. Thus my figures for per capita GDP of U.S.$302–64 in 2000 can be taken as a more realistic target.

In the 1980s the role of the International Monetary Fund (IMF) and the World Bank (WB) grew rapidly, and during that decade many sub-Saharan

countries subscribed to the structural adjustment programs proposed by these two organizations. The basic deficiencies which the IMF/WB recognized as calling for industrial adjustment in Africa were: (1) overextension of industrial capacity, (2) overextension of public ownership, (3) overinvestment in import substitution, (4) overinvestment in final-stage consumer goods, and (5) excessively high import and capital components in production [28, p. 84]. A strong urban bias may be added to this list [1]. In response three points were stressed in the World Bank strategy for the 1980s: (i) more suitable trade and exchange rate policies, (ii) increased efficiency of resource use in the public sector, and (iii) improvement in agricultural policies [19, p. 321]. The broad objectives of a fund-supported program were the attainment of a viable balance-of-payments, satisfactory long-term growth performance, and low inflation.

Khan estimated the effects of fund-supported programs in sixty-nine countries during the 1973–88 period [14, p. 195] and found quite a strong effect upon the balance of payments [14, p. 213], but "the growth rate is significantly reduced in program countries relative to the change in nonprogram countries" [14, p. 215]. Thus the IMF/WB structural adjustment programs might work well for short-run targets like balance of payments and inflation, but the long-run effects are dubious compared with the set targets. Faini et al. also assessed the effects of IMF/WB growth-oriented adjustment programs in the 1980s for fourteen loan-recipient countries (including seven African countries). Their observation was: "we found no evidence of a statistically better (or worse) performance for loan recipient countries. . . . the positive effects on growth and resource mobilization expected from adjustment-with-growth packages had not yet occurred" [7, pp. 965–66]. Although the World Bank's emphasis was on improving agricultural policies, there was "no evidence that the decline of per capita agricultural output in Africa over the past two decades has yet been arrested" [19, p. 348].

Naturally it is very difficult to assess the effects of programs separately because the international environment worsened greatly. "Eighty-eight per cent of sub-Saharan Africa's exports in 1987 were in fuels, minerals, metals or other primary commodities" [28, p. 90]. The terms of trade worsened by 3.3 per cent during 1981–88 and "the emphasis on resource exports as part of the so-called comparative advantage of developing countries has been rather problematic" [28, p. 90].

The ongoing deindustrialization and the depletion of existing technological capacities, the deteriorating terms-of-trade of primary commodities and the increasing external debt strongly urge the conversion of IMF/WB structural adjustment programs in Africa and the formation of new development strategies. What I have stressed in this paper is the resurrection of manufacturing activity as the engine for growth. Naturally there is no point in repeating the big push strategy, so the promotion of manufacturing activity must be made on a very selective basis. As a starter each country might select a small number of manufactured goods as the national minimum for basic manufactured goods, and give special incentives for domestic production. If and after these pilot projects succeed, they can extend to other fields. Only in this narrow way might the survival and the redevelopment of Africa's manufacturing sector be possible given the very hard economic environment.

VI. SUMMARY AND CONCLUSIONS

The ongoing structural reforms in consultation with international agencies are important for Africa's future development. When undertaking structural adjustment plans, one of the important points is to determine whether the gap is of a cyclical nature or a structural deficit by measuring the long-run effect of basic structural trends. This study will be useful for estimating the resource gap of a structural nature as well as to predict future growth possibilities.

I have placed special emphasis on the manufacturing sector because I believe that a supply of manufactured goods able to maintain a minimum standard of living is indispensable for the general public and is a central target for development planning especially in LDCs. I constructed a pilot model which puts special emphasis on the demand and supply of manufactured goods and which can be utilized to evaluate some policy effects on this balance. I did not incorporate many fiscal and monetary variables which can be treated satisfactorily in other models.

Sierra Leone faces the difficult task of economic recovery from the deterioration in the 1980s while simultaneously coping with continuous heavy population pressure. According to my simulation predictions, 2–3 per cent of TFPG is needed to realize a successful recovery to the past highest level achieved in the manufacturing sector when I assumed a middle rate of world economic growth, increasing inflow of foreign resources, and a 2.5 per cent population growth. This TFPG implies a big effort on the part of the government and private sector. Favorable world economic growth and increasing foreign resources can accelerate overall growth, but recovery of the manufacturing sector hinges critically upon successful TFPG. As the prospect of net foreign capital inflow is limited [32], it is indispensable for Sierra Leone to obtain the overall support of the leading international agencies and the donor countries so that a long-run rehabilitation plan for the manufacturing sector could be established. This is a difficult task, but might be the only one long-run cure for the sub-Saharan disease.

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APPENDIX TABLE I

DATA OF SIERRA LEONE 1980–89

(U.S.$ million in 1980 prices)

Year	*MAV*	*IMMA*	*EDMA*	*XMA*	*GDP*
1980	81.000	371.288	380.841	71.447	1,101
1981	104.000	301.189	346.548	58.641	1,311
1982	126.000	279.896	350.401	55.494	1,381
1983	109.000	111.651	115.824	104.826	1,354
1984	92.000	141.274	188.984	44.290	1,361
1985	80.000	147.638	178.798	48.841	1,152
1986	78.000	132.101	158.006	52.095	1,114
1987	80.000	109.328	153.696	35.631	1,119
1988	85.000	74.487	134.398	25.089	1,170
1989	83.000	43.124	111.035	15.089	1,184

(U.S.$ in 1980 prices)

Year	*MAVN*	*IMMAN*	*EDMAN*	*XMAN*	*GDPN*
1980	24.575	112.648	115.546	21.677	334.041
1981	31.017	89.827	103.355	17.489	390.993
1982	36.939	82.057	102.727	16.269	404.867
1983	31.394	32.158	33.360	30.192	389.977
1984	26.018	39.953	53.446	12.525	384.898
1985	22.210	40.988	49.638	13.559	319.822
1986	20.817	35.255	42.169	13.903	297.305
1987	20.828	28.463	40.015	9.277	291.330
1988	21.585	18.915	34.128	6.371	297.105
1989	20.550	10.677	27.491	3.736	293.142

(U.S.$ million in 1980 prices)

Year	*C*	*I*	*K*	*EMANU* (No. of persons)	*NMAGDP*
1980	1,091.972	178.032	1,152.393	0	1,020
1981	1,268.917	175.412	1,212.566	8,653	1,207
1982	1,359.180	173.177	1,264.486	10,774	1,255
1983	1,213.590	164.511	1,302.549	9,652	1,245
1984	1,235.924	137.461	1,309.755	9,492	1,269
1985	1,003.046	141.005	1,319.784	9,410	1,072
1986	964.947	119.978	1,307.784	9,708	1,036
1987	975.992	119.957	1,296.962	10,093	1,039
1988	1,009.008	120.042	1,287.308	9,658	1,085
1989	1,009.005	120.058	1,278.635	9,441	1,101

APPENDIX TABLE I (Continued)

(U.S.$ million in 1980 prices)

Year	*PCON* (1980=100)	*EXR* (U.S.$ per leone)	*YW*	*XOT*	*IMOT*
1980	100.0	0.953	6,216,727	180.572	49.735
1981	123.3	0.864	6,326,571	147.842	38.753
1982	161.6	0.808	6,305,805	97.382	24.339
1983	279.2	0.596	6,484,418	38.968	56.245
1984	464.9	0.398	6,802,209	101.882	17.283
1985	821.3	0.211	7,026,786	120.158	12.490
1986	1,448.5	0.119	7,219,093	126.925	17.843
1987	4,036.9	0.033	7,462,575	110.398	13.651
1988	5,420.7	0.032	7,807,067	101.856	11.508
1989	8,717.0	0.017	8,089,122	90.879	7.906

(U.S.$ million in 1980 prices)

Year	*EXS*	*TIME* (1980=1, 1989=10)	*N* (Million)
1980	169.004	1	3.296
1981	133.460	2	3.353
1982	151.358	3	3.411
1983	24.101	4	3.472
1984	12.385	5	3.536
1985	−8.870	6	3.602
1986	−29.075	7	3.747
1987	−23.051	8	3.841
1988	−40.950	9	3.938
1989	−54.938	10	4.039

Source: Calculated from [2] [30].

APPENDIX TABLE II

RESULT OF FINAL TEST OF SIERRA LEONE MODEL, 1981–89

No.	Variable	*MAPE* (%)	*COR*
3	*EDMAN*	1.3457	0.9994
4	*XMAN*	4.5093	0.9025
5	*IMMAN*	1.5237	0.9936
6	*MAVN*	2.1577	0.9864
7	*EDMA*	1.3457	0.9992
8	*XMA*	4.5093	0.8953
9	*IMMA*	1.5237	0.9929
10	*MAV*	2.1577	0.9768
11	*GDPN*	2.8158	0.9808
12	*GDP*	2.8158	0.9451
16	*C*	3.0548	0.9792
18	*X*	0.8710	0.9310
20	*IM*	1.3188	0.9932
21	*I*	4.0812	0.8545
22	*K*	0.9469	0.9075
35	*EMANU*	1.4679	0.9647
41	*NMAGDP*	3.1768	0.9224
53	*EXR*	2.4852	0.9748
54	*PCON*	2.7241	0.9994

Note: *MAPE*=mean absolute percentage error; *COR*=correlation between actual and estimated values.