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Analysis of the Manufacturing Sector in Tanzania

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The economy of Tanzania suffered from negative growth in the 1980s. Per capita manufacturing output and consumption declined also. This paper analyzes the demand and supply balance of manufactured goods using an empirical model and clarifies the long-term effects of foreign aid, population growth and devaluation. We calculated alternative forecasts until the year 2000 and pointed out the importance of total factor productivity growth for industrial rehabilitation.

I. Introduction

Many sub-Saharan LDCs suffer from foreign currency shortage, high population pressure, low capacity utilization rate and declining standard of living. In this hard environment, the manufacturing sector also suffered, thus in the 1980s manufacturing value added (MAV) at constant prices declined absolutely. The decline of per capita MAV (P.C. MAV) was even more serious. The level of domestic use is the sum of this domestic production and net foreign supply, import minus export. Domestic use increased in many countries due to increasing foreign aid and import. But the domestic use per capita decreased due to high population pressure. When we analyze the manufacturing sector, the balance of demand and supply, domestic as well as foreign, is the necessary basis for further in-depth study. We take up the case of Tanzania and analyze this basic balance in the past and in the future, using an empirical model.[1]

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[1] When I worked in UNIDO in 1990-92, I engaged in a series of studies about the manufacturing sector in Sub-Saharan countries. This paper summarizes the result for Tan-

II. Overview of the Tanzanian Economy

In this section we discuss trends of the Tanzanian economy, the basic balance of manufactured goods, and finally two important constraints in the 1980s.[2]

After independence, the Tanzanian government placed great emphasis on meeting basic human needs (BHN). According to the Physical Quality of Life Index (PQLI), which is the average of infant mortality, life expectancy at the age of 1 year and literacy indexed on a scale of 0 to 100, the score of Tanzanian was 16 in 1960, but increased to 53 in 1980, when per capita GDP was US$260. This score was about the same (53) in Egypt with per capita of US$580 and in Guatemala (59) with a per capita of US$1110 in 1980 (Liser-White (1985)). Thus Tanzania achieved remarkable progress in meeting BHN, and was once popular as the model of rural socialism and created an atmosphere of "Tanzaphilia." But "by the late 1970s this phenomenon had all but ceased to exist" and most observers "had begun to conclude that the Tanzanian experiment in rural socialism had failed" (Lister-White (1985), p. 207). Some reasons were institutional matters. Overexpectation and mismanagement existed e.g. in the Ujamaa village scheme and operational Vijiji (Liser-White (1985), pp. 204-6). The number of state-owned enterprises (400) was at its highest and the tax rate on poverty-level income (average rate was 54.4% and marginal rate was 85.0%) was the highest in the sub-Saharan countries (Bartlett (1989), p. 303 and p. 307). "By 1974, the cumulative effects of drought in major food-producing areas, increased oil-prices and world stagflation produced in Tanzania the largest annual trade deficit since independence. Burgeoning government expenditures on villageisation, programme providing social services, and drought relief all exacer-

zania. Fukuchi (1991) reported the study of Sierra-Leone, and Fukuchi (1993) included the result for Ethiopia. These three countries are classified as Least Developed Countries (LDCs) by United Nations. In recent decades, the main emphasis of development efforts in LDCs was put on the agricultural sector and the satisfaction of basic human needs, and the role of manufacturing sector was relatively neglected. The share of development aid to manufacturing sector also largely diminished. But the LDC economies have suffered continuously without successfully finding out effective development strategies. So, one of the basic purposes of these studies was once again to point out the important role of manufacturing sector as a focal point of development efforts.

[2] There are many demographic and economic similarities in Sub-Saharan LDC economies: for example, high population pressure, balance-of-payment difficulty, shortage of manufactured goods and high inflation. Fukuchi (1991, 1993) include some comparisons among countries.

bated a deteriorating situation, leaving the country on the verge of bankruptcy, which was only avoided by massive infusions of foreign aid." (Liser-White (1985), p. 207). "In real terms, the primary commodity prices in 1982 were at their lowest level since the Great Depression." (Singh (1986), p. 426), and the foreign currency earning greatly diminished. Green (1985) has estimated the total foreign exchange cost of these events to Tanzania to be US$1.5 billion since 1979. Thus the high growth rate of 5.4 percent in 1973-78 dropped to only 0.4 percent in 1979-84. Especially the manufacturing sector was damaged greatly. "Because of the balance-of-payments constraint, both agricultural and particularly industrial production suffer heavily. For example, it is due to the inability to import industrial raw materials, spare parts etc. that the manufacturing industry has been operating at only 20 percent of its capacity" (Singh (1986), p. 429). But the decline in the economy bottomed out in 1982 and since then the economy has resumed growth. The Tanzanian government adopted an economic recovery programme (ERP) after 1986. "It was formulated at a time when the manufacturing sector was deprived of its import requirements. It is in this context that the concern of the ERP was first to raise the level of industrial capacity utilization from about 20-30 percent to about 60 percent over the programme period." (UNIDO (1990), p. 8).

Let us observe first the balance of manufactured goods. The demand and supply of manufctured goods in Tanzania changed in the 1980s as follows:

(US$ million in 1980 prices)

Absolute Term	**Supply**			**Demand**		
Year	**Total**	**Domestic (MAV)**	**Foreign (import)**	**Total**	**Domestic**	**Foreign (export)**
1980	1506	499	1007	1507	1259	248
minimum	1284(81)	370(86)	835(81)	1284(81)	1050(81)	234(81)
1989	1747	420	1327	1747	1355	392

Thus all the four components in demand and supply first decreased from the 1980 levels, but have recovered after 1981. Thus the absolute level of total demand or supply in 1989 exceeded that in 1980 by 15.9 percent. But the population increased by 38.1 percent in 1980-89, so

(US$ million in 1980 prices)

Per capita	Supply			Demand		
Year	Total	Domestic (P.C. MAV)	Foreign	Total	Domestic	Foreign
1980	81.1	26.9	54.2	81.1	67.7	13.3
minimum	66.9(81)	16.0(86)	51.0(86)	66.9(81)	52.5(86)	12.2(81)
1989	68.1	16.4	51.7	68.1	52.8	15.2

domestic production, import and domestic use decreased in per capita terms, while only per capita exports showed a slight increase. Per capita domestic use decreased by 22 percent in the 1980s. This hindered all economic activities greatly because manufactured goods are indispensable for non-manufacturing production, consumption and investment activities. In the current information society, people in LDCs are keenly familiar with the high level of consumption in advanced countries. Based upon the demonstration effect, they seek not only the minimum package of manufactured goods but also those goods which symbolize modern life. It is very important to secure the supply of food and other agricultural goods to maintain the bare minimum life. But also it is important to supply an adequate amount of manufactured goods for everybody.

Now we turn to the most important external constraint of the balance-of-payment deficit. The values of export and import were as follows (1980 price US$ million). The trade deficit, import minus export, was financed by foreign resource inflow which we call external saving (EXS). As non-manufacturing export decreased greatly in real terms, the total export or purchasing power acquired decreased in the 1980s. The big increase in manufacturing import canceled out the decrease of non-manufacturing import, and the total import increased in the 1980s. Thus the trade balance worsened from US$677 million in 1980 to US$899 million in 1989, and was financed by increasing external saving.

As EXS is measured in constant dollars, the actual increase of the nominal external saving was far bigger in the 1980s. Thus it is clear that another strong factor compelled to decrease the per capita GDP and manufacturing output in spite of the increase of external saving. This was the rapid increase of population.

Year	Export			Import			EXS
	Total	Manuf.	Non-Manuf.	Total	Manuf.	Non-Manuf.	
1980	675	248	427	1352	1007	345	677
minimum	376(83)	234(81)	94(83)	897(83)	835(81)	62(83)	431(81)
1989	550	392	158	1449	1327	122	899

The population in Tanzania kept a high rate of increase in the 1980s as shown as follows:

POPULATION (Popu) AND GROWTH RATE G (Popu)

Year	Tanzania		Sudan		Mozambique		Kenya	
	Popu mill.	G(Popu) %	Popu mill.	G(Popu) %	Popu mill.	G(Popu) %	Popu mill.	G(Popu) %
1980	18.58	3.2	18.68	3.6	12.10	2.8	16.63	3.9
1989	25.66	3.7	23.80	2.9	15.32	2.6	24.06	4.2

The growth rate of the Tanzanian population was roughly comparable with the ones in neighboring countries. Because of this rapid growth, the population grew by 38%, 27%, 26% and 44% in these countries, respectively, over ten years. The average growth rate in Tanzania in 1980-89 was 3.65%, 2.26% and 3.20% for population, GDP and EXS respectively. So this high population growth exceeded the growth of external capital inflow (EXS) and GDP, and per capita GDP decreased steadily. The control of population pressure will be one of the urgent issues in future development planning.

In the next section we construct a quantitative model for Tanzania. We set the basic demand and supply balance of manufactured goods as the core, and analyze the impacts of various external shocks.

III. Construction of Model

This is a pilot study to describe the basic environment of the manu-

facturing sector and to analyze the impacts of external shocks. So we constructed a compact model with twelve endogenous variables. 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 the future studies.

The following variables were used in the model. In principle variables were measured in 1980 priced US million dollars.[3]

Endogenous variables

EDMA	Domestic consumption of manufactured goods
XMA	Export of manufactured goods
IMMA	Import of manufactured goods
MVA	Domestic output of manufactured goods
GDP	Gross domestic product
C	Consumption
I	Investment
K	Capital Stock
NMAGDP	Non-manufacturing GDP
PCON	Consumer price index (1980 = 100)
EXR	Exchange rate (Tanzanian Shillings per US dollar)
EMANU	Manufacturing employment (persons)

Exogenous variables

N	Population (million)
YW	World income
XOT	Non-manufactured export
IMOT	Non-manufactured import
EXS	External saving
TIME	Time trend (1980 = 1, 1989 = 10)
D86	Dummy of specific year (= 1 in 1986, = 0 otherwise)

The data are shown in Appendix Table 1, which also shows the per capita values of manufacturing export (XMAN), import (IMMAN), value added (MAVN), domestic use (EDMAN) and GDP (GDPN), and population growth rate (R(N)), GDP deflator (PGDP) and

3 I mainly utilized the data sources by UNIDO and African Development Bank. There are some consistency problems, especially between domestic outputs and international transactions subject to future improvements. This is a central problem when we try to disaggregate the model into several subsectors in the future.

deflator of manufacturing sector (PMANU) as reference. We defined the world income (YW) as the sum of GDP of six countries (USA, UK, West Germany, France, Italy and Japan).

The result of the estimations by the ordinary least squares method were as follows. Equation (8) was estimated without the constant term.

Model for Tanzania (1981-89)

(1) Manufacturing export (XMA)

$$\underset{}{\text{LOG(XMA)}} = \underset{(-0.63)}{-7.451} + \underset{(1.08)}{0.8240} * \text{LOG}((\text{YW})_{-1}) + \underset{(1.25)}{0.07255} *$$

$$\text{LOG(EXR)} \underset{(-3.88)}{-0.1357} * \text{(TIME)}$$

$$R = 0.9692,\ S = 0.0296$$

(2) Manufacturing import (IMMA)

$$\text{IMMA} = \text{XMA} + \text{XOT} - \text{IMOT} + \text{EXS}$$

(3) Manufacturing output (MAV)

$$\log((\text{MAV})/(\text{K})_{-1}) = \underset{(-5.69)}{-2.0488} + \underset{(1.82)}{0.3081} * \log\ ((\text{IMMA})_{-1}/(\text{K})_{-1})$$

$$+ \underset{(3.45)}{(0.01440 * (\text{D88} + \text{D89}) - 0.04634)} * \text{(TIME)}$$

$$R = 0.9090,\ S = 0.0331$$

(4) Domestic supply of manufactured goods (EDMA)

$$\text{EDMA} = \text{MVA} + \text{IMMA} - \text{XMA}$$

(5) Manufacturing employment (EMANU)

$$\underset{}{(\text{EMANU})} = \underset{(2.38)}{21915.53} + \underset{(5.77)}{0.5413} * (\text{EMANU})_{-1} + \underset{(3.37)}{5260000} *$$

$$(\text{MAV})/(\text{EMANU})_{-1} + \underset{(6.13)}{4057} * (\text{D82} - \text{D84} + \text{D86})$$

$$R = 0.9214,\ S = 1109$$

(6) Investment (I)

$$(I)/(N) = -153.076 + 0.4416 * (GDP/N)_{-1}$$
$$(-2.50) \quad (3.71)$$
$$+ 0.6950 * (EXS/N) + 1.140 * (IMMA/N)_{-1}$$
$$(1.90) \quad (2.28)$$
$$+ 9.130 * (D86 - D85 - D84 + D83)$$
$$(7.17)$$
$$R = 0.9437, \; S = 2.521$$

(7) Capital stock (K)

$$K = 0.9 * (K)_{-1} + I$$

(8) Domestic demand for manufactured goods (EDMA)

$$(EDMA/N) = 0.1830 * (C/N) + 0.1181 * (I/N)$$
$$(31.45) \quad (3.09)$$
$$+ 0.1749 * (XMA + XOT)$$
$$(2.47)$$
$$R = 0.9998, \; S = 0.7464$$

(9) Definition of GDP (GDP)

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

(10) Non-manufacturing GDP (NMAGDP)

$$NMAGDP = GDP - MVA$$

(11) Consumer price index (PCON)

$$(PCON)/(PCON)_{-1} = -1.1081 - 0.5323 * (EDMA)/(C)$$
$$(-2.79) \; (-1.18)$$
$$+ 1.559 * (N)/(N)_{-1} + 0.9148 * ((GDP)/N)/((GDP)/N)_{-1}$$
$$(4.53) \quad (5.14)$$
$$+ 0.05336 * (D84 + D85)$$
$$(7.38)$$
$$R = 0.9303, \; S = 0.00842$$

(12) Exchange rate (EXR)

$$(EXR) = 5.734 + 0.1546 * (PCON) - 0.04298 * (EXS)$$
$$(0.61) \; (25.44) \quad (-3.00)$$

$$+12.41 * (D82-D85-D86)$$
$$(4.74)$$

$$R=0.9916,\ S=4.39$$

NB: R and S denote the estimates of the multiple correlation coefficient and standard deviation of error corrected by degree of freedom. The figures in parenthesis are T ratios.

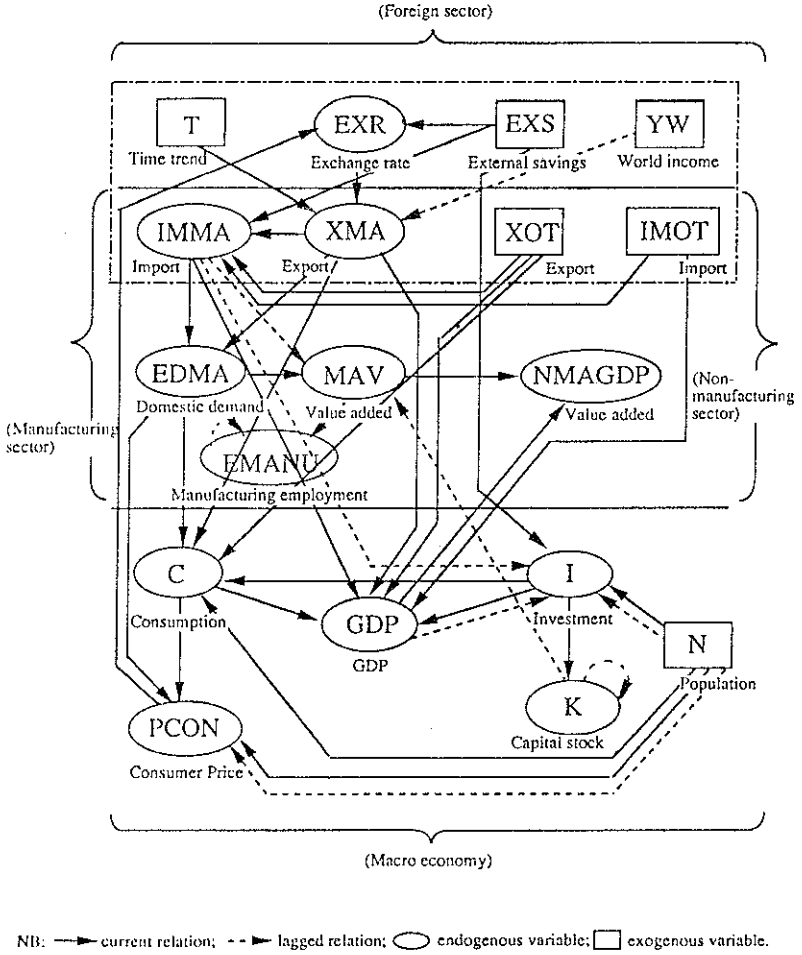
Figure 1 shows the causal relations in the model. First, the manufacturing activities are decided, and then the macro variables are determined. Equations (1)-(5) determine the manufacturing activities: in equation (1), export is decided by world income, exchange rate and other factors represented by time trend. In (2) import is decided by definition of balance-of-payments. In (3) the output depends upon capital stock and manufacturing import (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 (4) the domestic use is determined by definition of demand and supply balance. (5) decides the manufacturing employment by lagged labour productivity, but this does not enter into the production function. Actually the manufacturing value added and employment decreased by 15.9% and 11.0% in 1980-89, respectively. In such a shrinking stage when the utilization rate is going down, the relation between labour input and MAV is not directly related to the production function.

Next, equations (6)-(12) determines other variables. In (6) investment is decided by demand factor (described by past GDP), additional saving resource (EXS) and supply of necessary imported goods (IMMA). In (7) capital stock is decided by past stock and current investment with assumed rate of depreciation rate as ten percent. Equation (8) decides consumption, because other variables in (8) are exogenous or determined already. GDP and non-manufacturing GDP are decided by definition in (9) and (10). In (11), the consumer price index is decided by relative scarceness of manufactured goods (described by EDMA/C) and two demand pressures represented by population growth and per capita GDP growth. Finally in (12), the exchange rate is determined by purchasing power (described by consumer price) and the foreign resource inflow deficit (described by EXS).[4]

4 This model emphasizes the important role of the total factor productivity growth (TFPG). Traditionally, there was sharp contrast to deal with the effects of TFPG upon GNP between Keynesian-type model and CGE models. Usually the Keynesian-type model

Figure 1

Causal relations of the Economy of Tanzania



NB: ⟶ current relation; - - ▶ lagged relation; ⬭ endogenous variable; ▭ exogenous variable.

emphasizes the demand side, so GNP is defined as the sum of the effective demand. Thus TFPG has no positive effect upon GNP. On the other hand, the CGE models emphasizes the supply side, and emphasizes the positive effects of TFPG, but demand-driven policy does not increase GNP. The model developed here emphasizes the importance of supply of the manufacturing goods. GNE components as well as the activities levels of non-manufacturing sectors are decided depending upon the activity level of manufacturing sector. Therefore, although the model is basically of Keynesian-type, TFPG exerts a positive effect upon the overall economic growth.

We used dummy variables to eliminate big errors in specific years. In the production function (3), dummy and trend expressed the general negative disturbances in the 1980s and positive effects of various reforms after 1988. The exchange rate equation (12) before using a dummy was as follows:

$$(EXR) = 8.448 + 0.1525 * (PCON) - 0.04709 * (EXS)$$
$$\quad (0.42) \quad (11.75) \qquad\qquad (-1.53)$$
$$R = 0.9855,\ S = 9.40$$

The changes in coefficients were small, but the dummy eliminated the big errors in specific years. The trend of investment was unstable, so we were forced to use dummies intensively. On the other hand, we obtained a good result for domestic demand equation (8) without using any dummy and constant term. This suggests a stable market relation to manufacturing goods even in unstable economic conditions.

The result of the final test is shown in Appendix Table 2 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 2% except investment (8.0%) and exchange rate (6.2%). The values of COR exceeded 0.9, except investment, capital stock and employment. These variables showed rather big changes as the manufacturing activity suffered from negative growth.

IV. Simulation Experiments

We made three simulation experiments to assess the effects of the two important external shocks of capital inflow and population increase, and the effect of devaluation.

Experiment A. Population increases by one million holding the age distribution constant after 1980. This is equal to a population increase in 1980 by 5.3 percent.

Experiment B. External saving increases by 30 million dollars after 1980 which was supposed to finance the import increase. Based on the import share in 1981, other import and manufacturing import were increased by 20.55 percent and 79.45 percent of this increase, respectively.

Experiment C. Devaluation of exchange rate by 10 percent.

Theoretical value of exchange is once again multiplied by 1.1 in 1981-89.

The impacts for the demand and supply balance of manufactured goods and GDP in two experiments were as follows. The values in the final test, experiments A, B and C are marked with F (factual), A, B and C.

Year	Manufactured Goods					GDP
	Total	Supply		Demand		
	Supply or Demand	Domestic (MAV)	Foreign (import)	Domestic	Foreign (export)	
(Absolute term)						
1981(F)	1286.0	450.7	835.6	1052.2	234.1	5101.7
1989(F)	1734.0	411.6	1323.1	1346.5	388.3	6278.5
1989(A)	1680.5	358.6	1321.9	1293.3	387.1	5874.4
1989(B)	1770.3	422.6	1347.7	1401.3	389.0	6616.0
1989(C)	1738.2	412.4	1325.8	1347.2	391.0	6281.4
(Per capita term)						
1980(F)	67.0	23.5	43.5	54.8	12.2	266.1
1989(F)	67.5	16.0	51.5	52.4	15.1	244.6
1989(A)	63.0	13.4	49.5	48.5	14.5	220.3
1989(B)	69.7	17.2	52.5	54.5	15.1	257.7
1989(C)	67.6	16.0	51.6	52.5	15.2	244.7

The main findings were:

Experiment (A). Based on the additional population increase, investments immediately decreased (by US$149 million in 1981, by negative constant term in equation (6)), and consumption increased (by US$96 million in 1981, because supply of manufactured goods was fixed and demand for investment decreased). GDP decreased by the difference (by US$53 million). The decrease of capital stock and GDP created a new vicious circle from both the supply and the demand side. In 1989, the values of MAV, domestic use of manufactured goods and GDP decreased by 12.8%, 4.0% and 6.5% in absolute terms, and 16.3%, 7.5% and 10.0% in per capita terms respectively.

Experiment (B). Increase of EXS had three direct effects. First it resulted in an increase of manufacturing import and domestic use and then consumption. Secondly, it increased investment. Based on these effects, GDP and capital stock increased and an expanding reproduction process was created over time. The third direct effect was the decrease of the exchange rate, but this was rather minor, and the exchange rate decreased during the first four years, but after that increased more than the final test values. In 1989, the values of MAV, domestic use of manufactured goods and GDP increased by 2.6%, 4.0% and 5.3% in absolute terms as well as in per capita terms respectively.

The adverse effects of population growth on savings and capital formation was usually classified as age-dependency effect, capital-shallowing effect and investment diversion effect. "However, empirical research has not sustained these hypothesis, individually or collectively." (Kelly (1988), p. 459). The impact in Experiment (A) was not the increase of the population growth rate, but the increase of population and the resulting decrease in per capita GDP. Thus the resulting increase in savings was remarkable. The economic cost of the population increase exceeds the current per capita GDP. If we compare the effects of population control and foreign resource inflow to increase the per capita GDP based on the two experiments, the increase of population by one million has the same effect with an increase of EXS by US$35.9 million. To maintain the same per capita GDP, EXS must increase by US$35.9 in each year per one person added. The discounted sum of US$35.9 for 9 years at a discount rate of 10 percent is US$265.0, which is about the same as per capita GDP in 1981 (US$266.1). The sum for thirty years at 30 percent is US$376.6. The average life expectancy was 50 in the 1970s.

Beyond this high cost, the population increase lowered the relative share of the manufacturing sector in GDP. Manufacturing value added decreased more than GDP (-12.8% versus -6.5% (absolute term) and -16.3% versus -10.0% (per capita term)) in experiment (A). MAV increased by 2.6%, while GDP increased by 5.3% in experiment (B).

Mahdavi (1990, Table 1) showed that AID will increase the share of private consumption and governmental expenditure in GDP, and other financial flows will decrease the share of private consumption, based on a sample of 51 LDCs (1981-85). But in our model we do not discriminate ODA and other financial flows, and there is no crowding out effect of foreign resource inflow to private investment. Thus in Experiment (B), the shares of private and public consumption decreased from

98.7 percent in the final test to 96.3 percent, and the one of investment increased from 15.5 percent to 17.6 percent. So the foreign resource inflow resulted in an increase of the investment share and in accelerated growth. Some writers argue about the normal or acceptable level of external deficit. For example, Singh (1986, p. 429) argued "I would regard this as being about 5 percent of GDP for Tanzania." We tried another experiment defining EXS as 5 percent of actual GDP. Then per capita GDP and MAV decreased to US$110.3 and US$4.7 in 1989, and suggested the impossibility of sustaining growth.

> Experiment (C). Exchange rate was multiplied by 1.1 after calculating the theoretical value each year. Because of the small elasticity in manufacturing export, the effect was limited. Even if manufacturing export increases, it results in a decrease of the same unit of domestic use, thus the opportunity cost is high under severe supply constraint. Per capita supply of manufactured goods increased by 0.2 percent, while the consumer price index decreased by 0.1 percent.

About the effectiveness of devaluation in Tanzania, Singh (1986, p. 433) noted "the most recent economic research on devaluation is very sceptical of its value as an instrument for correcting a fundamental structural disequilibrium of the economy." We neglected the impact to agricultural export, but its impact would be small. As Singh (1986, p. 437) argued, "although a devaluation may provide an incentive to increase production of export crops at the expense of, say, food crops, such production possibilities may only be realized if there is increased availability of infrastructural (e.g. transport) and other vital agricultural inputs (e.g. fertilizer, water)." We did not observe a vicious circle in which devaluation creates another devaluation through inflation, but basically our result is in line with such a pessimistic view about the effectiveness of devaluation and the limited role of export promotion. In this study about 47 LDCs, Colombatto (1990, p. 593) argued that "the link between development and outward orientation had been significant in the early Seventies, but then disappeared from the late Seventies onward" and concluded that the higher export growth does not necessarily benefit economic growth. These analyses do not deny the importance of export growth, but emphasize high opportunity costs. Thus the foreign resource inflow is still an efficient instrument for economic growth in spite of many criticisms. For example, Singh (1986, p. 433) argued that about 70 percent of foreign aid is project aid for creation of new productive capacity, while a small portion of the existing capacity is utilized, thus "if the project aid is eliminated or reduced, Tanzania's current account deficit will be

substantially reduced pari passu."

V. Forecast until the Year 2000

In this section, we forecast the Tanzanian economy under several assumptions. All through the experiments, we assumed that the favourable effect of the recent institutional reform, described by the positive impacts in 1988-89 in production function (3) by dummy variables multiplied with time trend, will persist into the future. First we assumed an optimistic and a pessimisic trend for world economy and trend of other export, and calculated two forecasts in predictions (1) and (2). Then we assumed the middle growth rates about world economy and others between the ones in predictions (1) and (2), and also additional Total Factor Productivity Growth (TFPG) by 1%, 2% and 3% additionally, and calculated predictions (3), (4) and (5).

The future growth rates of exogenous variables were set as follows:

(in %)

Experiment	PR-(1)	PR-(2)	PR-(3)	PR-(4)	PR-(5)
world income (YW)	4.8	3.6	4.2	4.2	4.2
external saving (EXS)	5.0	4.0	4.5	4.5	4.5
other export (XOT)	5.0	4.0	4.5	4.5	4.5
other import (IMOT)	3.2	3.2	3.2	3.2	3.2
population (N)	3.2	3.2	3.2	3.2	3.2
net TFPG (1990-)	0.0	0.0	1.0	2.0	3.0

We assumed that the population growth rate will decrease from 3.7% in 1989 to 3.2% in the early 1990s, and other import (agricultural commodities) will grow in parallel with population growth. In prediction (1), the world economy is expected to grow by 4.8%, which is the simple average of growth rates in U.S.A., Western Europe and Japan in 1990 and 1991 (UNIDO (1990), p. 4) and represents an optimistic rate because the rate is expected to decrease because of the Gulf War. The growth rates of foreign resource inflow (EXS) and other export were set slightly higher than the growth rate of world economy. In prediction (2), another conservative rate of 3.6% was assumed for world growth, and other rates were decreased accordingly. Other writers suggest a higher population growth. For example,

Gulhati (1983, p. 54) argued "should those fertility levels persist, the growth rate of population (in Eastern and Southern Africa) could rise further to 3.4 percent per annum in 1980-2000 and to almost 4.0 percent in 2000-2020," and "in no major African export commodity is growth likely to exceed 3.0 percent per annum." We assumed a higher growth rate for other exports (XOT), one of the reasons being that it decreased to US$99 million in 1984 from US$427 million in 1980 and has been recovering annually be 10 percent recently. As the results of these two predictions showed a further decrease of per capita manufacturing output (MAV), we assumed a positive TFPG in productions (3), (4) and (5) by 1%, 2% and 3%, respectively after 1990. We first summarize the results of predictions (1) and (2).

Future GDP growth was predicted as follows in each experiment. The growth rate was lower than the world growth rates: 4.62% vs 4.8%, and 2.97% vs 3.6%. When world economy grows faster by 1.2%, the Tanzanian GDP also grows faster by 0.65%. In absolute terms, the Tanzanian growth will be accelerated. In relative terms, the income gap to northern countries will widen.

GDP

(1980 price US$ million)

	Year	PR-(1)	PR-(2)	PR-(3)	PR-(4)	PR-(5)
	1981			5101.7		
	1989			6278.5		
	2000	10203.5	8641.0	9860	10383.5	10990.2
average	1990-1995	4.29	2.80	3.93	4.39	4.87
growth	1995-2000	5.04	3.15	4.60	5.15	5.79
rate (%)	1990-2000	4.62	2.97	4.26	4.77	5.33

This widening gap is more clearly based on per capita GDP figures. Its growth rate will be 1.37% and will be accelerated in the late 1990s in prediction (1), but in pessimistic prediction (2), it turned to be negative all through the 1990s. In this case, the gap with northern countries will increase in absolute terms.

The growth of manufacturing added value was lower than the rates of GDP by 2.21% and 2.42% in the two predictions. There

PER CAPITA GDP

(1980 price US$)

	Year	PR-(1)	PR-(2)	PR-(3)	PR-(4)	PR-(5)
	1981			266.1		
	1989			244.6		
	2000	281.1	238.0	271.6	286.1	302.8
average	1990-1995	0.96	-0.38	0.71	1.15	1.62
growth	1995-2000	1.79	-0.04	1.35	1.89	2.51
rate (%)	1990-2000	1.37	-0.21	1.03	1.52	2.06

was a tendency that higher economic growth resulted in an accelerated manufacturing growth. In the pessimistic case, the growth of manufacturing output will be very low.

MAV

(1980 price US$ million)

	Year	PR-(1)	PR-(2)	PR-(3)	PR-(4)	PR-(5)
	1981			450.7		
	1989			411.6		
	2000	523.8	436.0	550.9	633.7	730.0
average	1990-1995	1.39	0.30	2.02	3.22	4.43
growth	1995-2000	3.45	0.81	3.64	5.14	6.09
rate (%)	1990-2000	2.41	0.55	2.83	4.17	5.55

Per capita MAV showed a negative growth in predictions (1) and (2), though it turned to be slightly positive in late 1990s in the optimistic case. The per capita level in the year 2000 decreased by 18.4% and 49.1% in each prediction. In the pessimistic case, the level will become about a half in two decades.

The share of manufacturing sector in GDP further decreased from the level in 1989 in both predictions to around 5 percent,

PER CAPITA MAV

(1980 price US$)

	Year	PR-(1)	PR-(2)	PR-(3)	PR-(4)	PR-(5)
	1981			23.5		
	1989			16.5		
	2000	14.4	12.0	15.1	17.4	20.1
average	1990-1995	-1.74	-2.80	-1.13	0.02	1.19
growth	1995-2000	0.24	-2.31	0.43	1.88	3.38
rate (%)	1990-2000	-0.75	-2.56	-0.35	0.94	2.28

which showed the decrease of more than three percent compared with 1981.

SHARE OF MANUFACTURING IN GDP

(percent)

	Year	PR-(1)	PR-(2)	PR-(3)	PR-(4)	PR-(5)
	1981			8.83		
	1989			6.55		
	2000	5.13	5.04	5.58	6.10	6.64

The balance of manufactured goods was as follows. The total supply (or demand) increased from US$1734 million in 1989 by 67.2% and 47.6% in predictions (1) and (2), respectively. The population increased by 41.1% in 1989-2000. Thus per capita total supply increased largely and slightly in each prediction. This increase was mainly due to the increase of manufacturing import by 67.2% and 60.6% in each prediction. The foreign resource inflow increased by US$638 million and US$484 million, and total export increased by US$465 million (manufacturing 353 and other 112) and US$368 million (manufacturing 283 and other 85) in each prediction. Thus mainly depending upon the increased foreign resource inflow and also upon the increasing export, manufacturing import rapidly grew and increased the total supply, while the

manufacturing sector increased its output only by US$112 million and US$25 million in each prediction.

MANUFACTURED GOODS BALANCE IN THE YEAR 2000

(1980 price US$ million)

Prediction	Total	Supply		Demand	
		Domestic	Foreign	Domestic	Foreign
1981	1286	450	835	1052	234
1989	1734	411	1323	1346	388
PR-(1)	2900	523	2377	2159	741
PR-(2)	2561	436	2125	1890	670
PR-(3)	2799	550	2249	2093	706
PR-(4)	2884	633	2251	2176	708
PR-(5)	2983	730	2253	2272	710

In predictions (1) and (2), we assumed optimistic and pessimistic world environment. The results showed a recovery of growth, but with less participation of the manufacturing sector. This suggests that the additional need of reactivation within the manufacturing sector lies beyond the increased foreign resource inflow. In predictions (3), (4) and (5), first we assumed the middle growth rates for world environment, and then introduced positive TFPG in the manufacturing sector by 1%, 2% and 3%. This TFPG must come partly from the decrease of X-inefficiency in the sector by correcting the past distortions, and also from improving productivities of labour and capital through strengthening technology transfer, acquiring managerial and technical skills by suitable training, and the efforts for adaptation to and learning of appropriate and innovative technologies.

The results showed the usefulness of TFPG. The expected growth rate of GDP was just the middle of the ones in preditions (1) and (2), that is, 3.79%. Thus TFPG increased this rate by 0.47%, 0.98% and 1.54% in predictions (3), (4) and (5), respectively. The growth rate of per capita GDP was positive all through the 1990s, 1.03%, 1.52% and 2.06%.

The effect on the manufacturing sector was remarkable. The expected growth rate of MAV was 1.48%, and TFPG of 1%, 2% and 3% brought an increase of 1.35%, 2.69% and 4.07%. Growth rate of per capita MAV was -0.35% with TFPG of 1%, but 2.28% with TFPG 3%. The predicted balance of manufactured goods showed that the increases of manufacturing import and export were about the middle of cases (1) and (2), but domestic use could increase and contribute to economic growth, mainly based upon the growing domestic output. Thus per capita MAV in 2000 was higher in prediction (1), though US$20.1 is still below the 1981 level and another 9 years will be necessary to again arrive at that level, that is, US$23.51. The share of the manufacturing sector in GDP was lower than the 1989 level in prediction (3), but exceeded the one in prediction (5).

Based on the prediction of manufacturing employment by equation (5), it reached 104,825 and 114,404 in 1989 and 106,265 in 1980. Thus the level of manufacturing employment will recover or exceed the 1980 level by 2 or 3 percent of TFPG.

Thus our conclusion is that a TFPG of 2% for 1990-2000 will slightly increase the current per capita MAV, but the share of manufacturing sector in GDP will decrease. If TFPG is 3%, per capita MAV will increase by US$4.10 in 1989-2000 in spite of high population pressure, and the share of manufacturing sector will increase slightly. But the recovery of the 1980 level of per capita MAV will require another 9 years. Thus a TFPG of 3% is indispensable to discernible recovery of manufacturing sector in the 1990s, though it is still not sufficient for a quick recovery of the 1980 position. The higher growth of world economy and accompanying increase of foreign resources surely accelerates GDP growth, but with less participation of manufacturing sector, without the efforts of TFPG increase in manufacturing sector per se.[5]

VI. Summary and Conclusions

The on-going structural reforms in consultation with the international agencies are important for the future development. In the

5 Fukuchi (1993) included a comparison of the simulations for three Sub-Saharan countries (Ethiopia, Sierra-Leone and Tanzania). The effect of TFPG upon MAV is middle among three countries, but the effect upon per-capita GNP was biggest in Tanzania (*ibid.*, p. 65).

structural adjustment plan, one of the important points is to discriminate whether the gap is of a cyclical nature of structural deficit, by measuring the long-term effects of basic structural trends. This study will be useful to estimate the resource gap of a structural nature.

We put special emphasis on the manufacturing sector, because we believe that the supply of a civil minimum of manufactured goods is indispensable for the people and is a central target for development planning especially in LDCs. We constructed a pilot model which puts special emphasis on the demand and supply of manufactured goods, and can be utilized to evaluate some policy effects on the balance. We did not incorporate many fiscal and monetary variables which can be treated nicely in other models.

The ERP distributed the foreign exchange for rehabilitation mainly to the food, beverages and tobacco, textiles and leather, metals, machinery and equipment, and chemicals and petrol sectors (UNIDO (1990), p. 9). The studies at subsectoral levels can be made by further disaggregating this pilot model.

There are high expectations placed on the current structural adjustment reform, therefore a counter warning: "The IMF programme would not therefore be a panacea which would put the country back on its pre-1979 path of long-term economic growth, as some people blithely assume." (Singh (1986), p. 446). To this effect, our study pointed out the importance of positive TFPG in the manufacturing sector. A favourable world environment is a necessary condition but not the sufficient condition neither for rehabilitation nor for future development of industrial sector.

Although we treated the case of Tanzania, we believe that the same methodology can be applicable for other sub-Saharan LDCs to clarify the possibility of industrial rehabilitation and future development programmes.

Appendix

Table 1

DATA OF UNITED REPUBLIC OF TANZANIA

(1980 US Million Dollars)

Year	XMA	IMMA	MAV	EDMA	EMANU
1980	248.080	1007.560	499.927	1259.407	106265.000
1981	234.351	835.844	448.592	1050.084	104326.000
1982	260.652	906.893	427.924	1074.166	100671.000
1983	283.377	978.534	395.527	1090.684	103620.000
1984	294.139	1006.909	408.542	1121.312	98006.000
1985	308.360	1073.999	386.744	1152.384	93609.000
1986	336.835	1175.869	370.696	1209.729	95566.000
1987	353.555	1222.351	386.505	1255.301	98095.000
1988	370.861	1263.648	412.600	1305.387	94856.000
1989	392.575	1327.429	420.961	1355.815	94577.000

Year	GDP	NMAGDP	C	I	K
1980	5138.000	4638.073	4633.000	1182.000	6959.177
1981	5080.315	4631.723	4619.022	892.611	7155.871
1982	5143.320	4715.396	4954.046	956.143	7396.427
1983	5123.412	4727.885	5200.263	580.995	7237.779
1984	5244.438	4835.896	5446.873	635.626	7149.627
1985	5364.000	4977.255	5111.000	1015.000	7449.665
1986	5566.000	5195.305	5522.000	905.000	7609.699
1987	5786.000	5399.495	5815.000	731.000	7579.729
1988	6041.000	5628.400	5940.000	963.000	7784.756
1989	6283.000	5862.039	6243.000	939.000	7945.281

Year	PCON	EXR	YW	XOT	IMOT
1980	1.000	8.197	6216727.000	427.920	345.440
1981	1.256	8.284	6326571.000	385.447	215.273
1982	1.620	9.283	6305805.000	140.527	261.669
1983	2.058	11.143	6484418.000	99.342	62.031
1984	2.786	15.292	6802209.000	94.474	219.765
1985	3.735	17.472	7026786.000	169.640	166.001
1986	4.946	32.698	7219093.000	118.165	140.131

Table 1 (Continued)

1987	6.427	64.260	7462575.000	187.445	78.649
1988	8.434	99.292	7807067.000	161.139	130.352
1989	11.148	143.377	8089122.000	158.425	122.571

Year	EXS	N	R(N)	PGDP	PMANU
1980	677.000	18.580	0.000	1.000	1.000
1981	431.319	19.171	0.032	1.186	1.237
1982	766.869	19.782	0.032	1.401	1.240
1983	657.846	20.412	0.032	1.676	1.516
1984	838.061	21.062	0.032	2.044	1.799
1985	762.000	21.733	0.032	2.764	2.103
1986	861.000	23.038	0.060	3.472	2.813
1987	760.000	23.870	0.036	4.638	4.668
1988	862.000	24.739	0.036	6.601	7.322
1989	899.000	25.665	0.037	7.669	8.646

Year	XMAN	IMMAN	MAVN	EDMAN	GDPN
1980	13.352	54.228	26.907	67.783	276.534
1981	12.224	43.599	23.400	54.775	265.000
1982	13.176	45.844	21.632	54.300	260.000
1983	13.883	47.939	19.377	53.433	251.000
1984	13.965	47.807	19.397	53.239	249.000
1985	14.189	49.418	17.795	53.025	246.814
1986	14.621	51.040	16.091	52.510	241.601
1987	14.812	51.209	16.192	52.589	242.396
1988	14.991	51.079	16.678	52.766	244.189
1989	15.296	51.721	16.402	52.827	244.808

Table 2

RESULT OF FINAL TEST OF TANZANIA MODEL (1981-89)

Number	Variable	MAPE (%)	COR (ACT, EST)
6	MAVN	2.0290	0.9832
7	EDMA	0.6275	0.9952
8	XMA	2.4777	0.9857
9	IMMA	0.7210	0.9988
10	MAV	2.0290	0.9076

Table 2 (Continued)

Number	Variable	MAPE (•)	COR (ACT, EST)
11	GDPN	0.4572	0.7925
12	GDP	0.4572	0.9798
16	C	1.2588	0.9158
21	I	8.0593	0.1994
22	K	0.9741	0.8462
35	EMANU	1.6971	0.7410
41	NMAGDP	0.5702	0.9828
51	PCON	0.9658	0.9999
53	EXR	6.2879	0.9969

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