

Towards Agricultural Development and Poverty Alleviation in Tanzania: Some Policy Options

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Abstract

At the turn of the millennium, issues of agricultural development strategies and poverty alleviation continue to be among Tanzania's main development challenges. We use a computable general equilibrium (CGE) framework to address alternative policy measures aiming at agricultural growth and poverty alleviation in Tanzania. The CGE model used follows the neoclassical modeling tradition, but incorporates additional structuralist features, which are of particular importance in developing countries, such as own-household consumption and marketing margins. Since prices are signals for the allocation of resources and generation of incomes in the agricultural sector, we particularly focus on policies that alter the prices of inputs and outputs in the agricultural sector. Because low productivity is the main attribute of Tanzania's agricultural sector, we also focus on policies that aim at increasing productivity in the sector. The policy implication emanating from our analysis is that adoption of the proposed agricultural support policies can be an important element towards agricultural and overall economic growth and development and, consequently, support the national strategy for poverty alleviation.

1 Introduction

The agricultural sector has been mainstay of the Tanzanian economy over the entire postwar period and remains so at the beginning of the new millennium. Still over 80 percent of the total population in Tanzania depend on agricultural production for their living.

Adoption of the Arusha declaration in 1967 set the scene for a more interventionist state committed to stepping up the pace of development in the country. The economic development policies of the socialist regime aimed at modernizing the agricultural sector through facilitation of diffusion of new technologies into the sector. The new technologies included use of hybrid seeds, chemical inputs, and tractors. To facilitate this exercise, agriculture production was organized along socialist principles of collective farming. Therefore, farmers were moved into "Ujamaa Villages" where they could easily be provided with agricultural extension services, farm implements such as tractors, and subsidized inputs on credit basis.

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Agricultural marketing was also undertaken by the state through the state controlled marketing agencies, which included marketing boards, crop authorities, and cooperatives. These marketing agencies distributed agricultural inputs and farm implements to farmers, and procured their agricultural production. The government also channeled input subsidies and credit for agricultural production and marketing through these marketing agencies. Transportation of inputs to villages and agricultural products to storage facilities and markets within each region were undertaken by these marketing agencies as well. The government established state transport companies, which undertook interregional transportation of inputs and agricultural commodities to markets within the country and to the two main ports. These companies were also subsidized by the state to lower the transport costs in the country to ensure the integration of widely spread regional markets.

In the mid 1980s, economic performance in Tanzania faltered and persuaded Tanzania to reconsider its existing inward-looking, interventionist, and non-market-based policies. The rate of inflation increased and the budgetary resources gradually failed to cover the financing requirements of the government to run the economy. Monetary accommodation of public sector financial losses also added to inflationary pressures.³ As in many other developing countries, the government of Tanzania was pressurized by the donor community to adopt structural adjustment policies (SAPs) in the mid 1980s, in an effort to deal with the lingering economic crisis.

One could therefore distinguish two main phases of Tanzania's economic policy changes aimed at stimulating growth and alleviating poverty. The inward-looking, interventionist, and non-market-based policies from the mid 1960s to the mid 1980s; and the free market economy thereafter. In the interventionist regime the aim was to modernize the agricultural sector through facilitation of diffusion of new technologies into the sector by providing free agricultural extension services, subsidized farm implements and subsidized inputs on credit basis. Mounting economic difficulties led to a policy shift towards a free market economy in mid 1980s, where all types of public support to the agricultural sector were eliminated resulting into unsatisfactory performance of the agricultural sector and mounting poverty

During the 1990s the Tanzanian government paid only modest attention to sectoral policies, while it rather concentrated on macro policies to provide an impetus towards a free market economy. Sectoral policies in this decade focused mainly on safeguarding government expenditures and promoting more participation of the private sector in almost all spheres of the economy. The government endeavored towards privatization of

³ There is a considerable literature on the Tanzanian crisis. Major causes of the economic crises are cited as internal and due to economic mismanagement as well as external such as the oil shocks, droughts and the Uganda war (e.g. Lofchie 1989 and Sarris and van den Brink 1993).

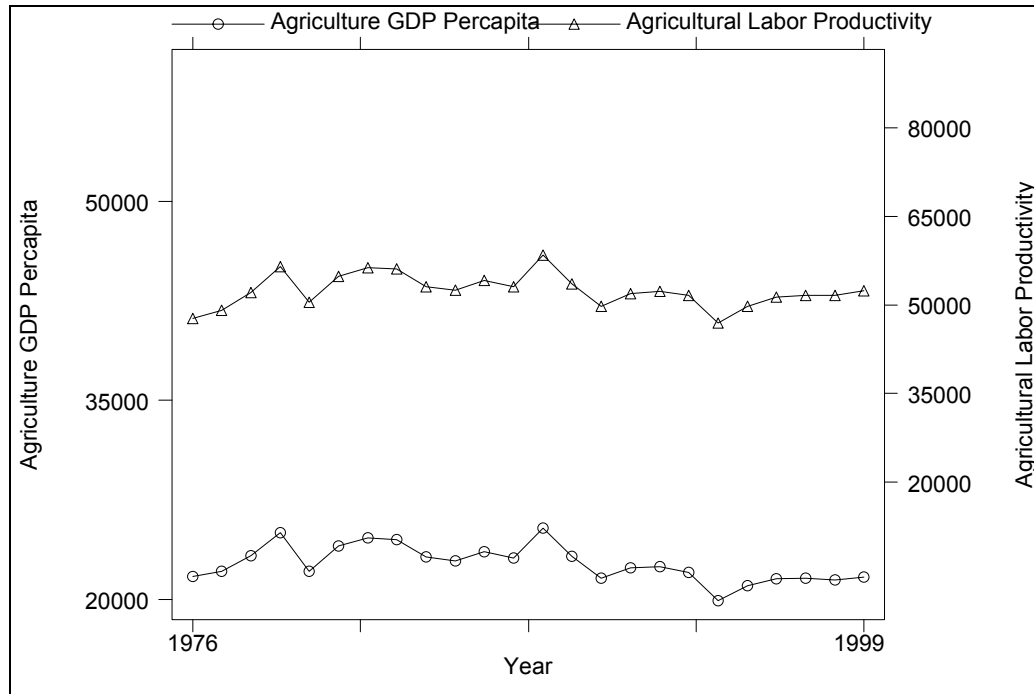
all state enterprises and gradually withdrew from the role of providing most of the basic services to the agricultural sector.

The results of the economic reforms in Tanzania are, however, far from satisfactory. A study by Ponte (2001) on policy reforms, market failure, and input use in African smallholder agriculture, for example, which is based on the analysis of the Tanzanian economy, indicates the following:

- a) Poor infrastructure and dispersed settlements have limited the capability of the private sector to cover the ground left by state withdrawal and private traders have not shown great interest in operating in remote areas.
- b) The elimination of subsidies and currency devaluations have resulted in higher prices and reduced use of inputs.

Consequently, performance of the agricultural sector has been hampered. Agricultural productivity in real terms has remained stagnant (see Figure 1.1). To meet the growing demand for food, as well as of cash incomes, yields of staple food and cash crops must increase in order to maintain or improve current per capita consumption, in a country like Tanzania, where the overwhelming population depends on agriculture for their livelihood. Yields must increase even more if we are to make progress overcoming malnutrition and poverty in Tanzania. This therefore calls for guided government intervention to change the economic and social context within which agricultural production and marketing takes place: by adoption of agricultural policies specifically aimed at altering the price of farm inputs and outputs, and by promoting new technologies in agriculture.

Figure 1.1: Real Agricultural GDP Percapita and Trends in Agricultural Productivity in Tanzania (Constant 1992 Prices)



Source: Based on FAOSTAT data.

In this study we adopt a standard computable general equilibrium (CGE) approach following Dervis, De Melo, and Robinson (1982), which is documented in Löfgren et al (2001), emphasizing the particular characteristics of developing countries. The model follows the neoclassical modeling tradition, but incorporates additional (structuralist) features, which are of particular importance in developing countries, include household consumption of non-marketed (or “home”) commodities, explicit treatment of transaction costs for commodities that enter the market sphere, and a separation between producing activities and commodities that permits any activity to produce multiple commodities and any commodity to be produced by multiple activities (Löfgren et al 2001). The 1998 social accounting matrix applied in this analysis was constructed by Wobst and Mhamba (2002)

2 Some Policy Options and their Impact on the Agricultural Sector

Based on the performance of the Tanzanian agricultural sector described above, we identify three intertwined sets of policy options the Tanzania government could adopt in order to improve productivity and production in the agricultural sector. The first set includes policies that are specifically aimed at altering the price of farm outputs, namely:

- (a) Decrease of domestic and export agricultural marketing margins through infrastructure improvement;
- (b) Cut of tariffs in the packing material sector; and
- (c) Elimination of producer taxes in agriculture.

Farm output prices are generally recognized as having three main functions in the economic system: (i) to allocate farm resources, (ii) to distribute incomes, and (iii) to encourage or retard investments and capital formation in agriculture.

The second set of policies includes those that are specifically aimed at increasing productivity through extension services and adoption of new technologies in agriculture, in particular input policies and mechanization policies. The input policies are concerned with strategies that influence the quantities and combinations of purchased variable inputs used in the agricultural sector. To achieve an increase in productivity in the agricultural sector we thus propose the following policy measures:

- (a) Increase in labor productivity through improved extension services;
- (b) Reintroduction of fertilizer subsidy;
- (c) Increase in total factor productivity through improved seeds; and
- (d) Enhancing agriculture mechanization.

Extension services constitute training and visiting farmers to provide technical and professional advise. Farmers can potentially increase their productivity through adoption of new agricultural techniques, practices, and new input packages, if appropriate extension services are put in place.

Factor productivity can be enhanced through enhancing the use of fertilizer and improved seeds. Chemical fertilizers are by far the most important purchased variable input in terms of their yield impact in conjunction with new seeds and other inputs (Ellis 1992:136). Improved seeds are also an essential component in increasing productivity in agriculture. Improved seeds include the following categories: firstly, higher yields, greater resistance to pests and diseases, greater tolerance to environmental stresses, and secondly shorter crop duration varieties. For resource-poor farmers, such built-in resistance means the plant itself can resist attack and is less dependent on protection by pesticides or other costly control measures. This approach is especially important in countries like Tanzania, where the agricultural sector is dominated by small subsistence farmers.

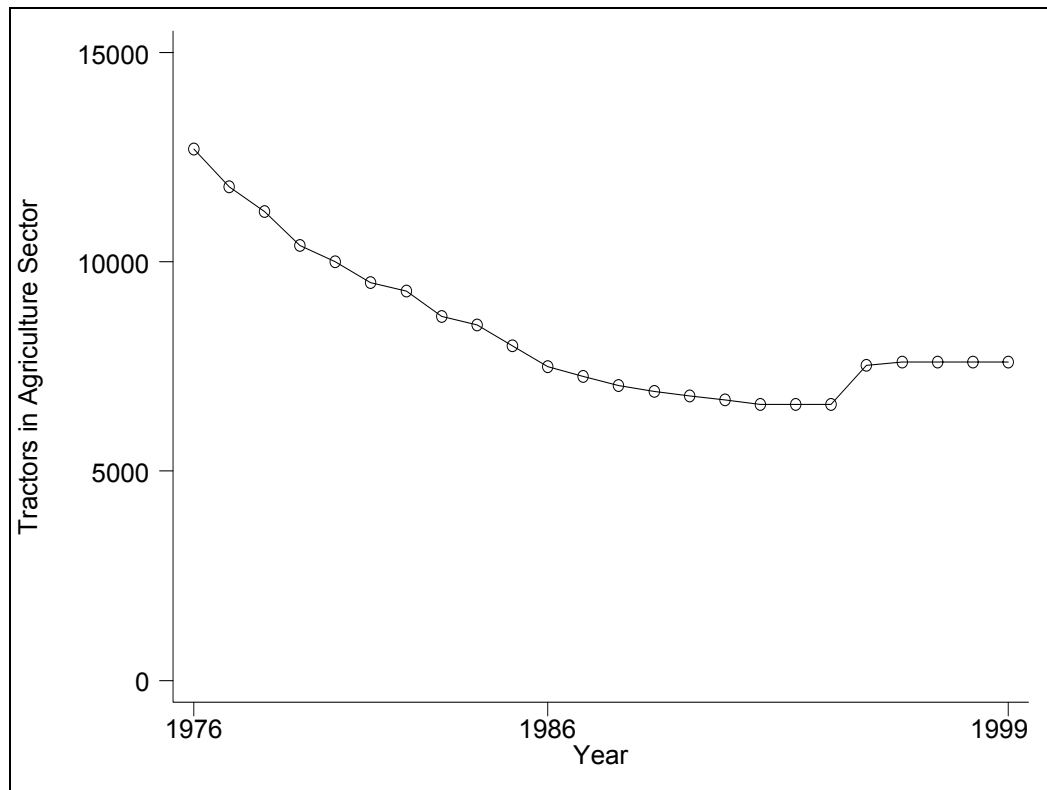
Furthermore, agricultural mechanization is one of the crucial factors in increasing labor productivity, and it is one component of a mix of management tools a farmer has available to maximize production and profit. Mechanization is defined as the use of non-human sources of power for undertaking agricultural tasks (Ellis 1992:190). Ellis (1992) identifies three basic types of mechanical technology: (i) hand-tools or implements that increase the effectiveness of human power, (ii) animal-draught machines or equipment,

which make use of animal power, and (iii) engine or motor driven machines, which make use of mechanical power. Mechanical power is further subdivided into mobile machines and stationery machines. Mechanization can increase productivity by either increasing output at a given resources cost or substituting capital for labor at the same resource cost. In a country like Tanzania, where land is not the major constraint to production, increased farm power can lead to direct increases in agricultural output by simply increasing the land area or animal numbers that one man can handle.⁴

Agricultural production in Tanzania is dominated by small-scale peasants producing mainly for subsistence, with high reliance on family labor, hand tools, and animal-drawn implements in some parts of the country. The use of mechanical powered machines has been decreasing over the last 25 years (Figure 2.1). The subsistence nature of agriculture practice in Tanzania suggests that most power-driven equipments are beyond the reach of most peasants in the country. Any improvement in mechanization initially would, therefore, fall under the two categories of mechanical technologies identified above, i.e. hand-tools and animal-drawn machines.

⁴ The country contains a number of high-potential agricultural regions, and estimates suggest that only 13% of potential arable land is cultivated (See Louis 1995:312).

Figure 2.1: Tractor Utilization in Tanzania's Agricultural Sector



Source: Based on FAOSTAT data

In the next section we provide simulation results of adopting the different policy options we have proposed here.

3 Policy Simulations

Several policy scenarios are simulated separately as well as in combination to assess their impact on the Tanzanian agricultural sector and the economy as a whole:

- (d) Fifty percent decrease of domestic and export agricultural marketing margins;
- (e) Fifty percent cut of tariffs in the packing material sector;
- (f) Elimination of producer taxes in agriculture;
- (g) Reintroduction of 25 percent fertilizer subsidy;
- (h) Five percent increase in labor productivity through improved extension;
- (i) Five percent increase in total factor productivity through improved seeds; and
- (j) Five percent increase in capital productivity through improved mechanization.

3.1 Fifty Percent Decrease of Domestic and Export Agricultural Marketing Margins

A 50 percent decrease of domestic and export agricultural marketing margins (simulating increased investment in infrastructure, e.g. rural roads, that improve marketing conditions) results in an improvement of agricultural producer prices, which motivates farmers to increase agricultural production. Significant increase is observed in the production of the main cash crops, i.e. coffee, tobacco, tea, cashew nuts, and sisal, ranging from 11.4 to 47.0 percent. Consequently, the improved marketing conditions cause an increase in export volumes of these crops in the same relative magnitudes (Table 3.1).

Improved efficiency in the marketing sector also results in an increase in the production of all other agricultural crops, because productive resources are released from the trade and transportation sector and move into other sectors. However, production in these sectors increased only moderately ranging from 0.1 to 3.0 percent. A relatively larger increase in the production of cash crops as compared to food crops is due to the fact that food crops are mostly traded domestically and their domestic marketing margins are relatively small (around 3 percent) compared to the export marketing margins (around 30 percent). Therefore, a 50 percent decrease in domestic and export margin is bound to have a significantly higher impact on the agricultural sub-sectors with high export shares. Thus, apart from benefiting from the decrease in domestic marketing margins, export crops also enjoyed price improvements as a result of decrease in agricultural export marketing margins.

Table 3.1: Percentage Change in Cash Crop Production and Exports

	Coffee	Tobacco	Tea	Cashew Nuts	Sisal
Change in output quantities	28.0	12.0	36.0	11.4	47.0
Change in export quantities	29.5	15.5	42.8	11.9	51.4

Source: Simulation Results

An increase in the level of activity in the production of agricultural products entailed an increase in the demand for factors of production in that sector. Demand for agricultural labor in the production of cash crops increased by 1 to 4 percent, while that in the main cash crops increased by between 18 and 71 percent. This resulted into labor migration from the non-agricultural sector, which lost 4.7 percent of its labor force to the agricultural sector, where the labor force increased by 4.9 percent

The demand for capital decreased in the food production activities while increasing in the cash crops production activities. This is because cash crops are particularly favored by

the policy option. The pull in substantial labor resources from the food crops production activities to cash crops led to and increase the demand for capital input, as labor and capital are substitutable to a limited degree only. The migration specification of the agriculture and non-agriculture labor market in our model provides sufficient labor resources, while total agriculture capital supply is fixed and thus much scarcer than labor. Consequently, food crops employ more labor to substitute for capital that they released to the cash crop sectors (Table 3.2).

Table 3.2: Percentage Change in the Demand for Agricultural Labor and Capital

	Food crops			Cash crops	
	Labor	Capital		Labor	Capital
Maize	2.4	-2.3	Coffee	41.4	34.9
Paddy	3.5	-1.3	Tobacco	18.1	13.0
Sorghum	4.4	-0.3	Tea	54.0	46.8
Wheat	1.0	-4.0	Cashew Nuts	18.0	12.4
Beans	4.0	-1.0	Sisal	71.0	63.0

Source: Simulation Results

Factor incomes in the agricultural sector also increased by 10.0, 11.7, and 11.6 percent for labor, land, and capital respectively, while non-agriculture factor income for labor and capital decreased by 0.1 and 6.5 percent respectively. The increase in factor incomes contributed to an increase in incomes among households endowed with these factors of production. The income of rural agricultural households and rural non-agricultural households below food poverty line increased by 10.5 and 8.0 percent respectively. Moreover, the incomes of rural agricultural households and urban agricultural households above basic needs poverty lines increased by 4.5 and 3.7 percent respectively; while the income of the urban agricultural households within food poverty line and basic needs poverty line increased by 3.5 percent. However, the income of all other categories of households decreased (Table 3.3). Changes in household expenditures followed the same pattern: households that experienced an increase in income increased their expenditures by the same proportion, while those that experience a decrease in income decreased their expenditures by the same proportion.

Table 3.3: Percentage Change in Household Income

Household Category	Percentage Income Change
Urban agri. below FPL	-2.1
Urban agri. within FPL and BNP	3.5
Urban agri. above BNP	3.7
Urban non-agri. below FPL	-4.4
Urban non-agri. within FPL and BNP	-1.4
Urban non-agri. above BNP	-4.8
Rural agri. below FPL	10.5
Rural agri. within FPL and BNP	-0.1
Rural agri. above BNP	4.5
Rural non-agri. below FPL	8.1
Rural non-agri. within FPL and BNP	-0.7
Rural non-agri. above BNP	-1.2

Note: FPL = Food Poverty Line and BNP = Basic Needs Poverty Line

Source: Simulation results

3.2 Fifty Percent Cut of Tariffs on Packing Material

This experiment was carried out but did not produce significant results. We therefore do not consider the cut in tariffs on packing material to be a viable option for a positive policy stimulus.

3.3 Elimination of Producer Taxes in Agriculture

The elimination of producer taxes in agriculture entail a removal of all kinds of taxes on goods and services related to agriculture production. In our model the agriculture producer tax ranges from 0.2 to 1.1 percent. Eliminating such taxes may seem to be like imposing an insignificant policy stimulus. However, the elimination of these taxes resulted into an increase in agricultural producer prices by approximately 1.0 percent. This led to a shift in agricultural production towards cash crops, viz. cotton, coffee, tobacco, and tea, where production increased by 0.4, 0.6, 1.0, and 0.9 respectively.

Increase in production of these crops necessarily requires factor inputs. Demand for labor in agriculture increased substantially more in the cash crops sub-sectors (ranging from 0.6 to 5.7 percent) than in the food crops sub-sectors and other agricultural activities, for which labor demand either decreased or increased only marginally. Output in all agriculture sub-sectors slightly increased with the exception of cashew nuts, fruits and vegetables, and fish. The utilization of agricultural capital shifted towards production of cash crops, where capital utilization increased by not more than 1.1 percent. This leads to a decrease in employment of agricultural capital in other agricultural activities including food production. The increases in the employment of agricultural labor and capital in the cash crop sub-sectors lead to an increase in factor incomes and, therefore, income earnings in almost all households in the economy. The only household category, which experienced a decrease in factor income earnings, is the urban agricultural household below food poverty line, which is not endowed with any agricultural capital.⁵

3.4 Reintroduction of 25 Percent Fertilizer Subsidy

Tanzania is currently dependent on imported chemical fertilizers. Reintroduction of a 25 percent fertilizer subsidy resulted into a decrease of the fertilizer import price by 0.3 percent, which follows an appreciation of the exchange rate by the same magnitude. Given the static model framework with fixed coefficient Leontief technology as part of the CES production function, the reintroduction of a fertilizer subsidy cannot lead to an increase in *relative* fertilizer use in any production sector. However, relative production across sectors shifts to those sectors that have high fertilizer shares and thus are particularly favored through the introduction of the subsidy (Table 3.4).

Most cash crop sectors are fertilizer intensive (except sisal) and thus increase production accordingly (column “Output” in Table 3.4) also demanding more labor and capital inputs (columns “Factor demand for agriculture labor/capital” in Table 3.4). However, the labor pull occurs mostly between cash crop and other agricultural sectors, while the total agricultural labor supply increase through migration accounts for only 0.1 percent.

⁵ From the 1991/92 Households Budget Survey data, these households are not endowed with any agricultural factor of production.

Sectoral output increases between 0.4 and 11.4 percent for the major cash crops except sisal. As compared to cash crops, most other agricultural sectors are not fertilizer intensive and thus are not favored through the subsidy. However, even food crops such as wheat and other cereals that show some substantial fertilizer use do not increase factor demand and production as much as cash crops with comparative levels of fertilizer application. This result mostly reflects that export demands are infinitely elastic at given world prices, while increasing domestic supply of food crops would cause domestic commodity prices to decrease. Thus, cash crop sectors are not only favored by the fertilizer subsidy because of their relatively high fertilizer application levels, but also because world markets absorb their increased production at given prices.

Table 3.4: Percentage Change in Agricultural Output and Factor Demand

Sector	Fertilizer use as percent of gross output	Output	Factor demand for agri. labor	Factor demand for agri. capital
Maize	1.4	-0.1	0.0	-0.1
Paddy	0.1	-0.1	0.0	-0.1
Sorghum	0.7	-0.1	0.0	-0.1
Wheat	4.4	-0.1	-0.1	-0.2
Beans	0.6	-0.1	0.0	-0.1
Cassava	0.1	-0.1	0.0	-0.1
Other cereals	3.9	0.2	0.0	-0.1
Oilseeds	0.3	-0.2	-0.1	-0.2
Roots	0.7	-0.0	0.1	0.0
Cotton	9.3	1.6	2.1	2.0
Coffee	3.6	0.4	0.6	0.5
Tobacco	5.1	2.2	3.0	2.9
Tea	13.7	11.4	15.3	15.2
Cashew nuts	8.4	3.6	4.8	4.7
Sisal	0.0	-3.1	-3.9	-4.0
Other fruits and vegetables	0.6	-0.2	-0.2	-0.3
Other crops	0.6	-0.2	-0.1	-0.2

Source: Simulation Results

At the household level the policy led to an increase in aggregate income of the rural agricultural and rural non-agricultural households below poverty lines by 0.3 percent. It also led to an increase by 0.1 percent of aggregate income of all the rural household categories with an exception of the rural agricultural households, which are within the basic needs poverty line and food poverty line which did not experience any change in income. Also the incomes of three categories of urban households (i.e. the urban agricultural households within food poverty line and basic needs poverty line, the urban

agricultural households above basic needs poverty line, and the urban non-agricultural households within food poverty line and basic needs poverty line) increased by 0.1 percent, while the income of the rest of the urban household categories did not change.

3.5 Five Percent Increase In Labor Productivity Through Improved Extension Services

We model a five percent increase in labor productivity in all agricultural sectors that is meant to simulate improved extension services to farmers. Our results show that, in general, better extension services and thus increased labor productivity increase total output of the agricultural sector. Relatively higher increases are observed in the production of cash crops compared to the food crop sub-sectors (Table 3.5). Increased labor productivity through better extension services translates to a more efficient utilization of agricultural labor and thus incorporates the classical problem of “technological change”. Less of the (now) more productive labor is required to produce the same output and thus some of the more effective labor becomes redundant. Given the migration opportunity between the agricultural and non-agricultural labor markets in our model economy, this particular experiment causes 2.5 percent of the agricultural labor force to migrate to non-agricultural sectors. Although total agricultural capital supply in the model is fixed, agricultural capital is mobile across different sectors and thus can move according to the relative factor price shifts induced by the labor movements. Consequently, farmers increase output in food and other crops production by 0.7 to 2.6 percent despite reducing utilization of labor and capital and increase output in cash earning crops production up to 6.9 percent through increased capital (and partly labor) utilization (Table 3.5).

Table 3.5: Percentage Change in Output, Value-Added, Factor Demand, and Producer Prices

Sector	Output quantity	Value-added	— Factor demand —		Producer prices
			Labor	Capital	
Maize	0.8	0.6	-3.0	-0.4	-2.4
Paddy	0.9	0.6	-3.0	-0.4	-2.3
Sorghum	0.7	0.5	-3.2	-0.6	-2.2
Wheat	1.6	1.5	-1.8	0.8	-1.6
Beans	0.8	0.3	-3.3	-0.8	-3.2
Cassava	0.9	0.2	-3.5	-3.0	-3.5
Other cereals	2.6	0.7	-2.9	-0.4	-2.4
Oilseeds	1.2	0.6	-3.0	-0.4	-3.2
Roots	0.2	-0.1	-3.9	-1.3	-3.6
Cotton	-0.6	-0.6	-4.6	-2.1	-0.7
Coffee	5.7	5.7	3.5	6.2	-0.7
Tobacco	3.6	3.6	0.8	3.4	-0.5
Tea	1.9	1.9	-1.4	1.2	-0.6
Cashew nuts	6.9	6.9	5.1	7.9	-0.6
Sisal	1.5	1.5	-1.9	0.7	-0.7
Other fruits and vegetables	1.5	1.0	-2.4	0.1	-2.9
Other crops	1.6	1.2	-2.3	0.3	-2.8

Source: Simulation Results

The increase in agricultural output reduced the producer prices of all agricultural products. Higher agricultural labor productivity also reduced total factor earnings from all agricultural factors (labor, capital, and land) by more than 2 percent. Due to the labor shift from agricultural to non-agricultural sectors and the diverse factor endowment across households, the net effect on household incomes is mixed. Aggregate income increased in only one of the rural agricultural household categories (the rural agricultural household within food poverty line and basic needs poverty line) by 1.4 percent. Income also increased in two of the rural non-agricultural household categories (the rural non-agricultural household within food poverty line and basic needs poverty line and the rural non-agricultural households above basic needs poverty line) by 2.2 and 2.3 percent respectively. There was also an increase in income in all the urban household categories with the exception of the urban agricultural household within food poverty line and basic needs poverty line. Due to the increase in agricultural labor productivity, 2.5 percent of total agricultural labor migrates to non-agricultural sectors, which is reflected in the respective increase in urban non-agricultural households' income increase (Table 3.6).

Table 3.6: Percentage Change in Household Incomes

Household category	Income change
Urban agri. below FPL	2.3
Urban agri. within FPL and BNP	-0.1
Urban agri. above BNP	0.3
Urban non-agri. below FPL	3.1
Urban non-agri. within FPL and BNP	2.4
Urban non-agri. above BNP	3.2
Rural agri. below FPL	-2.3
Rural agri. within FPL and BNP	1.4
Rural agri. above BNP	-0.2
Rural non-agri. below FPL	-2.4
Rural non-agri. within FPL and BNP	2.2
Rural non-agri. above BNP	2.3

Note: FPL = Food Poverty Line and BNP = Basic Needs Poverty Line

Source: Simulation results

3.6 Five Percent Increase in Total Factor Productivity Through Improved Seeds

In this experiment we increased total factor productivity by five percent simulating the introduction of improved seeds in maize, sorghum, and fruits and vegetable production. The increase in total factor productivity improved maize, sorghum, fruits and vegetables production, which as a result reduced the activity prices in the sectors producing these goods (Table 3.7). As in the previous simulation, the increase in productivity reduced the demand for labor and capital utilization in maize, sorghum, and fruits and vegetables production resulting into a total shift in labor utilization from agriculture to non-agricultural activities of 2.7 percent.

Table 3.7: Change in Output, Factor Demand, and Activity Prices

Sector	Output	— Factor Demand —	—	Activity
		Labor	Capital	Prices
Maize	1.0	-6.5	-3.9	-5.8
Paddy	1.1	-0.3	2.5	-0.6
Sorghum	0.2	-7.4	-4.9	-5.5
Wheat	1.9	1.1	3.9	0.1
Beans	0.9	-0.7	2.0	-1.2
Cassava	0.9	-0.9	1.8	-1.5
Other cereals	2.1	-0.5	2.2	-0.6
Oilseeds	1.3	-0.4	2.3	-1.2
Roots	0.7	-0.9	1.7	-1.4
Cotton	-1.9	-2.9	-0.2	-0.5
Coffee	1.9	1.2	4.0	0
Tobacco	0.9	-0.1	2.6	-0.4
Tea	-0.6	-2.0	0.7	0.3
Cashew nuts	3.3	3.0	5.8	-0.1
Sisal	-1.9	-3.7	-1.0	0
Other fruits and vegetables	2.4	-5.4	-2.8	-6.8
Other crops	2.0	0.7	3.5	-0.7

Source: Simulation Results

Table 3.8: Percentage Change in Household Expenditures due to (a) Increase Factor Productivity, (b) Mechanization, and (c) the Combination of all the Policy Strategies

Household Category	Improved seeds	Mechanization	Combination of all policy strategies
Urban agri. below FPL	2.5	1.7	3.9
Urban agri. within FPL and BNP	0.0	0.1	4.0
Urban agri. above BNP	0.0	-0.2	4.2
Urban non-agri. below FPL	3.6	2.5	4.0
Urban non-agri. within FPL and BNP	2.8	2.0	5.7
Urban non-agri. above BNP	3.6	2.6	3.9
Rural agri. below FPL	-3.1	-2.3	4.3
Rural agri. within FPL and BNP	1.6	1.1	3.9
Rural agri. above BNP	-0.5	-0.4	4.0
Rural non-agri. below FPL	-2.2	-1.3	3.3
Rural non-agri. within FPL and BNP	2.7	2.0	6.2
Rural non-agri. above BNP	2.8	2.0	5.8

Note: FPL = Food Poverty Line and BNP = Basic Needs Poverty Line

Source: Simulation Results

Increase in factor earnings in the non-agricultural sector enabled all non-agricultural households to increase their expenditures, with an exception of the urban non-agricultural households below the poverty line. Household expenditures increased in only two of the agricultural households (the urban agricultural households below the poverty line and the rural agricultural households within the basic needs poverty line and the food poverty line). Expenditures in all the other rural agricultural households either remained the same or decreased (Table 3.8).

3.7 Five Percent Increase in Capital Productivity Through Improved Mechanization

In this experiment, we increase agricultural capital productivity simulating a higher degree of mechanization and irrigation for all agricultural sectors excluding cashew, livestock, fishing, and forestry and hunting. Adoption of this policy generally increased output in the agricultural sector, with relatively larger output increase in the cash crop sub-sectors than in the food crop sub-sector (Table 3.9). In addition, the strategy resulted into a shift in demand for labor and capital within the agricultural sector from food crop production to cash crops production. The increase in agricultural capital productivity reduced the demand for labor thus generated a labor surplus in the agricultural sector, with a consequential movement of surplus labor from agriculture to the non-agricultural sector of 1.8 percent.

The decrease in the demand for factors of production in the agricultural sector reduced the factor incomes earnings in the sector, while factor incomes in the non-agricultural sector increased. This enabled all non-agricultural households to increase their expenditures, with an exception of the urban non-agricultural households below the poverty line. Household expenditures decreased in two of the rural agricultural household categories, namely the rural agricultural household below the poverty line, which is endowed with agricultural labor, and the rural agricultural households above the basic needs poverty line, which is endowed with agricultural labor and capital (column “Mechanization in Table 3.8).

Table 3.9: Percentage Change in Output, Factor Demand, and Producer Prices

Sector	Output quantity	— Factor demand —		Producer prices
		Labor	Capital	
Maize	0.5	-2.4	-1.0	-5.8
Paddy	0.6	-2.5	-1.1	-0.6
Sorghum	0.3	-2.7	-1.2	-5.5
Wheat	1.2	-1.5	0.0	0.1
Beans	0.5	-2.7	-1.3	-1.2
Cassava	0.6	-3.0	-1.5	-1.5
Other cereals	2.3	-2.3	-0.8	-0.6
Oilseeds	0.9	-2.5	-1.0	-1.2
Roots	-0.1	-3.3	-1.9	-1.4
Cotton	-0.4	-3.4	-2.0	0.5
Coffee	5.8	4.6	6.2	0.0
Tobacco	4.1	2.4	4.0	0.4
Tea	3.0	0.9	2.4	0.3
Cashew nuts	1.8	1.1	3.9	0.1
Sisal	2.7	0.6	2.1	0.0
Other fruits and vegetables	1.2	-1.9	-0.4	-6.8
Other crops	1.1	-1.9	-0.5	-0.7

Source: Simulation Results

3.8 Adoption of a Combination of all the Seven Policies in our Simulation

Simultaneous application of the entire package of policies that have been analyzed above, yielded a positive response of the agricultural sector. Agricultural output in the entire sector increased with a relatively greater output response in the cash crop production sectors (Table 3.10).

Table 3.10: Percentage change in agricultural output, factor demand, and producer prices

Sector	Output quantity	---- Factor demand ----		Producer prices
		Labor	Capital	
Maize	2.4	-8.5	-7.7	-5.1
Paddy	3.0	-1.6	-0.7	0.5
Sorghum	3.2	-7.8	-7.0	-4.5
Wheat	3.4	-0.9	-0.0	-0.3
Beans	3.0	-2.2	-1.3	0.8
Cassava	4.3	-0.9	-0.0	1.5
Other cereals	2.5	-2.5	-1.6	-0.3
Oilseeds	5.4	0.2	1.1	1.8
Roots	3.4	-1.6	-0.7	1.1
Cotton	-6.4	-13.0	-12.2	-3.3
Coffee	45.8	56.9	58.2	11.2
Tobacco	24.5	26.7	27.8	4.1
Tea	59.6	77.8	79.4	8.4
Cashew nuts	27.8	33.6	36.4	9.5
Sisal	53.3	67.9	69.4	10.1
Other fruits and vegetables	4.1	-7.1	-6.2	-5.1
Other crops	4.7	0.0	0.9	1.6

Source: Simulation Results

The adoption of the entire policy package resulted into efficient utilization of agricultural labor and capital in food crop production, which reduced the demand for these factors in the sub-sector while increasing food production output. Apart from enhancing efficient labor and capital utilization, the policies also led to a shift in the pattern of agricultural labor and capital utilization within agriculture from food crop to cash crop production. Labor demand in cash crop production (except cotton) increases between 26.7 and 77.8 percent, while decreasing up to 8.5 percent in most food crop production activities. Capital utilization in cash crop production (except cotton) also increased between 27.8 and 79.4 percent, while decreasing up to 7.7 percent in most food crops production activities. The combination of all policies mostly causes labor shifts between agricultural

food crops and agricultural cash crop sectors as described above and shown in Table 1.10, while only 1.1 percent of the total agricultural labor force migrates to non-agricultural sectors.

Wages and rents for all factors in the economy increased, thereby increasing factor incomes in the entire economy. The increase in factor earnings in the economy resulted into an increase in household consumption expenditures in all categories of households.

4 *Summary and Conclusion*

In this paper we have used a computable general equilibrium modeling framework to revisit a set of agricultural support policies that were abolished during the economic reforms in Tanzania. These include, on the one hand, policies that aim at altering the price of farm inputs and outputs and, on the other hand, policies that aim at increasing productivity through extension services and adoption of new technologies in agriculture.

Results show that a decrease in marketing margins through investment in infrastructure improves agricultural output, employment of factors of production and incomes in the sector. The elimination of producer taxes in agriculture improves agricultural producer prices and farmers respond by increasing cash crop production. Consequently, agricultural incomes improve through increased employment of factors of production. The reintroduction of a 25 percent fertilizer subsidy results into an increase in the production of fertilizer-intensive cash crops, while most other agricultural sub-sectors are not favored through the subsidy as they are not fertilizer-intensive. The fertilizer subsidy also improves the incomes of most agricultural households.

Improvements in the agricultural extension services—simulated through increased labor productivity—increase output in the agricultural sector. However, higher agricultural labor productivity also reduces the demand for labor and capital utilization and, consequently, total factor earnings from all agricultural factors. The introduction of improved seeds in maize, sorghum, and fruits and vegetable production increases output for these products. Both measures, improved extension services and improved seeds, also increase the factor earnings of most non-agricultural households as a result of a total shift in labor utilization from agriculture to non-agricultural activities. A higher degree of mechanization and irrigation for all agricultural sectors (excluding cashew, livestock, fishing, and forestry and hunting) is simulated through increased capital productivity. This policy measure increases output in the agricultural sector, with relatively larger output increases in the (capital-intensive) cash crop sub-sectors than in the (less capital-intensive) food crop sub-sector. Overall, the policy reduces the demand for factors of production in the agricultural sector, thus reducing factor incomes earnings in the sector, while factor incomes in the non-agricultural sector increase.

The adoption of the entire policy package results into more efficient allocation of factors of production in the entire economy in general and between food and cash crops production in particular. As a result of the increase in factor earnings household incomes improve in the entire economy. The policy implication emanating from our analysis is that adoption of the agricultural support policies can be an important element towards agricultural and overall economic growth and development and, consequently, support the national strategy for poverty alleviation.

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