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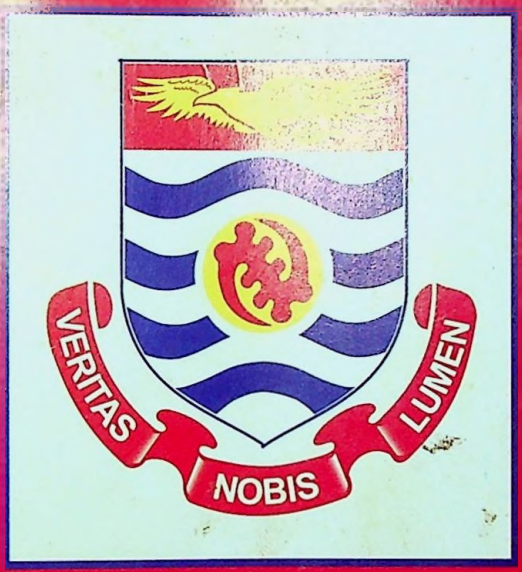


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# Public Spending, Growth and Poverty Reduction: A Dynamic CGE Analysis for Ghana

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***Abstract***

*The objective of this study was to determine the differential impact of various government expenditures on economic growth and poverty reduction in Ghana using a dynamic computable general equilibrium model based on a social accounting matrix (SAM) for Ghana for the year 1999. Even though there is evidence to show that higher fiscal deficits resulting from the increase in public investment outlays 'crowd-out' some private investment by raising interest rates, the overall impact points to increased real GDP on a net basis by removing physical bottlenecks of infrastructure and thereby raising the factor productivity of private investment. Two main lessons can be drawn from this study. First, various types of government spending have differential impacts on economic growth and poverty reduction, implying greater potential to improve efficiency of government spending by reallocation among sectors. Second, governments should reduce their spending on unproductive sectors and rather give priority to increasing its spending on production-enhancing investments such as education, health and infrastructure.*

## Introduction

Ghana has reached the completion point under the enhanced HIPC Initiative of the World Bank and the International Monetary Fund (IMF) after joining the initiative in March, 2001 and reaching the decision point in February 2002. The implications of the completion point included creditors being irrevocably committed to debt relief. This means the Paris Club creditors would provide 100 percent debt stock cancellation on all loans contracted before June 6, 1999 (GOG, 2003). Within the Ghana Poverty Reduction Strategy (GPRS) framework, these benefits must encompass a broad based pattern of public sector spending on basic social services with special emphasis on health, education and infrastructure [4].

To achieve broad-based growth resulting in effective poverty reduction in Ghana, an investment in human capital has been defined and articulated among the top three top priorities of government within its broad Growth and Poverty Reduction Strategy (GPRS) framework (GOG, 2003). The efforts of the government of Ghana have already borne fruit, in that, the economy has in recent years witnessed an upsurge of its budgetary allocations to the social sectors such as health, education, and on infrastructure among other social services. Also, Ghana has in recent times embarked upon a wide range of educational and health reforms to provide the knowledge, capacity, skills and attitudes necessary for the challenges ahead. For example, as part of the reforms in the context of Education for All (EFA), the ministry of education on behalf of the government of Ghana is implementing the capitation grant policy towards free Compulsory Basic Education (FCUBE) programme which provides that all children of school-going age should be in school by the year 2015[5]. Ghana is also embarking on the ambitious project of a Universal Health insurance system, financed out of general taxes as well as beneficiary contributions, in order to protect all citizens against

[4] In its policy objectives as specified in the Growth and Poverty Reduction Strategy (GPRS II), the government indicated that growth will be pursued through expanded development of production infrastructure in, among others, energy, transport, water and communications (GOG, 2003)

[5] Though sources differ on actual enrolments, the policy of free universal compulsory basic education which was introduced in 1987 as well as the current capitation grant and school feeding programs in Ghana has raised primary enrolments over the years.

preventable and manageable diseases such as malaria, tuberculosis and HIV/AIDS. The ultimate anticipated outcome is to stimulate economic growth and reduce poverty.

There are however, serious concerns about effectiveness of public spending in many key areas for growth and human development, including education, health care, roads and other rural infrastructure in stimulating growth and poverty reduction (Aryeetey and Kanbur, 2004). Likewise, there is a widespread perception that poorer groups benefit less from public spending, both in the sense of poorer individuals and households and of poorer regions. An important question that arises concerns the extent to which the current strategy of increasing public spending in totality and on various components such as health, education and transport infrastructure constitutes a targeted means for accelerated economic growth and poverty reduction in Ghana.

Investigating the link between public spending and economic growth and poverty reduction also becomes important when one looks at it from the multiplicity of consequences, both intended and unintended involved in the process. The consequences include short-and long-run allocative efficiency, income distribution and welfare, fiscal and foreign exchange balances, sustainability of resource use, and political response (Sadoulet and de Janvry, 1995). For example, while it is clear that the current levels of spending are still inadequate for achieving the poverty-reduction goals, it is also obvious that the objective of low inflation creates a new tension that is well known in development macroeconomics. This has become one of the most important policy issues that Ghana has to grapple with in the search for pro-poor growth (GOG, 2003). Also, questions such as 'do we need to spend on priority activity one or two' or to whether public investment programmes needs to be kept to a minimum because of the argument that they crowd out private investment all need to be answered in reference to their expected impact on poverty. Again, in as much as public spending is a potentially powerful instrument for stimulating economic growth and fighting poverty, budgets are limited.

The afore-mentioned issues call for a better understanding of the constraints of poverty reduction in a relatively stable growth context and the transmission mechanism through which such public spending policies affect the poor, and the possible trade-offs that poverty reduction may entail regarding the allocation of scarce resources and the sequencing of policy reforms. A more comprehensive way of modeling the overall impact of fiscal policy changes on the economy is through dynamic CGE modeling. These models are well suited to explain the medium to long-term trends and structural responses to changes in development policy (Adjakayi, 1999). Unfortunately, most of the applied studies addressing such public spending policy options have not dealt with Ghana. Also, the few recent studies, such as Bhasin and Annim (2005) and Bussolo and Round (2003) were not that rigorous in their approach and tended to rely on the static CGE, which does not capture inherent time lags associated with policy interventions. This study is therefore an application of a dynamic computable general equilibrium model in a case study of Ghana.

The rest of the paper is structured as follows. The objectives are provided in Section 2 and this is followed up in Section 3 with a discussion on recent trends in governments' social spending in Ghana. The theoretical issues related to the topic and the methodology is discussed in sections 4 and 5. The results from implementing the dynamic CGE model are presented in Section 6 whiles the final Section 7 is devoted to a brief summary and conclusions from the study.

**Objective of Study**

The objective of the study is to determine the differential impact of various government expenditures on economic growth and poverty reduction in Ghana using a dynamic computable general equilibrium model. Specifically, the study examines the potential impact of the following categories of government spending (i) increased total government consumption spending (ii) increased total government investment spending (iii) increased education spending (iv) increased health spending (v) increased spending on road infrastructure.

**Trends in Government Expenditure in Ghana**

The discussion that follows is based on the paper by Wetzel (2000) which provides classification of expenditures in terms of public services, economic services and social services. Public services consist of expenditures on such items as government administration, foreign affairs, justice and internal security.

**Table 1: Central Government Expenditure by Sectoral Category**

| | 1957-66 | 1967-71 | 1972-82 | 1983-91 | 1992 - 96 |
|---|---|---|---|---|---|
| (as a share of GDP) | | | | | |
| Public Services | 5.4 | 6.0 | 4.3 | 2.9 | 4.5 |
| Economic Services | 9.0 | 4.9 | 3.9 | 2.4 | 3.4 |
| Agriculture | 2.0 | 1.4 | 1.6 | 0.6 | 0.3 |
| Infrastructure | 5.0 | 2.4 | 1.9 | 1.3 | 2.3 |
| Other Economic Ser | 2.0 | 1.1 | 0.4 | 0.5 | 0.8 |
| Social Services | 6.1 | 6.9 | 6.4 | 5.2 | 6.0 |
| Education | 3.7 | 4.2 | 3.6 | 3.0 | 4.4 |
| Health | 1.3 | 1.4 | 1.3 | 1.2 | 1.3 |
| Other Social Expend. | 1.1 | 1.4 | 1.5 | 1.1 | 0.3 |

Source: Adopted from Wetzel (2000)

**Table 2: Central Government Expenditure by Sectoral Category (as a share of total expenditures and net lending-narrow coverage)**

| | 1957-66 | 1967-71 | 1972-82 | 1983-91 | 1992-96 |
|---|---|---|---|---|---|
| Public Services | 22.3 | 28.1 | 22.9 | 23.0 | 20.7 |
| Economic Services | 37.4 | 22.5 | 20.9 | 18.7 | 15.8 |
| Agriculture | 8.4 | 6.4 | 9.1 | 4.7 | 1.3 |
| Infrastructure | 20.8 | 11.0 | 9.6 | 10.3 | 10.8 |
| Other Economic Ser | 8.2 | 5.1 | 2.3 | 3.7 | 3.6 |
| Social Services | 25.2 | 32.2 | 33.8 | 39.9 | 28.1 |

| | | | | | |
|---|---|---|---|---|---|
| Education | 15.3 | 19.6 | 19.1 | 22.9 | 20.3 |
| Health | 5.2 | 6.3 | 7.0 | 8.7 | 6.2 |
| Other Social Expend | 4.7 | 6.2 | 7.7 | 8.3 | 1.6 |

Source: Adopted from Wetzel (2000)

These expenditures were highest during the 1967-71 periods at 6 percent of GDP and 28 percent of all expenditures. The share of expenditure allocated to agriculture was at its highest during the 1957-66 periods at 2 percent of GDP and 8.4 percent of total expenditure. Since then, it has continually declined, reaching 0.3 percent of GDP and 1.3 percent of total expenditures in 1992-96. The second major item under economic services is infrastructure. This includes items such as roads, transport, storage and communication, power/electricity, and water and sanitation. Spending on infrastructure was 5 percent of GDP and about a fifth of total expenditures during the Nkrumah years from1957-66.

During the 1972-82 periods, the expenditure on infrastructure fell to an average of 1.9 percent of GDP and 9.6 percent of total expenditure. This increased to 2.3 percent of GDP and almost 11 percent of total expenditures in 1992-96. The third major category of expenditure is social services including education, health and other social expenditures. As a share of GDP, expenditure on social services remained fairly steady across the periods except from the 2000s. As a share of GDP, social expenditures declined with the onset of the ERP, but their share of total expenditure increased to around 40 percent. Across all time periods, within the social services, education has received the largest shares of resources. With an improvement of the economic situation in recent years, government expenditures and budgetary revenues started increasing. Poverty-related expenditures indicated positive trends as observed in Table 2 and is projected to rise to about 12 percent of GDP (World Bank, 2004).[6]

[6] Poverty-related expenditures for 1999 could not be obtained and is deeply regretted

**Table 3: Poverty-Related Expenditure Estimates, 2002-2004**

| In % of GDP unless otherwise specified | 2002 | 2003 | 2004 |
|---|---|---|---|
| Total Poverty Related Expenditure 1/ | 4.8 | 6.5 | 6.9 |
| As a % of Total Expenditure | 21.7 | 27.3 | 28.5 |
| Basic Education | 2.8 | 3.6 | 3.3 |
| Primary Health Care | 0.6 | 1.0 | 1.5 |
| Agriculture | 0.2 | 0.2 | 0.3 |
| Rural Water | 0.1 | 0.1 | 0.2 |
| Feeder Roads | 0.3 | 0.5 | 0.4 |
| Rural Electricity | 0.1 | 0.1 | 0.2 |
| Other Poverty Related Expenditure | 0.7 | 1.2 | 1.1 |
| Memorandum Items: | | | |
| Total Expenditures 2/ | 21.9 | 23.7 | 29.0 |
| Total Expenditures 2/ (Billions of Cedis) | 10,716 | 15,673 | 19,173 |
| Nominal GDP (Billions of Cedis) | 48,862 | 66,158 | 78,650 |

*Source:* Adopted from World Bank (2004). 1/. Excluding externally financed expenditures; 2/ Including externally financed expenditures and excluding interest

## The Literature Review

Even though the long running debate in economic circles between the roles attributed to the market as opposed to extensive state intervention has almost become old-fashioned, it is worthwhile restating a few of the salient points. The arguments that seek to legitimize government interventions include both long recognized forms of efficiency-oriented interventions of market failure such as public goods, externalities, economies of scale imperfect competition, as well as the non-efficiency oriented interventions that has to do with issues like poverty reduction, income distribution, intergenerational equity and food security, and other forms of welfare.

Public investments in strategic areas can generally stimulate economic growth and also affect the poor in a number of ways. First, fiscal policy influences the macroeconomic balances, fiscal and trade deficits and the rate of inflation. These changes affect standards of living directly (changes in real incomes) and indirectly (change in growth). Second, public investments in areas such as energy, rural roads, irrigation and primary schools often stimulate private investment and create opportunities for the poor to create, own, and accumulate assets and to smooth consumption (Vandemoortele, 2004). Finally, public expenditures generate transfers, in form of cash or monetary transfers (pensions, unemployment, insurance) or in kind (publicly provided health, education, and infrastructure services).

In as much as the justification for a robust role of government is attractive, it is important to note that economic theory indicates that such an expansion of government can negatively affect growth through inefficiencies created by government expenditures and the means of financing these expenditures (Schaefer, 2006). According to Mitchell (2005), government spending can interfere with competitive markets by establishing a "third-party payer" problem that disconnects end users from costs. This creates a lack of concern about prices that undermines competitive markets and increases inefficiency. The government cannot also spend money without taking it from someone through taxes. These taxes have the potential of discouraging productive activities by imposing a cost on work, savings, and investment. Borrowing to finance public spending also requires future payment eventually, implying a future tax burden, and diversion of investment resources from the private sector (Schaefer, 2006).

The empirical literature on the impact of various types of government spending on economic growth is mixed. The well-known study by Barro (1991) finds that "the ratio of real government consumption expenditure to real GDP has a negative association with growth and investment." Schaefer (2006) documents the study by Bernhard Heitger who examines the impact of government expenditures in 21 OECD countries from 1960 to 2000. The paper notes a substantial growth in average government expenditures over that period and a corresponding decline in average economic growth. Tanzi and Zee, according to

(Schaefer, 2006) also find no relationship between government size and economic growth. A National Bureau of Economic Research study concluded that "An increase in government spending by 1 percentage point of trend GDP decreases profits as a share of the capital stock by about a tenth of a percentage point" (Schaefer, 2006).

There are also a number of studies that have reported positive impacts of the relationship between government spending and growth and poverty reduction.Vandemootele (2004) argues that public investment was a key instrument to fostering growth and reducing human poverty in the Republic of Korea and still plays that role in China and Vietnam[7]. There is also evidence that national investments in agricultural research and rural infrastructure also contribute to agricultural and rural non-farm economic growth and to rural poverty reduction in their own right, even when markets are not widely liberalized (Fan, Hazell, and Thorat 1999; Fan, Zhang, and Zhang 2000).

Pasha and Palanivel (2004) in their work on 'pro-poor policies' argue that during the 1980s, China's agriculture-led development strategy sparked off on historically unprecedented reductions in poverty. According to the paper, farmers benefited from earlier state investment in rural physical infrastructure and basic health and education. The consequence was a surge in pro-poor growth. Easterly and Rebelo (1993) also show that an increase in public investment in transport and communication by 1.7 percentage points of GDP will raise growth by one percentage point. Gertler and van der Gaag (1990) document many studies which among other objectives indicate the correlation of health care expenditures on economic growth. Other studies include Fan, Hazell and Thorat (1999), Chu et al (2000), Addison and Rahman (2001).

Extensive evidence also exists on the positive effects of public investment on poverty and growth from studies that use CGE models. The literature is almost difficult to draw together and includes such studies by Bhasin and Annim (2005), Karl (2004), Wobst and Mhamba (2004), Agenor et al. (2004), Anderson (2003), Obi (2003), Bautista and Thomas (2000), Chitiga (2000), Bussolo and Round

[7]These two countries are top performers vis-avis the MDG targets.

(2003), Boccanfuso et al. (2003). All these studies in part explain, at least, the political will of many governments to increase public expenditures on education, health and other development activities so as to reduce poverty. But whether or not this hypothesis holds in the Ghanaian situation within a dynamic computable general equilibrium framework remains to be validated and forms the main concern this study seeks to address.

## Methodology

### The Static and Dynamic CGE

ModelThe model used in this study is based on the standard static and dynamic CGE model developed by Löfgren et al. (2002). The model structure has two major parts: the main iteration that determines equilibrium for the current year and the updating part, in which the exogenous variables of the main iteration part are updated (for iteration of the following year) as functions of the equilibrium solution of the previous period. The static CGE model can be described as the within period module that defines the behaviour of public and private agents who choose their optimal level of consumption and production on the basis of relative prices. All producers (each represented by a sector or activity) are assumed to maximize profits subject to their existing technology, taking prices (for their outputs, intermediate inputs, and factors) as given. The production technology is represented by a set of nested constant-elasticity-of-substitution (CES) value-added functions and fixed (Leontief) intermediate input coefficients[8].

Household consumption is assumed to be distributed over composite goods, which are a mix of domestic goods and imports, according to a Linear Expenditure System (LES) demand functions. Fixed investment demand is defined as the base-year fixed investment multiplied by an adjustment factor. Government consumption demand, in which the main components tend to be the services provided by the government labour force, is also defined as the base year quantity multiplied by an adjustment factor. The competitive equilibrium in

[8] See Lofgren et al (2002) for details on the complete listing of the model equations and assumptions as well as a schematic representation of the structure of the model.

this model exists and is given by the set of prices of consumption goods, wage rate of labour, rental rate of capital, and the levels of output, sectoral use of labour and capital, such that market clearing conditions are satisfied.

In the dynamic model, a time element is introduced by solving the model sequentially, updating the capital stock to simulate population growth and productivity parameters to simulate advances in technology. In the base, run labour stock evolvement is connected to population growth, which is adjusted to account for HIV-AIDS growth rates in Ghana. Accumulation of capital is assumed to be endogenous and depends on the stock of the previous period, investments and the depreciation rate. In the model, all agents are myopic which means that they do not make their decisions with regard to future expectations but base their decision making on current economic conditions. The model is solved for each consecutive period thus creating a data set for each of the periods in the horizon, which contains economy-wide data on micro and macro levels plus evolvement of stocks that are allowed to change over time.

**Description of the Dataset-The 1999 Ghana SAM**

The model dataset is based on the 1999 SAM for Ghana prepared by Bhasin and Annim (2005), and has been substantially modified for the present application. The modification of the SAM involves straightforward aggregations of the capital transactions accounts into a single 'savings-investment' account and a consolidation of the primary, secondary and use of income accounts into one single set of current accounts for institutions. In addition, the production accounts are initially disaggregated into six sectors or activities namely cocoa, other agriculture, manufacturing, other industry, transport services and other services. These activities in turn produce three commodities namely agriculture, industry and services. This distinction between activities and commodities allow individual activities to produce more than a single commodity and conversely, for a single commodity to be produced by more than one activity.

Instead of a single representative labour category, segmentations based on gender and skill level of workers are introduced, and comprise four groups. They are labeled in the SAM as skilled male labour (LABSM), skilled female

labour (LABSF), unskilled male labour (LABUF) and unskilled female labour (LABUF). This labour classification is important to examine the consequences of policy measures on 'factorial' income distribution. Institutions have also been grouped into four: households, enterprises, government and the rest of the world. Firms comprise non-financial corporations, financial corporations and non-profit institutions serving households. Domestic production by enterprise is assumed to require intermediate inputs from itself and from all other productive sectors and value added from the four categories of factors of production and capital. The capital factor income is shared between the households and enterprises while the factor income is entirely versed with households. Enterprises pay dividends to households and taxes and dividends to the government, and the remainder also goes into the saving account.

The household classification adopted in the SAM consists of two-level disaggregations, the first level being a distinction according to the type of economic activity of the household. The five household groups here are agricultural farmers (HAF), public sector employees (HPUSE), private sector employees (HPRSE), non-farm self employed (HNFSE), and non-working households (HNW). The second level is a distinction between rural and urban households. The gross income of the households consists of the payments to the factors of production and transfers from other institutions (enterprises, government and the rest of the world). This income is used for final consumption, for transfers to enterprises and to the government (including the direct taxes). The remainder is saved.

The leading role of government is handled by an explicit formulation of the tax financing and expenditure. In the SAM, the government is disaggregated into a core government account and different tax accounts, one for each type of tax. The tax account consists of indirect taxes on production, import tariffs and direct income taxes. The sources of revenue to government are transfers from other institutions. The balance of the current account of the rest of the world corresponds to the saving of this account. The overall classification of accounts therefore leads to a total of 27 accounts. The main source of information was obtained from the Ghana Living Standards Survey (GSS, 2000), which provided

the raw data. Data for other endogenous variables, which could not be tracked from the SAM, were obtained from other secondary sources including the International Financial Statistics and the Ghana Statistical Service. The size of the capital stock was estimated on the basis of value-added and gross capital income data in the SAM.

**Implementing the Model & Data**

Three main steps are involved in the CGE analysis: (a) the compilation of base data (SAM); (b) the calibration of model parameters to the base data; and (c) computation of counterfactual equilibria for the policy changes to be analyzed. The 1999 SAM was used to calibrate the model's parameters. Some parameters such as international trade elasticities were estimated from a reasonable mixture of evidence from countries with productive structures similar to the Ghanaian case[9].

In order to bring about balance in the macro accounts, it is necessary to specify a set of mechanisms or macro 'closure' rules. For the government, consumption is fixed in real terms. For most simulations, tax rates are also fixed, with savings clearing the government account. For the current account of the balance of payments, a flexible exchange rate adjusts to maintain a fixed level of foreign savings. In other words, the external balance is held fixed in foreign currency. There is no explicit modeling of the investment decision or the financial sector within a particular time-period, but aggregate savings-investment equality is required. Nominal investment is a fixed share of nominal absorption meaning that, other things being equal, real investment will respond positively (negatively) to decreases (increases) in the prices of investment commodities relative to other commodities. Finally, the base year for the model is also the base year for the price indices, which was equal to one.

The estimated and calibrated parameters must reproduce the data for the base year. This condition was satisfied. The model solution to the base year and calibration was then used to run the simulation of policy changes. The CGE model was implemented and calibrated using the General Algebraic Modeling

[9] See Appendix for estimates of various elasticities used in this study

System (GAMS) programming software. Policy impacts are compared to the situation observed in the base year in terms of sectoral outputs, macroeconomic aggregates, and poverty levels. Poverty, in this study is defined according to per capita real expenditure. Following a shock to the model, the model generates real growth rates in per capita consumption expenditure for the five categories of households in the economy, which is then applied separately to the per capita consumption expenditure of households in the survey data for the poverty calculation using the Foster, Greer and Thorbecke (1984) class of poverty measures defined as:

$$Pov_{h,k} = \int_0^z \left[(z - y_h)/z\right]^k f(y_h)dy_h, \qquad k = 0,1,2$$

Where $y_h$ is the income of household $h$, $k$ is a poverty aversion parameter, $z$ is the endogenously determined poverty line. The incidence of poverty is indicated by $k=0$, the depth of poverty is indicated by $k=1$ and the severity of poverty is indicated by $k=2$. [10]

**Dynamic CGE Simulation Results**

In this section, the dynamic CGE model (run up to the year 2010 from 1999) is used to assess the growth and income effects of (i) increased government consumption expenditure (ii) increased public investments (iii) increased health spending (iv) increased education spending and (v) increased spending on road infrastructure. [11] In the SAM, total government spending is made up of consumption expenditure (comprising mainly of government services such as public administration and social services), transfer payments to institutions plus investment spending (capital or development expenditures). In all of the cases of the experiments, an important question or consideration for the government is how to finance such spending. The range of simulation experiments together with

[10] The poverty lines for the calculations were drawn from Bhasin and Anim (2005). Assuming different initial poverty lines for the rural and urban sectors (expressed in monetary units and adjusted over time to reflect increases in rural and urban price indexes), and using the new absolute nominal levels of income and consumption for each individual and each group, the model will calculate a poverty index, and a poverty gap index. Two nutritionally-based poverty lines drawn from the Ghana Living Standards Survey (GLSS 4) were used for the base year - a lower poverty line of 700,000 cedis per adult per year and an upper poverty line of 900,000 cedis per adult per year.

[11] The percentage increase in all of these scenarios for the simulations was arbitrarily set at 20 percent.

some underlying assumptions follow the ones employed by Lofgren, Thurlow and Robinson (2004) for Zambia and Levin and Mhamba (2005) for Tanzania. The GAMS outputs for these simulations are summarized in Tables 3-5. Although the model reports annual changes in a number of variables, the report here is based only on the average annual change for the whole period. [12]

**Increased Government Consumption Expenditure Simulation**

Under this scenario, the effects of an increase in total government consumption expenditures on overall growth and poverty reduction is assessed. Given the assumption that direct taxes are fixed under this scenario, the initial impact of the increase is to decrease government savings. Since the model is savings-driven, the decreased savings leads to a crowding out of private investment by 4.26 percent and consequently to a reduction in real GDP. Given the compositional differences in government consumption spending, the increased demand for government services has different consequences for different sectors. The compositional changes in production towards government expenditure increases demand for and output of those sectors whose commodities feature in the government consumption bundle.

[12] The base path growth rates were generated based on the following assumptions: Agriculture is assumed to grow at 5.4 percent; industrial activities grow at 6 percent, while services are assumed to grow at 6 percent over the period. Government real current expenditure is assumed to grow by 3 percent and total investment is assumed to be growing at 10 percent with private investment growing faster than public investment. Export volumes are assumed to grow by 8.2 percent while imports are growing by 6.9 percent.

[13] The abbreviations represent the following: Gov Exp Inc: 20 percent increase in government consumption expenditure simulation, Gov Inv Inc: 20 percent increase in government investment simulation; Infras Inc: 20 percent increase in government spending on infrastructure simulation

**Table 3: Base Values and Simulation Results (Average Annual Percentag Change)** [13]

| Sector | Initial Values | Base Scenario | Gov Exp Inc | Gov Inv Inc | Infras Inc |
|---|---|---|---|---|---|
| Real GDP | 4513.17 | 7.70 | 7.55 | 7.84 | 7.64 |
| Household Consumption | 4340.24 | 4.32 | 4.07 | 4.43 | 4.23 |
| Rural Consumption | 1876.20 | 3.98 | 3.69 | 4.07 | 3.87 |
| Urban Consumption | 2464.04 | 4.57 | 4.36 | 4.69 | 4.49 |
| Investment | 868.47 | 2.37 | -0.07 | 1.26 | 0.91 |
| Government Consumption | 710.52 | 3.00 | 4.0 | 3.00 | 3.23 |
| Real Exports | 533.95 | 9.73 | 10.05 | 10.15 | 9.87 |
| Real Imports | 1087.11 | 4.33 | 3.21 | 4.10 | 3.91 |
| Real Exchange Rate | 100 | 4.95 | 5.58 | 5.22 | 5.21 |
| Investment/GDP | 16.22 | 1.15 | -4.26 | -0.60 | -0.80 |
| Private Savings | 0.09 | -0.02 | -0.02 | -0.02 | -0.02 |
| Government Savings | 9.82 | 1.41 | -1.36 | 0.94 | 0.55 |
| Foreign Savings | 8.82 | -3.14 | -2.75 | -3.09 | -2.99 |

**Source: Simulation Results**

From Table 4, the expenditure increase leads to a slight increase (0.1 percent) in agricultural growth and services (0.1) but reductions in the growth of industry (0.9 percent). The fall in real GDP reduces the demand for imported commodities by 1.12 percent. The trade balance is maintained through a nominal depreciation in the currency (0.63 percent) which facilitates an increase in exports by 0.32 percent.

**Table 4: Sectoral Production Base Levels and Simulation Scenarios**

(Average Annual Percentage Change)

| | Initial Values | Base Scenario | Gov Exp Inc | Gov Inv Inc | Infras Inc |
|---|---|---|---|---|---|
| Agriculture | 2816.8 | 10.2 | 10.3 | 10.5 | 10.2 |
| Industry | 2628.4 | 6.0 | 5.1 | 5.9 | 6.0 |
| Services | 2440.4 | 4.7 | 4.8 | 4.9 | 4.8 |
| Total | 7885.6 | 7.3 | 7.1 | 7.4 | 7.2 |

Source: Simulation Results

On one hand, the increase in government spending should lead to a rise in the demand for factors and put an upward pressure on factor returns. However, given the fixed supply of these factors, the crowding out of investment forces a downward pressure on real returns tc factors. The net effect from Table 5 shows a reduction in real household incomes and hence a fall in real per capita consumption for all the household groups, except the public sector employed (HPUSE) group. This, together with the investment crowding out effect drives down the real GDP. Accordingly, the incidence, depth and severity of poverty as shown in Tables 9 and 10, increase for almost all the household groups with the exception of public sector emplcyed households.

**Table 5: Base Values & Simulation Scenarios: Real Household Consumption (Average Annual Percentage Change)** [14]

| | Initial levels | Base scenario | Gov Exp Inc | Gov Inv Inc | Infras Inc |
|---|---|---|---|---|---|
| HAF | 1015.8 | 4.2 | 4.1 | 4.4 | 4.1 |
| HPUSE | 880.8 | 5.9 | 6.0 | 6.1 | 5.8 |
| HPRSE | 756.0 | 5.9 | 5.7 | 6.0 | 5.8 |
| HNFSE | 827.3 | 4.9 | 4.9 | 5.1 | 4.8 |
| HNW | 860.4 | 5.8 | 5.3 | 5.8 | 5.7 |

Source: Simulation Results

**Increased Public Investment Spending Scenario**

In this policy scenario, outlays on current government consumption are assumed to be fixed while we explore the effects of increased public investments (Gov Inv Inc) on overall growth and poverty reduction. Such capital investments reinforce capital intensity (i.e. capital per worker) and thus have a formidable positive effect on productivity. This is in line with the theory of production where, productivity performance is tied to capital inputs or capital deepening (Mitchell, 2005). It further stimulates job creation and increases the profitability of the targeted sectors. Again, given the compositional differences in government investment spending, the change has different consequences for different sectors. Except for the industrial sector that shows a fall from 6.0 percent to 5.1 percent, the shift towards public capital expenditures in this policy scenario has a positive impact on the output of agricultural and service sectors. Overall real GDP increases to about 7.9 percent from the base growth of 7.7 percent.

[14] The abbreviations represent the following: HAF: agricultural farmers' households, HPUSE: Public sector employed households; HPRSE: private sector employed households; HNFSE: non-farm self-employed households; and HNW represents non-working households.

Intersectoral linkages and endogenous price feedbacks within the model capturing the full repercussion mechanisms in the economy of the increase in investment spending (together with an initial crowding out of private investment from 9.3 percent to about 4 percent) show a trade balance that is maintained through a nominal depreciation in the currency about (0.3 percent) which facilitates an increase in exports from 9.7 to 10.2 and a fall in imports from 4.3 to 4.1 (see Table 3). In the end, the investment spending policy scenario showed welfare gains for all the household groups. The welfare gains are mostly achieved through a rise in households' capital income gains.

**Increased Education Spending Simulations**

The remaining policy scenario involves a shift towards targeted specific spending in education, health and infrastructure which has been necessitated by the need of expanding these services in line with the GPRS (GOG, 2003). In the analysis on increased education spending, three alternative scenarios are considered. In the first scenario (Educ), the investment is assumed to be non-financed; in the second case (Educ-T), financing is done through increased taxes, and finally, Educ2 shows the case of increased spending on education with higher total factor productivity growth. The results from the education scenarios are summarized in Table 6.

**Table 6: Base Values and Simulation Results (Average Annual Percentage Change)** [15]

| Sector | Initial Value | Base Scenario | Anti-Aids | Anti-Aids-T | Educ. | Educ-T | Educ 2 |
|---|---|---|---|---|---|---|---|
| Real GDP | 4513.17 | 7.70 | 8.19 | 8.65 | 7.81 | 8.05 | 9.20 |
| Household Consumption | 4340.24 | 4.32 | 4.55 | 5.01 | 4.29 | 4.35 | 5.77 |
| Rural Consumption | 1876.20 | 3.98 | 4.01 | 4.66 | 3.87 | 4.01 | 5.42 |
| Urban Consumption | 2464.04 | 4.57 | 4.95 | 5.27 | 4.60 | 4.61 | 6.02 |
| Investment | 868.47 | 2.37 | -12.65 | 2.37 | -1.11 | 3.33 | 3.36 |
| Government Consumption | 710.52 | 3.00 | 6.34 | 6.34 | 4.28 | 4.28 | 4.28 |
| Real Exports | 533.95 | 9.73 | 11.57 | 10.64 | 10.67 | 10.17 | 11.47 |
| Real Imports | 1087.11 | 4.33 | 1.74 | 5.11 | 2.82 | 4.71 | 5.48 |
| Real Exchange Rate | 100 | 4.95 | 6.84 | 5.01 | 6.04 | 5.03 | 5.42 |
| Investment/GDP | 16.22 | 1.15 | -5.08 | 6.39 | -5.33 | 2.24 | 0.93 |
| Private Savings | 0.09 | -0.02 | -0.03 | -0.03 | -0.02 | -0.03 | -0.02 |
| Government Savings | 9.82 | 1.41 | -7.10 | 0.67 | -2.25 | 2.64 | 1.75 |
| Foreign Savings | 8.82 | -3.14 | -2.45 | -3.52 | -2.66 | -3.27 | -3.66 |

Source: Simulation Results

[15] The abbreviations represent the following Anti-Aids-T represents Anti-aids policy scenario, Anti-Aids-T represents the tax-financed anti-aids policy scenario. Educ represents non-financed increased education spending policy scenario, Educ-T represents increased education spending with flexible direct taxes, Educ-2 represents increased education spending with higher Total Factor Productivity (TFP) elasticity with respect to education

Given the assumption that direct taxes are fixed in the first scenario (Educ), the initial impact of the increase is to decrease government savings. This leads to a crowding out of investment and consequently to a reduction in real GDP as well as sectoral production growth rates. For the publicly funded scenario (Educ-T), government consumption is seen to increase from 3 percent to about 4.3 percent. The increased economic growth leads to an accelerated investment growth rate. The rising investment demand increases import demand as well as exports alongside the increase in GDP.

The scenario where additional spending in the sector is complemented with TFP increases (Educ2) has the largest impact. Sectoral production levels increase with higher growth rates being demonstrated for the services sector followed by the agricultural and services sector.

**Table 7: Sectoral Production Base Levels and Simulation Scenarios (Average Annual Percentage Change)**

| Initial values | Base scenario | Anti-Aids | Anti-Aids T | Educ | Educ-T | | Educ2 |
|---|---|---|---|---|---|---|---|
| Agriculture | 2816.8 | 10.2 | 11.5 | 11.0 | 10.7 | 10.4 | 11.8 |
| Industry | 2628.4 | 6.0 | 3.9 | 6.6 | 4.9 | 6.4 | 6.9 |
| Services | 2440.4 | 4.7 | 5.4 | 6.2 | 4.8 | 5.2 | 6.5 |
| Total | 7885.6 | 7.3 | 7.5 | 8.2 | 7.3 | 7.7 | 8.7 |

Source: Simulation Results

Looking at welfare (approximated here as changes in real per capita consumption), the results from Table 8 show an improvement in welfare for all the household groups with private sector employed households benefiting more from enhanced productivity through education policy.

**Table 8: Base Values & Simulation Scenarios: Real Household Consumption (Average Annual Percentage Change)**

| Initial values | | Base scenario | Anti-Aids | Anti-Aids-T | Educ | Educ-T | Educ2 | |
|---|---|---|---|---|---|---|---|---|
| HAF | 1015.8 | | 4.2 | 4.7 | 4.9 | 4.4 | 4.2 | 5.7 |
| HPUSE | 880.8 | | 5.9 | 6.0 | 6.6 | 5.7 | 5.9 | 7.3 |
| HPRSE | 756.0 | | 5.9 | 6.2 | 6.6 | 5.9 | 6.0 | 7.4 |
| HNFSE | 827.3 | | 4.9 | 5.7 | 5.6 | 5.2 | 4.9 | 6.3 |
| HNW | 860.4 | | 5.8 | 5.4 | 6.5 | 5.4 | 5.8 | 7.2 |

Source: Simulation Results

**Increased Health Spending Scenario-the case of HIV/AIDS Treatment**

HIV/AIDs is assumed to influence the real economy through its effect on the growth rate of the population, labour force and total factor productivity. The initial task here involved the estimation of the total cost of the government HIV/AIDS treatment programs. In this experiment, an estimated cost for an antiretroviral therapy was assumed to be around 50 percent of the total budget [16]. The Anti-Aids scenario (costless treatment) assesses the impact of minimizing the AIDS impact without requiring any intervention from government through increased taxation. Government consumption growth increases from 3 percent to 6.4 percent. This results in decreased government savings and leads to a crowding out of investment. The rate of real investment falls as a result but not to such an extent as to diminish the positive gains in real GDP growth rate of 8.2 percent compared with the base case of 7.7 percent.

A similar effect is shown at the sectoral level (Table 7) with reductions in growth levels for industry from 6.0 percent to about 4 percent and increases for

[16] The main calculations on the estimation of the total cost of government treatment programs were drawn from Levin and Mhamba (2005). The underlying assumptions included 50% coverage and the fact that HIV/AIDS treatment program will increase population, labour force and total factor productivity growth rates.

agriculture and services, with growth rates of 11.5 from 10.2 and 5.4 from 4.7 respectively. The increase in real GDP is also reflected in increases in the demand for imports alongside exports. The results in terms of per capita real consumption of households' growth rates show increases for all the households groups with the exception of non-working households that posts a fall.

The results from the publicly funded HIV/AIDS scenario shows that increased TFP from such an intervention allows production to increase and consequently increases the level of GDP. Government consumption growth again increases, rate of real investment growth remains constant while total household consumption increases. On the sectoral level, the growth acceleration is spread across the three main sectors, with higher resulting growth levels for the services sector followed by agriculture and then the industry in that order. Welfare gains are higher for all the household groups posting average gains of about 0.7 percentage points.

**Table 9: Poverty Measures for the Base Year and Simulations**

| | HAF | HPUSE | HPRSE | HNFSE |
|---|---|---|---|---|
| HNW | | | | |
| Poverty Incidence (alpha=0) | | | | |
| Base | 17.29 | 19.28 | 25.36 | 21.04 | 20.00 |
| Gov Exp Inc | 17.93 | 19.01 | 26.12 | 21.04 | 21.59 |
| Gov Inv Inc | 16.94 | 18.73 | 24.99 | 20.35 | 20.00 |
| Anti-Aids | 15.80 | 19.00 | 24.30 | 18.53 | 21.25 |
| Anti-Aids-T | 15.24 | 17.50 | 23.02 | 18.81 | 18.13 |
| Educ | 16.25 | 19.86 | 25.36 | 20.02 | 21.25 |
| Educ-T | 17.29 | 19.28 | 25.00 | 21.04 | 20.00 |
| Educ2 | 13.42 | 16.03 | 20.83 | 17.01 | 16.59 |
| Infras | 17.63 | 19.56 | 25.73 | 21.40 | 20.30 |

**Table 10: Poverty Measures for the Base Year and Simulations**

| HNW | HAF | HPUSE | HPRSE | HNFSE |
|---|---|---|---|---|
| Depth of Poverty (alpha=1) | | | | |
| Base | 7.15 | 9.02 | 9.85 | 8.56 | 7.99 |
| Gov Exp Inc | 7.29 | 9.43 | 10.14 | 8.56 | 8.62 |
| Gov Inv Inc | 6.88 | 8.89 | 9.71 | 8.28 | 7.99 |
| Anti-Aids | 6.52 | 8.89 | 9.44 | 7.54 | 8.49 |
| Anti-Aids-T | 6.30 | 8.19 | 8.94 | 7.65 | 7.06 |
| Educ | 6.89 | 9.29 | 9.85 | 8.15 | 8.49 |
| Educ-T | 7.15 | 9.02 | 9.71 | 8.56 | 7.99 |
| Educ2 | 5.55 | 7.50 | 8.01 | 6.92 | 6.63 |
| Infras | 7.29 | 9.15 | 9.99 | 8.71 | 8.11 |
| Severity of Poverty (alpha=2) | | | | |
| Base (in %) | 4.16 | 5.30 | 5.41 | 4.96 | 4.30 |
| Gov Exp Inc | 4.24 | 5.54 | 5.57 | 4.96 | 4.64 |
| Gov Inv Inc | 4.01 | 5.22 | 5.33 | 4.80 | 4.30 |
| Anti-Aids | 3.79 | 5.22 | 5.18 | 4.37 | 4.57 |
| Anti-Aids-T | 3.66 | 4.81 | 4.91 | 4.43 | 3.89 |
| Educ | 4.01 | 5.46 | 5.41 | 4.72 | 4.57 |
| Educ-T | 4.16 | 5.30 | 5.33 | 4.96 | 4.30 |
| Educ2 | 3.23 | 4.41 | 4.44 | 4.01 | 3.56 |
| Infras | 4.24 | 5.38 | 5.49 | 5.05 | 4.36 |

Source: Author's Calculations

**Increased Transport Infrastructure Spending Simulation**

This simulation (Infras-T) involved the doubling of government consumption and investment in transportation, assumed to be financed through an increase in direct taxes. The simulation results, together with the non-publicly financed scenario (not shown) appeared not to produce any significant changes compared with the base in terms of real GDP growth, sectoral production growth rates (except for a slight 0.1 percentage point increase for the services sector) and real household consumption growth rates.[17]

[17] The Infras-Inc simulation did not produce significant changes from the base scenarios and as such was excluded from the presentations in tables 9 and 10

**Concluding Remarks**

Two main lessons can be drawn from this study. First, various types of government spending have differential impacts on economic growth and poverty reduction, implying greater potential to improve efficiency of government spending by reallocation among sectors. Second, governments should reduce their spending on unproductive sectors and rather give priority to increasing its spending on production-enhancing investments such as education, health and infrastructure. This type of spending not only yields high returns to agricultural production, but also has a large impact on poverty reduction since most of the poor still reside in rural areas and their main source of livelihood is agriculture. In concluding, it is significant to mention that the findings from these analyses are entirely conditioned by the data used and model specifications and should be interpreted as such. However, additional sensitivity analysis in substitution and transformation elasticities, which are the core parameters of the applied CGE approach, indicates an acceptable robustness of the modeling results obtained.

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## Appendix 1: Table AI: Social Accounting Matrix for Ghana 1999 (Billions of Cedis)

| | ACOCOA | AOAGRG | AMANUF | AOINDG | ATRANSG | AOSERG | CAGRG | CINDG | CSERG | LABSM | LABSF | LABUM | LABUF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ACOCOA | | | | | | | 504.1 | | | | | | |
| AOAGRG | | | | | | | 2017 | | | | | | |
| AMANUF | | | | | | | | 972 | | | | | |
| AOINDG | | | | | | | | 1805.2 | | | | | |
| ATRANSG | | | | | | | | | 350.2 | | | | |
| AOSERG | | | | | | | | | 1981.7 | | | | |
| CAGRG | 56.6 | 226.5 | 59.2 | 109.9 | | | | | | | | | |
| CINDG | 26.7 | 107 | 251.5 | 467.1 | 58.5 | 329.5 | | | | | | | |
| CSERG | 44.5 | 178.2 | 66.2 | 123 | 85.4 | 483.6 | | | | | | | |
| LABSM | 70 | 280.2 | 52.5 | 97.5 | 32.4 | 183.5 | | | | | | | |
| LABSF | 3.5 | 14.1 | 2.6 | 4.9 | 1.6 | 9.2 | | | | | | | |
| LABUM | 217.2 | 868.7 | 162.8 | 302.3 | 100.4 | 568.8 | | | | | | | |
| LABUF | 59.6 | 238.2 | 44.6 | 82.9 | 27.5 | 156 | | | | | | | |
| CAP | 11.1 | 44.6 | 168.2 | 312.3 | 43.6 | 246.8 | | | | | | | |
| HAF | | | | | | | | | | 156.2 | 7.8 | 484.4 | 132.8 |
| HPUSE | | | | | | | | | | 150 | 7.5 | 465 | 127.5 |
| HPRSE | | | | | | | | | | 132.3 | 6.6 | 410 | 112.4 |
| HNFSE | | | | | | | | | | 139.6 | 7 | 432.7 | 118.6 |
| HNW | | | | | | | | | | 138.2 | 6.9 | 428.3 | 117.4 |
| ENT | | | | | | | | | | | | | |
| GOV | | | | | | | | | | | | | |
| YTAX | | | | | | | | | | | | | |
| INDTAX | 14.9 | 59.5 | 164.4 | 305.3 | 0.8 | 4.3 | | | | | | | |
| TARRIFS | | | | | | | 56.3 | 316 | 3.2 | | | | |
| ROW | | | | | | | 62.4 | 985.9 | 211.9 | | | | |

## Appendix 1: Table AI (Continued): Social Accounting Matrix for Ghana 1999 (Billions of Cedis)

| | CAP | HAF | HPUSE | HPRSE | HNFSE | HNW | ENT | GOV | YTAX | INDTAX | TARRIFS | ROW | S-I | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ACOCOA | | | | | | | | | | | | | | 504.1 |
| AOAGRG | | | | | | | | | | | | | | 2017 |
| AMANUF | | | | | | | | | | | | | | 972 |
| AOINDG | | | | | | | | | | | | | | 1805 |
| ATRANSG | | | | | | | | | | | | | | 350.2 |
| AOSERG | | | | | | | | | | | | | | 1982 |
| CAGRG | | 435.7 | 408.4 | 357.6 | 380.4 | 383.5 | | | | | | 232.8 | -10.9 | 2640 |
| CINDG | | 227.9 | 214 | 187.4 | 199.3 | 200.8 | | | | | | 278.6 | 1531 | 4079 |
| CSERG | | 150.6 | 141.4 | 123.9 | 131.7 | 132.7 | | 732.3 | | | | 6.6 | 146.9 | 2547 |
| LABSM | | | | | | | | | | | | | | 716.1 |
| LABSF | | | | | | | | | | | | | | 35.9 |
| LABUM | | | | | | | | | | | | | | 2220 |
| LABUF | | | | | | | | | | | | | | 608.8 |
| CAP | | | | | | | | | | | | | | 826.6 |
| HAF | 25.8 | -20.8 | | | | | 9.5 | 10 | | | | 23.3 | | 829 |
| HPUSE | 25.3 | | -20.5 | | | | 5 | 5.5 | | | | 12.4 | | 777.7 |
| HPRSE | 21.3 | | | -18.1 | | | 3.5 | 4 | | | | 8.9 | | 680.9 |
| HNFSE | 23.8 | | | | -19 | | 5 | 5 | | | | 11.4 | | 724.1 |
| HNW | 28.8 | | | | | -18.7 | 6.5 | 7 | | | | 15.9 | | 730.3 |
| ENT | 560 | 4.5 | 3.7 | 3.2 | 3.5 | 3.8 | 523.7 | 195.5 | | | | 74.5 | | 1392 |
| GOV | | | | | | | | | 479.1 | 549.2 | 375.5 | 190.1 | | 1594 |
| YTAX | | 33.3 | 31.3 | 27.4 | 29.1 | 29.4 | 200.2 | 128.4 | | | | | | 479.1 |
| INDTAX | | | | | | | | | | | | | | 549.2 |
| TARRIFS | | | | | | | | | | | | | | 375.5 |
| ROW | 121.5 | 1 | 1 | 0.8 | 0.9 | 0.9 | | | | | | | | 1386 |
| S-I | | -3.3 | -1.8 | -1.3 | -1.7 | -2.3 | 638.8 | 506.2 | | | | 532.1 | | 1667 |
| TOTAL | 826.5 | 828.9 | 777.5 | 680.9 | 724.2 | 730.1 | 1392 | 1594 | 479.1 | 549.2 | 375.5 | 1386.6 | 1667 | |

**Appendix 2: Table A2: Values of Elasticity of Substitution and Transformation**

| SECTOR | CET | CES | FACTORS | LABOUR |
|---|---|---|---|---|
| Agriculture | 1.25 | 1.5 | 0.75 | 1.25 |
| Industry | 1.25 | 0.8 | 0.75 | 1.25 |
| Services | 1.25 | 0.8 | 0.70 | |