PUBLIC SPENDING, GROWTH, AND POVERTY ALLEVIATION IN SUB-SAHARAN AFRICA: A DYNAMIC GENERAL EQUILIBRIUM ANALYSIS

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Abstract

This study explores the impact of government policy on long-run growth and poverty in Sub-Saharan Africa (SSA), drawing on insights from cross-country research on the direct and indirect links between public spending and total factor productivity (TFP) growth. Methodologically, we use a dynamic, computable general equilibrium (CGE) model that is solved for the period 1998-2015. The model keeps track of the accumulation of major assets and captures the impact of government spending (disaggregated by function into agriculture, human capital, transportation-communication, defense, and other) on TFP growth. The model is applied to a stylized country-level data set that reflects the structural characteristics of economies in SSA and incorporates empirically estimated links between TFP and different types of public spending. Simulations of alternative government spending strategies suggest that a reallocation of spending to more productive areas, most importantly agriculture, and increased efficiency of government spending are key elements in pro-poor growth strategies. The returns from increased government spending in target areas without cuts elsewhere are lower since, in the absence of foreign financing, less resources is available for private consumption and investment. By releasing domestic resource constraints, foreign grant financing can play a crucial role in strategies aimed at drastic improvements in economic performance, including the realization of the Millennium Development goal of halving poverty by 2015.

1. Introduction[1]

The purpose of this paper is to explore the impact of government policies on long-run growth and poverty in Sub-Saharan Africa (SSA). Methodologically, we analyze growth in an archetype SSA country, using a dynamic computable general equilibrium (CGE) model that is an extension of the static, standard CGE model in Lofgren et al. (2002). In addition to incorporating time, the model extends the earlier static model by incorporating the influence of economic openness and government spending on factor productivity. The model is applied to a stylized database that captures structural characteristics of the economies of SSA and draws on insights from research on the effects of different public spending policies on economic performance. The economywide approach supports analysis of trade-offs and synergies between different public investment strategies.

Section 2 provides a brief review of the literature on the determinants of growth and poverty reduction, with an emphasis on the role of public policy, which informs the subsequent sections of this study. The synthesis draws on a large body of econometrically-based, cross-country analysis. In Section 3, the model structure is explained and situated in the context of the literature on dynamic, economywide, policy models. We also present the stylized model database and the ability of the model to replicate stylized facts from the growth and development literature. In Section 4, we present and analyze a set of simulations that explore the links between growth, poverty, and government policies. In Section 5, we summarize our findings and identify high-priority areas for future research. In a set of appendices, we provide supplementary information on the database, and a more extensive review of the empirical literature on growth and poverty reduction.

[1] The authors thank Moataz El-Said for professional research assistance.

2. Background[2]

In recent decades, a considerable research effort has been made to untangle the determinants of growth and poverty, including public policy. Although there is a lack of consensus on many of its findings, this body of research nevertheless provides a valuable source for stylized facts and parameter estimates that are useful in the construction of a CGE model and its database.

One strand of this literature uses growth accounting to disaggregate GDP growth into factor accumulation and TFP growth. The picture that emerges from this work is that in SSA, average TFP growth has been negative in recent decades. Across all developing countries, the TFP share in GDP growth varies but may typically be 33-50 percent. Recent research suggests that TFP growth may be of increasing importance and now accounts for the bulk of cross-country growth gaps. At a more disaggregated level, TFP growth has in recent decades been faster for agriculture than manufacturing in countries in all regions, including SSA.

The econometric literature on growth determinants constitutes a second strand. This literature has tried to unravel the determinants of growth, typically relying on single-equation, cross-country regressions of a measure of GDP on a set of potential determinants, selected in light of modern growth theory. In recent years, this literature has in some cases been extended to time-series analysis, analysis at the single-country level, and estimation of simultaneous-equation systems. The major growth determinants have been divided into accumulation of factors (physical capital, labor, and human capital), public policy, economic openness, and miscellaneous other conditions, often including aspects related to politics or geography.

Although this body of work has suffered from econometric problems and theoretical shortcomings (in addition to the data problems that hamper most lines of analysis), it is nevertheless possible to extract some general findings. In general, the results indicate that accumulation of labor and physical capital has a robust, positive impact on growth. When physical capital has been disaggregated into private and public, the growth effect has been more consistently positive for private capital. This may reflect

[2] This section is a synopsis of the more detailed review that is included in Appendix 2. For sources, please refer to the appendix.

that, due to corruption and other factors, a large share of public investment has not generated public capital as well as the fact that, in addition to growth-enhancing investments that complement private sector production, public investment also has included growth-retarding investments that compete with more efficient private sector investments.

For human capital, the evidence is less clear and differs widely across studies. Theoretical growth models with human capital permit increases in human capital per worker to raise labor productivity. On balance, the empirical evidence suggests that education (typically proxied by an average level of schooling measure) has a positive growth effect whereas the macro-level links between health indicators and growth are less clear.

From a policy perspective, it would be useful if the analysis could be more disaggregated and if the analysis of human capital could be extended to consider the impact of public spending as opposed to indicators of education and health status. The analysis in Fan and Rao (2004), which we will draw on in the model-based analysis in this study, responds to these demands. They estimate Cobb-Douglas production functions for Africa, Asia, and Latin America with national GDP as the dependent variable, and, as independent variables, labor, private capital, and public capital stocks. The latter are disaggregated into agriculture, education, health, transportation and telecommunication, social security, and defense. These government capital stock variables were constructed from past government spending (both current and capital) in each functional area. For the most part, the coefficient of these determinants (which may be interpreted as representing elasticities) had the expected signs (positive except for defense) and most were significant at the 10 percent level. The only coefficients with the "wrong" sign were those for education spending in Africa and Latin America, which both had negative signs. However, for both regions, the combined marginal impact of human capital (education and health) spending was positive. For Africa, the strongest positive effect was for health spending followed by agriculture, while defense spending has a strong negative effect (Fan and Rao 2004, pp. 14-15).[3] In other studies that have used a disaggregated approach,

[3] The estimated elasticities of GDP with respect to health and defense are +0.21-0.22 and –0.17-0.18, respectively. For agriculture, the elasticity is around +0.05.

very strong growth effects have been identified for investments in transportation and communications infrastructure. For agriculture, the impact of infrastructure investments may be particularly strong given that transportation costs often represent a large share of output prices.

The growth literature has also addressed aspects of policy and economic performance that are not readily summarized on the basis of government budget data. There is considerable agreement that macroeconomic stability, often proxied by low inflation or a low budget deficit relative to GDP, has a positive impact on growth. Although the role of trade has become contentious, it seems that, on balance, an open trade policy and a strong involvement in foreign trade promote growth. This does not mean that the specific mechanisms are well understood or that openness invariably is growth promoting. On the contrary, economic structure and domestic policies are likely to have a strong conditioning impact on the effects of trade liberalization and economic openness.[4]

The fact that many cross-country analyses found a negative and significant SSA dummy has stimulated a search for additional growth determinants with special relevance for this region. The addition of variables indicative of geography ("landlockedness"), demographics (age dependency and the gap between growth in labor force and population), and external factors (terms-of-trade shocks and trading partner growth) has eliminated the negative dummy. Findings also suggest that, once these additional growth determinants are accounted for, the marginal responses of countries in SSA to changes in their economic environment are no different from those of countries in other regions.

The cross-country regression literature strongly suggests that, on average, more rapid GDP growth is associated with more rapid poverty reduction — "growth is good for the poor." The elasticity of the headcount poverty rate with respect to mean per-capita consumption is commonly estimated to be between –2 and –3 whereas the estimates for the poverty gap and squared poverty gap measures are slightly higher. Empirical findings suggest that the effectiveness of growth in reducing poverty often is higher if growth is biased in favor of rural areas, if initial inequality is lower and/or if the initial state of rural

[4] For example, see case studies of Tanzania (Wobst 2001), Zimbabwe (Bautista *et al.* 2003), and Mozambique (Tarp *et al.* 2002).

development and human resource development is more favorable. Pro-poor public expenditures and land tenure reform can play a role in skewing the growth benefits in favor of the poor. In general, these findings confirm the notion that there may be synergies between different policies and structural characteristics — the consequences of any given policy on economic indicators depend on the nature of other policies and structural characteristics.

In sum, the literature on growth in developing countries suggests a number of desiderata for simulation models of developing countries. Such models should be able to capture a set of stylized facts concerning the relationships between poverty reduction and GDP, including the roles of labor force growth, accumulation of private capital, economic openness, and productivity-enhancing public spending (both on agriculture, human development (education and health) and physical infrastructure (especially transportation and communications). In addition, simulation models should permit the government to influence economic performance via policies that contribute to economic openness and enhance private capital accumulation (for example by raising the incomes of agents with high savings). Models should also be able to address the trade-offs that are involved in economic development, among other things between private capital accumulation and government spending.

Finally, the literature includes a wide range of estimates of the impact of different government interventions and economic openness on growth and poverty. Given that it primarily is based on reduced-form models, underlying structural mechanisms are typically left out. Thus, builders of simulation models face the challenge of exploring the consequences of alternative estimates of and channels for the links that have been identified in the econometric literature.

3. Dynamic Poverty Analysis: Model Structure and Database

In this section, we present a dynamic CGE model and a database that is representative of an archetype SSA country. The model is an extension of the static, standard CGE model in Lofgren et al. (2002). Its formulation incorporates insights from the literature on the potential channels through which different kinds of government spending influence productivity and economic performance.

We first situate our model in the literature on dynamic economywide policy models, and then describe the model structure and its database. The Appendix presents additional information on the database.

Background

There have been two bursts of work on dynamic models in the post-war period. The first work program concerned neoclassical growth models — starting from the "Solow-Swan" model — and ran from the mid-1950s until the late-1960s.[5] This literature focused on the mathematical properties of a variety of optimal growth models, with little empirical work. This program died out in the 1970s, largely, as Barro and Sala-i-Martin (1995, p. 12) argue, because of its "lack of empirical relevance."

The second burst of work, which started in the mid 1980s, was based on "endogenous growth" models. Considerable progress has been made in developing analytic dynamic models that seek to incorporate the stylized facts of long-run growth as it has occurred in the past in the currently developed countries and as it is unfolding in the less developed countries in the post-war period.[6] In particular, the new approach has sought to "endogenize" the process of technical change in the models, linking productivity growth to factors such as R&D investment, capital growth (human and physical), and international linkages through trade.[7] The standard approach is to assume that the economy maximizes some kind of intertemporal utility function and makes choices regarding variables like the rate of savings, investment in various kinds of physical or human capital, and investment in "research" or "knowledge creation" that affect "technical change" or "TFP growth" — where research or knowledge have elements of being public goods. These theoretical models, and their empirical counterparts, rely heavily on the mathematics of dynamic optimization and the analysis of alternative steady-state growth paths, with limited discussion of "adjustment processes" by which the steady-state path is reached.[8]

[5] For an extensive survey of the neoclassical growth literature in this, see Burmeister and Dobell (1970).
[6] A major part of this new work program, at least as practiced by Barro and various coauthors, has involved cross-country empirical analysis to keep the theoretical models grounded in historical experience.
[7] A textbook treatment of this literature is Aghion and Howitt (1998).
[8] For a notable exception, see Diao *et al*. (1998) who focus on adjustment paths to steady states.

In these models, agents are assumed to optimize with perfect foresight and correct knowledge about the forces at work — these models all implicitly or explicitly embody a "rational expectations" notion of dynamic equilibrium. Agents generally operate in perfectly competitive markets. However, the models are also characterized by knowledge diffusion, spillovers, and externalities, which leads to the failure of competitive markets to achieve optimality. These market failures affect the behavior of agents, and hence government policy can play a significant role in determining long-run growth.

While the work program on endogenous growth models has paid appropriate attention to the linking of theory and empirical cross-country analysis, the mathematics of dynamic optimization models constrains the "domain of applicability" of the analytic growth models. These models must, of necessity, focus on a very few driving forces and make very strong assumptions about agent behavior and the working of markets in order to remain mathematically tractable. Developing countries, on the other hand, are characterized by great heterogeneity in initial conditions, market structures, degree of market integration, nature of constraints on agent behavior, and role of government.

Since the emergence of the growth literature, there has been a considerable, although narrowing, gap between growth theorists and development economists. In the words of Barro and Sala-i-Martin, "development economists … retained an applied perspective and tended to use models that were technically unsophisticated but empirically useful." In development economics, CGE models have become a commonly-used economywide approach. They build on and generalize earlier generations of programming and input-output models, most importantly by incorporating endogenous prices and using formulations that permit a detailed treatment of households and income distribution. The CGE literature has incorporated features from, and contributed to, the growth literature.

The dynamic CGE literature includes two strands, dynamic recursive models and optimal growth models.[9] In recursive models, all agents (private and public) make their decisions on the basis of past and current conditions, with no role for forward-looking expectations about the future. Agents are either myopic, so they do not care about the

[9] Dervis *et al.* (1982, pp. 169-181) and Diao et al. (1998) explain the structure of recursive and intertemporal dynamic models, respectively.

future, or are ignorant — nobody can or does know anything about the future, so all behavior must be based on information from the past. Alternatively, one can assume that the economy is on a stable (balanced) growth path, and hence agents can simply assume that the future will be "like" the present, and need no other information to behave rationally.

A recursive dynamic model can be divided into a "within-period" module (in essence a static CGE model) and a "between-period" module that links the within-period modules by updating selected parameters (typically including factor supplies, population, and factor productivity) on the basis of exogenous trends and past endogenous variables. Information from past solution can also be used in the between-period modules to generate expectations about the future, which might be used to affect agent behavior in later within-period modules. Dynamic-recursive models can be, and often are, solved recursively — the within-period modules are solved separately in sequence, and the between-period modules are solved to provide parameters needed for the within-period model in the succeeding period.

The second strand of empirical dynamic analysis is with optimal growth models. These may be viewed as an applied counterpart to the theoretical neoclassical optimal growth models used in the endogenous growth literature. All agents have "rational expectations" and make intertemporally optimal decisions — everybody knows everything about the future, and they use that information in making decisions. Empirical models in this tradition solve simultaneously for all variables in all time periods, often looking for infinite-horizon, steady-state, balanced growth paths.

Recursive models are used extensively in empirical policy analysis while intertemporal optimal growth models that can be solved analytically are more important in the theoretical literature. Both modeling traditions (as well as many static models) have incorporated features highlighted by the growth literature, including endogenous determinants of productivity growth. Since they are to complex to solve analytically, CGE models in both traditions have to be solved empirically and are used in simulation analysis.

In its current formulation, our model belongs to the class of dynamic-recursive models: agents have no knowledge about the future. In the absence of empirical support

for the assumption that private agents act on the basis of perfect foresight, a dynamic recursive formulation is certainly plausible for simulation analysis. We do not explicitly specify the factors that prevent private agents from realizing intertemporally optimal patterns of savings and investment (e.g., market imperfections, credit constraints, and/or the belief that any knowledge about the future is too uncertain to act on), but we do explore the potential gains from different policy strategies, given that agents do not have perfect foresight. The model is solved for a finite horizon and is used to explore the properties of a "growth episode" characterized by initial conditions, particular dynamic forces at work, growth linkages, agent behavior, institutional constraints, and the length of the time period.[10]

We integrate the within-period and between-period modules in one set of simultaneous equations, making it possible to solve the full model in a single pass for the planning horizon. Apart from being efficient computationally, this approach support implementation non-recursive dynamic models, either by adding an objective function or by reformulating the first-order conditions of selected agents to incorporate forward-looking behavior. As an example, an objective function can be specified measuring discounted inter-temporal social welfare. In the constraint set (the rest of the model), some government policies could be endogenized[11] Maximization of the objective with respect to the choice of values for the free policy variables would generate a general equilibrium solution with perfect foresight on the part of the government, with or without perfect foresight or freedom of action on the part of private agents. It would also be feasible to reformulate the first-order conditions of private agents to incorporate more knowledge about future periods, with perfect foresight as a special case.

Our model is designed to analyze the links between government policies, growth, and poverty reduction in SSA. Synthesizing the empirical and theoretical literature, we incorporate causal links between factor productivity and different types of government spending and openness to foreign trade. We use and extend formulations that have

[10] Our notion of a "growth episode" has much in common with Kuznets' (1966) notion of an "economic epoch," which he characterized as a long period whose dynamics were driven by the working out of what he called an "epochal innovation." Our episodes, however, are shorter, characterized by medium-run "drivers" or "engines" of growth.

[11] If no policy choices are endogenized, the model is "square" and there is only one feasible solution. In this case, the addition of the objective function does not influence the model solution.

appeared in other CGE models, both static and dynamic. Other model features, which are of particular importance in an SSA setting, include household consumption of non-marketed (or "home") commodities and an explicit treatment of transactions costs for commodities that enter the market sphere

Model Structure

The model is formulated as a simultaneous equation system, including both linear and non-linear equations. The equations are divided into a within-period module, which defines the decisions in each time period, and a between-period module, which updates the stocks of different endowments over time.

In any given time period, the equations capture the full circular flow of payments including production (activities producing outputs using factors and intermediate inputs), consumption (by households and the government), investment (private and public), trade (both domestic and foreign), other government revenue and spending activities, as well as the market equilibrium conditions, macro balances and dynamic updating equations under which the agents operate.

Within-period module

In essence, the within-period module defines a one-period, static CGE model.[12] It includes the first-order conditions for optimal production and consumption decisions, given available technology and preferences. The technology is defined by a nested, two-level structure with, at the top, a Leontief aggregation of value-added and an aggregate intermediate and, at the bottom, a CES aggregation of primary factors and a Leontief aggregation of intermediate inputs. Consumer demand is given by the linear expenditure system (LES), derived from a maximization of a Stone-Geary utility function subject to a spending constraint. Both producers and consumers behave myopically, considering only current conditions when making their decisions. They take relevant prices (of outputs, factors, and intermediate inputs) as given, and markets are assumed to be competitive.

[12] Apart from the fact that variables are time indexed, the "within-period" module is very similar to the standard, static CGE model developed by researchers at IFPRI. We keep the discussion of these features brief, focusing our attention on new features. The reader is referred to Lofgren *et al.* (2002) for more details on model features.

For primary factors, demanded by production activities, aggregate supplies are fixed. For each factor, an economywide wage variable adjusts endogenously to clear the market, equating the quantity demanded with the quantity supplied. Each activity pays an activity-specific wage that is the product of the economywide wage and a fixed, activity-specific wage (distortion) term.

The bulk of household incomes comes from factors — each household group receives factor incomes in proportion to the share that it controls of each factor stock. The main items on the household spending side are direct taxes, savings, and consumption. Taxes and savings are determined on the basis of simple rules.

The government earns most of its incomes from direct and indirect taxes and spends it on consumption, investment, and interest payments (on its foreign and domestic debt). Real government demand (consumption and investment) is exogenous disaggregated by function. According to the aggregate investment function of the model, private investment is a fixed share of nominal absorption.

All commodities (domestic output and imports) enter markets. For marketed output, the ratio between the quantities of exports and domestic sales is positively related to the ratio between the corresponding supply prices. The price received by domestic suppliers for exports depends on the world price, the exchange rate, transactions costs (to the border), and export taxes (if any). The supply price for domestic sales is equal to the price paid by domestic demanders minus the transactions cost of domestic marketing (from the supplier to the demander) per unit of domestic sales. If the commodity is not exported, total output goes to the domestic market.

Domestic market demand is the sum of demands for household market consumption, government consumption, private and public investment, intermediate inputs, and transactions (trade and transportation) inputs. Typically, domestic market demands are for a composite commodity that is made up of imports and domestic output. The ratio between the demand quantities for imports and domestic output is a function of the ratio of their demand prices. Total market demand is directed to imports for commodities that lack domestic production and to domestic output for non-imported commodities. Import prices paid by domestic demanders are determined by world prices, the exchange rate, import tariffs, and the cost of a fixed quantity of transaction services

per import unit (which covers the cost of moving the commodity from the border to the demander).[13] Prices paid by demanders for domestic output include the cost of transaction services (in this case reflecting that the commodity was moved from the domestic supplier to the domestic demander). Prices received by domestic suppliers are net of this transactions cost. Flexible prices equilibrate demands for and supplies of domestically marketed domestic output. In international markets, the small-country assumption is followed: export demands and import supplies are infinitely elastic at exogenous world prices.

In its balance of payments, the country receives foreign exchange in the form of export revenue, net transfers to domestic institutions, foreign borrowing by the government (which may be negative if the government is repaying debt), foreign grants, and foreign direct investment. These earnings are allocated to imports, interest payments on foreign debt, and repatriation of profits to foreign investors. Among these components, exports, imports, interest payments, and profit repatriation are endogenous, while the rest is exogenous — in effect imposing a fixed current account deficit.

For the three macroeconomic balances of the model — government balance, savings-investment balance, and balance of payments — macro closure rules are required for the model.[14] This model incorporates a simple set of assumptions about how macro adjustments operate. For the government balance, government savings is the flexible, balancing variable. For the balance of payments, endogenous adjustments in the real exchange rate (influencing the trade balance) assure equality between flows (including net foreign borrowing and grants) and outflows of foreign exchange. In the savings-investment balance, real government investment is exogenous while private investment is a fixed share of absorption. Endogenous uniform percentage point adjustments in household savings rates assure that total savings is sufficient to finance investment.

The CGE model determines only relative prices and a numéraire is needed to anchor the aggregate price level. The consumer price index (CPI) is the numéraire price

[13] Note that these transactions costs are not *ad valorem* – the rates (the ratio between the margin and the price without the margin) change when there are changes in the prices of transactions services and/or the commodities that are marketed.

[14] For a discussion of macro closures in the context of the standard CGE model, see Lofgren et al. (2002, pp. 13-17).

index, so all changes in nominal prices and incomes in simulations are relative to a fixed CPI.

Finally, the within-period block also includes relationships defining TFP by activity and individual factor productivity by factor and activity. For each activity, two sources of endogenous change in TFP are covered: (i) changes in the economy-wide trade-GDP ratio relative to the base year ratio;[15] and (ii) changes in government capital stocks, defined by functional spending area. These relationships are captured by various constant-elasticity functions linking TFP or the productivity of a specific factor to different types of government expenditure and trade. The elasticity parameters are activity-, factor- and function-specific, making it possible to specify different channels and magnitudes for the productivity effects of different types of government spending.

Between-period module

The between-period module covers the links between time periods. It includes equations that define the stocks of different assets: factors (land, labor, and private capital), government capital stocks, and foreign debt (held by the government). All stocks are associated with specific institutions. This information is used to define the shares of each institution in total income of each factor and the interest payments of the government to the rest of the world.

Labor and land stocks are updated on the basis of exogenous trends. The population in each time period is also exogenous. The accumulation of private and government capital stocks and foreign government debt is endogenous. For both capital categories, the stock in any given year depends on past stocks, new investment, and the depreciation rate. In the accumulation equation for government capital, real investment is broadly defined to include both current and capital spending. The stock of foreign debt depends on past stocks and new borrowing.

The model is solved annually for the period 1998-2015. Each model solution generates an extensive, economywide set of results covering sectoral, household, and macro data in each solution period. In our analysis, we summarize this information in a

[15] The trade to GDP ratio is defined in real terms, using base-year prices, on the assumption that TFP is related to changes in real variables, not relevant market shares.

set of indicators, including data on macroeconomic growth, changes in the structure of production and trade, and the evolution of disaggregated household welfare and poverty.

The poverty indicators are computed on the basis of a representative-household (RH) approach in a separate poverty module. In this module, the within-group household distribution is specified by a lognormal frequency function. The 1998 poverty lines in rural and urban areas are calibrated to exogenous poverty rates; we use a log standard error of 0.35 for all RHs (household groups in the model). In the computation of poverty indicators for each simulation, the CGE model feeds the poverty module with simulated data for mean consumption and CPI for each RH.[16]

Database: Structural features of an archetype country in SSA

The model database, which captures the structural features of an archetype country in SSA, consists of a SAM, data on labor force and population, and various elasticity parameters for functions specifying production, import demand, export supply, consumer expenditures, and links between government investment, trade, and sectoral total factor productivity.

The SAM was constructed on the basis of a database extracted from the World Development Indicators that covered most countries in SSA (World Bank 2001) and a disaggregated SAM for Zimbabwe, drawing on information in other SSA SAMs.[17] As a first step, the World Bank database was used to build a Macro SAM for SSA (excluding South Africa) — see Table 2. Table 3 summarizes part of the information in the Macro SAM in a more familiar table format, including some additional items, and compares the figures for SSA to all developing countries.

In the construction of the Macro SAM, data for the different countries in the region were weighted by GDP share. Each entry was normalized to shares of GDP at market prices. Tables 2 and 3 indicate that, on the spending side, private consumption is the main item — 75.5 percent of GDP; out of this, 4.5 percent of GDP is home consumption. Absorption (the sum of private and government consumption, and

[16] For further details and a discussion of alternative approaches to poverty and inequality analysis in a CGE framework, see Lofgren et al. (2003).

[17] IFPRI research projects have generated SAM data for a number of Sub-Saharan African countries, including Malawi, Mozambique, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe. See www.ifpri.org. The Zimbabwe SAM is described in Bautista and Thomas (1999).

investment) is 109 percent of GDP, which implies a trade deficit of 9 percent. Total foreign trade (sum of exports and imports) accounts for close to 70 percent of GDP.

Table 1. Model disaggregation

Account category	Disaggregation
Activities (14)	Agriculture (6): Large-scale export crop, small-scale export crop, large-scale non-export crop, small-scale non-export crop, large-scale livestock, small-scale livestock Industry (4): Mining, Food-fiber, Domestic manufacturing, Import-substituting manufacturing Services (4): Construction, Trade and transportation, Public services, Other services
Factors (5)	Labor (2): Unskilled, Skilled Capital Land (2): Large-scale, Small-scale
Institutions and related accounts (12)	Households: Rural upper-income, Rural lower-income, Urban upper-income, Urban lower-income
	Government Auxiliary government accounts: interest payments; tax accounts (direct taxes, export taxes, import tariffs, other indirect taxes)
	Rest of the world
	Savings-Investment account (consolidated)

Note: The model also includes commodities, one for each activity except for Large-scale export crop and small-scale export crop activities which produce the same commodity.

Investment (20 percent of GDP) is financed in roughly equal shares by private, government, and foreign savings (the current-account deficit). Due to a surplus in non-trade items in the current account, the current-account deficit is smaller than the trade deficit. Current government operations represent 21 percent of GDP. On the spending side, consumption is the main item (14 percent of GDP). The major financing sources are import taxes (7 percent of GDP), direct taxes (on households and enterprises; 5 percent), and transfers from abroad (4 percent). Table 3 shows that, compared to the broader group of all developing countries, SSA is characterized by the allocation of a smaller GDP share to investment, a larger share to consumption, and a large trade deficit (as opposed to a slightly positive trade balance). The full micro SAM, which is the main data source for the model, is displayed in Appendix Table A.1. The micro SAM was built by

Table 2. Macro SAM for archetype country in SSA, 1998 (% of GDP at market prices)

		1	2	3	4	5	6	7	8	9	10	11	Total
1	**Activities**		159.4		4.5								164.0
2	**Commodities**	72.0	18.9		70.3	13.9	30.2	20.1					225.5
3	**Factors**	91.1											91.1
4	**Households**			85.4	1.3		4.5						91.1
5	**Government**				2.9		4.1		5.3	6.6	1.4	0.8	21.1
6	**Rest of the world**		39.1	5.8		1.0							45.9
7	**Saving-Investment**				6.9	6.2	7.0						20.1
8	**Direct taxes**				5.3								5.3
9	**Import taxes**		6.6										6.6
10	**Export taxes**		1.4										1.4
11	**Activity taxes**	0.8											0.8
Total		164.0	225.5	91.1	91.1	21.1	45.9	20.1	5.3	6.6	1.4	0.8	

Source: World Bank (2001) and authors' calculations.

Table 3. Macro aggregates for SSA and all developing countries, 1998 (% of GDP at market prices)

Item	SSA	All developing countries
Private consumption (C)	74.9	61.8
Investment (I)	20.1	23.5
Government consumption (G)	13.9	14.0
Exports (X)	30.2	27.1
Imports (M)	39.1	26.5
Absorption (= C + I + G)	108.9	99.3
GDP at market prices (GDP=C+I+G+X-M)	100.0	100.0
Net indirect taxes (T)	8.9	0.4
GDP at factor cost (=GDP – T)	91.1	99.6

Source: World Bank (2001) and authors' calculations

disaggregating the information in the macro SAM starting from information in a Zimbabwe micro SAM. In addition to the information in the macro SAM, SSA averages for the shares of agriculture in value-added, exports and imports were also imposed, using World Bank data.[18]

Tables 4 – 6 summarize the sectoral structure, household income sources, living standards, and the rural-urban dichotomy of our stylized SSA economy. Table 4 indicates that the agricultural sector dominates employment and accounts for roughly half of total exports but only a small part of imports. A large part of agricultural output is exported while the share of imports in its final demand is miniscule — agriculture produces a mix of traded and non-traded goods. Table 5 shows how the different representative household groups make their living: in both rural and urban regions, upper-income households earn incomes from skilled labor and rely more strongly on capital income. Rural households earn income from large-scale and small-scale land, respectively. The income sources of urban households are less diversified, especially for low-income groups who earn almost all of their income from unskilled labor. Rural low-income

[18] The archetype SAM was balanced using a cross-entropy estimation technique. See Robinson et al. (2001).

Table 4: Economic structure in base year (%)

Sector	Value added	Output	Employ-ment	Exports	Export/ Output	Imports	Import/ final demand
			(%)				
Export crops	18.4	11.4	15.2	46.4	62.6	0.1	1.2
Other crops	8.0	4.9	21.1	1.4	6.7	0.3	2.7
Livestock	5.5	4.3	20.7	0.4	1.6	–	–
Mining	4.0	3.9	1.1	9.3	35.8	1.1	11.5
Food-fiber	8.6	12.4	3.0	3.2	3.6	4.7	9.7
Domestic manufacturing	4.9	6.3	5.0	1.6	3.7	4.4	17.7
Import-substituting	9.1	12.8	2.9	13.0	15.6	65.4	63.5
Construction	2.4	6.2	2.2	–	–	–	–
Trade and transportation	13.8	15.9	11.3	–	–	–	–
Public services	10.4	8.5	5.8	–	–	–	–
Other services	14.9	13.4	11.7	24.7	33.9	23.9	39.6
Total	100.0	100.0	100.0	100.0	16.3	100.0	26.2
Agriculture	32.0	20.5	57.0	48.2	40.4	0.4	1.3
Non-agriculture	68.0	79.5	43.0	51.8	10.9	99.6	28.9
Total	100.0	100.0	100.0	100.0	16.3	100.0	26.2

Source: SSA 1998 SAM.

Table 5. Household income sources in base year (%)

Households \ Sources	Unskilled labor	Skilled labor	Capital	Large-scale land	Small-scale land	Rest of the World	Net Domestic Transfers	Total
Rural								
Upper-income		29.6	48.6	18.7		3.1		100.0
Lower-income	59.1		17.4		10.3	12.3	0.9	100.0
Urban								
Upper-income		51.4	43.4	2.5		2.8		100.0
Lower-income	78.9		6.0			15.2		100.0

Source: SSA 1998 SAM.
Note: Net domestic transfers are net transfer receipts from other households and the government. Value is only showed in the table (as income) if the net is positive.

Table 6. Household poverty and population data (%)

	Per-capita income	Head-count poverty rates	Population shares	Poor population shares
Rural				
Upper-income	224.3	0.0	16.4	0.0
Lower-income	21.9	72.5	49.3	84.4
Urban				
Upper-income	315.3	0.0	13.7	0.0
Lower-income	44.3	32.0	20.6	15.6
Total	100.0	42.3	100.0	100.0
Rural	72.5	54.4	65.7	84.7
Urban	152.7	19.2	34.3	15.6

Source: SSA 1998 SAM.
Note: Per-capita income is indexed so that the economywide average is 100.

households have a diversified income profile, with unskilled labor dominating but also with substantial shares for capital and land. According to Table 6, the national head-count poverty rate is 42.3 percent. Rural areas, which account for some two thirds of the population, have lower per capita incomes and constitute a large of the poor.

Table 7 shows the empirical TFP linkage elasticities on which the elasticity parameters for our productivity functions are based. The elasticities in the model productivity functions have been scaled on the basis of the share of base-year economy represented by the activities or factors to which the productivity effect is directed.[19]

Table 7. TFP linkage elasticity parameters

Government expenditure category	TFP link elasticity value	Standard error of estimated elasticity	Linkage channel
Agriculture	0.052	0.024	TFP in agriculture
Human Capital	0.115	n.a.	Labor productivity in all non-mining sectors
Defense	-0.182	0.034	TFP in all non-mining sectors
Transportation	0.021	0.021	TFP in trade services (strong effect); TFP in other non-mining sectors (weak effect)
Other	0	n.a.	None.

Notes: Elasticity estimates and t statistics are based on Fan and Rao (2004). Human capital is an aggregation of education and health with the elasticity calibrated to give the same GDP growth as when the disaggregated Fan-Rao elasticities are used. Linkage channels are incorporated in the dynamic CGE model.

Appendix Tables A.2 and A.3 show the central-case values of the elasticities for trade, production and consumption. In the process of selecting these values, econometric and other model-based studies of SSA were consulted. We analyze the sensitivity of simulated results to changes in trade elasticities.

The model replicates major stylized facts and empirical regularities reported in the literature review in Section 2: GDP growth is negatively correlated with national, urban, and rural headcount poverty rates, and positively correlated with growth in exports, imports, investment and capital stocks (both private and public), government consumption, and labor force growth. Private investment and capital stocks are more strongly correlated with growth than the corresponding public items.[20]

[19] For example, if the empirical, economywide TFP elasticity for the public capital stock in agriculture is 0.2 and the agricultural activities represent one third of GDP at factor cost, then the elasticity used in the model function linking agricultural TFP to the public agricultural capital stock is 0.6.

[20] To verify the validity of the model for growth analysis, we computed correlation coefficients between GDP growth and the indicators listed in this paragraph, using as data inputs the results from the simulations reported in this study (treating each simulation as an observation).

4. Simulations

We use the model to explore the impact of alternative policies on long-run growth and poverty in SSA. Our starting point is a dynamic base simulation which provides a benchmark against which the other scenarios are compared.

Base Simulation

In the base simulation, government demand (both consumption and investment and across all functional areas) grows by 1.9 percent per year, a rate that is calibrated to maintain the base-year absorption share for this demand category. The base-year shares are also maintained throughout the simulation period for the other parts of absorption, private investment and household consumption — for private investment given that this demand category also is fixed as a share of absorption and for household consumption as the residual demand type.

Most real macro aggregates, including real household consumption, grow at annual rates of between 1.5 and 2.0 percent. (Tables 9 and 10 provide a result summary.) This range of growth rates also holds for all aggregate production sectors except mining, for which zero growth is imposed (an assumption that may be seen as reflecting a government decision on the rate of natural resource extraction). The endogenous annual rate of TFP growth is very close to zero. Household consumption and the rest of the economy grow at a rate that is very close to the population growth rate (2 percent), leaving growth in total household per-capita consumption (our aggregate welfare indicator) close to zero, with growth rates that are slightly positive in rural areas and slightly negative in urban areas. The headcount poverty rate (P0) also remains roughly the same — it registers a slight increase from 42.3 percent to 42.7 percent. The poverty gap and the squared poverty gap (P1 and P2) are also unchanged. Given so little change in poverty measures and mean per-capita consumption, the poverty elasticities for the base simulation contain little information.[21]

[21] For the simulations that generate significant changes in mean per-capita consumption and the headcount poverty rate, the elasticity is typically between –1.5 and –2.0, values that are well within the range observed

Public Spending Simulations: Reallocation to Target Areas

The assumptions for the non-base simulations are presented in Table 8. The results for the first set are summarized, along with results for the base simulation, in Tables 9 and 10. These simulations all involve reallocating government demand into alternative priority areas while keeping the real growth of total government demand constant. Unless otherwise noted, in year 2 (1999), 10 percent of total government spending is moved from what is classified as "other" (which has no productivity effects) into one or more priority areas, i.e. a reallocation that in the base year corresponds to 1.9

Table 8. Assumptions for non-base simulations

Simulation name	Description
AGRI	shift in government spending from "other" to agriculture
TRNS	shift in government spending from "other" to transportation
HCAP	shift in government spending from "other" to human capital
DEF	shift in government spending from "other" to defense
AG-TR-HC	shift in government spending from "other" to agriculture, transportation and human capital
AGRI+	expansion in government spending on agriculture with domestic financing
TRNS+	expansion in government spending on transportation with domestic financing
HCAP+	expansion in government spending on human capital with domestic financing
AGRI+F	expansion in government spending on agriculture with foreign grant financing
TRNS+F	expansion in government spending on transportation with foreign grant financing
HCAP+F	expansion in government spending on human capital with foreign grant financing
TRNS-EL	shift in government spending from "other" to transportation, with aggregate TFP elasticity of agriculture
HCAP-EL	shift in government spending from "other" to human capital, with entire productivity gain to unskilled labor
DEPR-03	reduction of public capital stock depreciation rate from 5 percent to 3 percent
AGRI-HI	same as AGRI but with high (doubled) trade elasticities
AGRI-LO	same as AGRI but with low (halved) trade elasticities

Notes: In all public spending simulations, expansion or reallocation refers to a change in 1999 corresponding to 10 percent of 1998 government demand (or 1.9 percent of GDP). Starting from 1999, all government demand areas grow at a uniform annual real rate of 1.9 percent. Unless otherwise noted, we use the elasticities in Table 7

in the literature (Easterly 2000, p. 14). The elasticities for the poverty gap and the squared poverty gap are also in line with expectations.

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percent of GDP or 10 percent of government demand. After this, government demands in all functional areas grow at the same annual rate across all government functions (1.9 percent). In the first experiment, AGRI, government spending is reallocated to agriculture, in 1999 raising its share of GDP 0.9 to 2.8 percent. This intervention has a positive impact on overall economic performance and poverty reduction. Annual growth in most macro aggregates increases by around 0.4 percent. As expected, annual agricultural GDP growth increases more rapidly (by 0.9 percent) while the terms of trade

Table 9. Scenarios for reallocation of public spending: summary results

	1998	BASE	AGRI	TRNS	HCAP	DEF	AG-TR-HC
		Annual growth rates, 1998-2015 (%)					
Absorption	4969.37	1.83	2.17	1.96	2.01	0.03	2.07
Household consumption	3416.29	1.88	2.31	2.04	2.12	-0.56	2.19
Gov. consumption & inv'ment	858.90	1.91	1.91	1.91	1.91	1.91	1.91
Private investment	694.19	1.49	1.79	1.57	1.61	0.11	1.66
Exports	1377.50	1.73	2.36	1.90	1.97	-0.77	2.09
Imports	1784.78	1.67	2.13	1.79	1.84	-0.07	1.92
Real exchange rate	100.00	0.05	-0.12	0.05	0.06	-0.19	0.02
Agric/non-agric terms of trade	100.00	0.21	-0.55	0.23	0.28	-0.11	0.08
Total GDP (at factor cost)	4158.39	1.90	2.27	2.04	2.12	-0.14	2.17
Agriculture	1329.11	1.97	2.85	2.13	2.18	-0.34	2.36
Mining	166.54	0.00					
Other industry	938.18	1.69	1.91	1.80	1.84	-0.14	1.87
Government services	430.64	2.05	2.08	2.14	2.21	0.93	2.19
Other services	1193.11	2.17	2.22	2.37	2.50	-0.44	2.46
TFP index	100.00	-0.01	0.29	0.11	0.18	-1.77	0.22
Total factor income	4158.39	1.86	2.26	2.00	2.05	-0.17	2.12
Private capital	1873.67	1.77	2.12	1.89	2.01	0.03	2.06
Land	372.87	3.44	3.92	3.69	3.92	0.19	3.96
Low skilled labor	543.96	1.71	2.11	1.87	1.85	-0.55	1.93
High skilled labor	1367.90	1.53	1.99	1.66	1.56	-0.42	1.69
		Percentage point deviations from 1998 values					
Ratios to GDP (%)							
Investment	20.11	0.30	-0.14	0.19	0.13	2.38	0.05
Government expenditure	23.26	0.10	-0.42	-0.01	-0.08	2.47	-0.17
Private saving	6.88	0.55	0.57	0.30	0.01	4.93	0.11
Government saving	6.19	-0.69	-0.51	-0.41	-0.13	-5.37	-0.18
Foreign saving	7.04	0.44	-0.20	0.29	0.25	2.82	0.12
Poverty headcount rate (P0)	42.31	0.39	-4.60	-1.60	-2.24	20.39	-3.14

Notes: All quantity variables are in real terms. Income variables are deflated by the consumer price index (CPI). The real exchange rate is price level deflated; the price index used is the CPI.

for agriculture relative to non-agriculture deteriorates. The terminal-year poverty headcount rate is five percentage points lower than for the base scenario. This scenario reinforces the pro-rural trends of the base scenario. In rural areas, per-capita consumption registers a positive growth rate and the rural poverty headcount rate declines slightly compared to 1998.[22]

Table 10. Scenarios for reallocation public spending: welfare indicators

	1998	BASE	AGRI	TRNS	HCAP	DEF	AG-TR-HC
			Annual growth rates, 1998-2015 (%)				
Household consumption per capita							
Rural upper income	552.30	0.14	0.54	0.32	0.45	-2.52	0.50
Rural lower income	60.18	0.21	0.83	0.37	0.49	-2.05	0.59
Urban upper income	804.78	-0.29	0.09	-0.14	-0.11	-2.55	-0.04
Urban lower income	113.57	-0.31	0.11	-0.17	-0.19	-2.38	-0.09
Average, all households	254.16	-0.08	0.34	0.09	0.16	-2.46	0.23
Rural	183.21	0.15	0.61	0.33	0.46	-2.40	0.52
Urban	390.06	-0.30	0.09	-0.15	-0.12	-2.52	-0.05
			Percentage point deviations from 1998 values				
Poverty headcount, P0							
Total	42.31	0.39	-4.60	-1.60	-2.24	20.39	-3.14
Rural	54.37	-1.12	-6.37	-3.37	-4.50	17.25	-5.25
Urban	19.20	3.30	-1.20	1.80	2.10	26.40	0.90
Elasticity		-0.70	-1.80	-2.56	-1.94	-1.39	-1.88
Poverty gap, P1							
Total	11.52	-0.08	-2.12	-0.93	-1.29	13.82	-1.62
Rural	15.62	-0.59	-3.08	-1.67	-2.25	15.80	-2.60
Urban	3.66	0.90	-0.29	0.48	0.54	10.04	0.26
Elasticity		0.52	-3.06	-5.48	-4.11	-3.47	-3.57
Squared poverty gap, P2							
Total	4.27	-0.09	-1.00	-0.48	-0.65	8.01	-0.79
Rural	5.95	-0.29	-1.47	-0.82	-1.09	9.94	-1.25
Urban	1.05	0.31	-0.10	0.17	0.18	4.33	0.09
Elasticity		1.50	-3.89	-7.61	-5.60	-5.43	-4.72

Notes: Household consumption is real per capita consumption. Elasticities for P0, P1, and P2 are the ratios between the percent change in the poverty indicator and the percent change in aggregate per capita consumption.

[22] In this scenario, neither poverty nor per-capita consumption change much compared to 1998. As a result, the recorded poverty elasticities are not informative.

In 1998, government spending on transportation and communication was similar in size to agricultural spending. In the second experiment, TRNS, spending in this area in 1999 increases from 0.8 to 2.6 of GDP. Given a lower elasticity, the aggregate effect of expanding government spending in this area is weaker, inducing an overall growth expansion and a decline in headcount poverty that is slightly less than half as strong as for AGRI. Compared to AGRI, the sectoral pattern of gains is more even, including a considerably smaller growth gain for agriculture. Performance according to per-capita consumption and the different poverty indicators is more positive than under the base scenario but less positive than for AGRI.

In the HCAP simulation, the GDP share of government expenditure on health and education expands from 3.9 percent to 5.8 percent (i.e., a much smaller relative increase in spending in the targeted area relative to the simulations AGRI and TRNS). The growth rate of GDP goes from 1.9 percent in the base run to 2.1 percent, a moderate increase. The poverty headcount falls by 2.6 percentage points relative to the terminal-year value for the base simulation, with the largest percentage point decline in rural areas. However, compared to the scenario AGRI, poverty declines less strongly everywhere.

According to the empirical estimates of the TFP linkage elasticities, the impact of defense spending on GDP is very negative. This relationship should be viewed as capturing not only the opportunity cost of the resources allocated to defense but also other factors that are associated with high defense spending such as wars, civil strife, and an unfavorable business climate. The scenario DEF assumes an increased allocation of government expenditure to defense amounting to about 1.8 percent of GDP (from 0.6 percent to 2.4 percent). The results are very detrimental for growth and poverty reduction. The GDP growth rate turns negative, changing from 1.9 percent in the base run to -0.1 percent, and the terminal-year poverty headcount rate is 20 percentage points higher than for the base simulation, almost a 50 percent increase in poverty. Avoiding civil strife and the disruptions associated with higher defense expenditures is clearly very important.

The final simulation, AG-TR-HC, tests the impact of a simultaneous increase in the three areas of government spending for which positive effects were reported above — agriculture, transportation and human capital. In each area, spending is set to increase by around 1.9 percent of GDP in the base year at the expense of the area of “other”

government spending, for which spending declines drastically between 1998 and 1999, from 10.7 to 5.1 percent of GDP. The resulting growth acceleration is positive but weaker than when reallocated spending exclusively is channeled to agriculture (AGRI). The terminal-year headcount poverty rate is 2.7 percentage points lower than under the base simulation. The gains in consumption and poverty reduction are limited to rural households whereas the urban households experience a small loss.

Public Spending Simulations: Expansion in Target Areas

The preceding set of public expenditure simulations all assumed that the government reallocated spending from non-productive areas. Alternatively, the government may increase spending, relying either on domestic or foreign financing. The second set of simulations involves expanded spending of the same magnitude and in the same three areas — agriculture, transportation, and human capital — as in the preceding simulations but without accompanying cuts in spending on other, unproductive areas. The results are summarized in Tables 11 and 12.

Table 11. Scenarios for expanding public spending: summary results

	BASE	AGRI+	TRNS+	HCAP+	AGRI+F	TRNS+F	HCAP+F
				Annual growth rates, 1998-2015 (%)			
Absorption	1.83	2.17	1.96	2.01	2.35	2.11	2.14
Household consumption	1.88	2.16	1.90	1.98	2.39	2.10	2.14
Gov. consumption & inv'ment	1.91	2.48	2.48	2.48	2.48	2.48	2.48
Private investment	1.49	1.78	1.56	1.59	1.97	1.72	1.73
Exports	1.73	2.36	1.91	1.98	2.22	1.79	1.89
Imports	1.67	2.13	1.80	1.84	2.36	2.00	2.00
Real exchange rate	0.05	-0.12	0.05	0.06	-0.24	-0.05	-0.03
Agric/non-agric terms of trade	0.21	-0.60	0.17	0.22	-0.64	0.15	0.21
Total GDP (at factor cost)	1.90	2.27	2.05	2.12	2.33	2.10	2.17
Agriculture	1.97	2.81	2.08	2.13	2.81	2.09	2.15
Mining	0.00			0.00			
Other industry	1.69	1.86	1.75	1.79	1.96	1.84	1.86
Government services	2.05	2.38	2.43	2.50	2.44	2.48	2.55
Other services	2.17	2.19	2.34	2.48	2.30	2.42	2.55
TFP index	-0.01	0.29	0.12	0.18	0.28	0.11	0.18
Total factor income	1.86	2.27	2.00	2.05	2.34	2.07	2.11
Private capital	1.77	2.13	1.90	2.02	2.20	1.96	2.07
Land	3.44	3.82	3.58	3.81	3.76	3.56	3.82
Low skilled labor	1.71	2.04	1.80	1.78	2.20	1.94	1.90
High skilled labor	1.53	2.06	1.73	1.62	2.16	1.81	1.70

			Percentage point deviations from 1998 values				
Ratios to GDP (%)							
Investment	0.30	0.37	0.72	0.66	0.58	0.89	0.79
Government expenditure	0.10	0.13	0.57	0.51	-0.08	0.37	0.35
Private saving	0.55	2.38	2.13	1.81	0.57	0.56	0.56
Government saving	-0.69	-1.81	-1.71	-1.40	-1.79	-1.69	-1.38
Foreign saving	0.44	-0.20	0.30	0.25	1.80	2.02	1.61
Poverty headcount rate (P0)	0.39	-2.57	0.54	-0.20	-5.40	-2.05	-2.34

Notes: All quantity variables are in real terms. Income variables are deflated by the consumer price index (CPI). The real exchange rate is price level deflated; the price index used is the CPI.

In the first three simulations (AGRI+, TRNS+ and HCAP+), this spending expansion is financed from domestic resources, requiring the allocation of additional private resources to finance domestic private investment. A comparison between the

Table 12. Scenarios for expanding public spending: welfare indicators

	BASE	AGRI+	TRNS+	HCAP+	AGRI+F	TRNS+F	HCAP+F
			Annual growth rates, 1998-2015 (%)				
Household consumption per capita							
Rural upper income	0.14	0.37	0.15	0.28	0.71	0.23	0.48
Rural lower income	0.21	0.66	0.19	0.30	0.70	1.08	0.58
Urban upper income	-0.29	-0.02	-0.25	-0.21	0.17	-0.04	-0.05
Urban lower income	-0.31	0.02	-0.27	-0.29	0.12	-0.67	-0.10
Average, all households	-0.08	0.21	-0.06	0.02	0.43	0.14	0.21
Rural	0.15	0.44	0.16	0.28	0.71	0.45	0.50
Urban	-0.30	-0.02	-0.25	-0.23	0.16	-0.15	-0.06
			Percentage point deviations from 1998 values				
Poverty headcount, P0							
Total	0.39	-2.57	0.54	-0.20	-5.83	-0.63	-3.04
Rural	-1.12	-3.75	-0.75	-1.87	-8.25	-4.87	-5.25
Urban	3.30	-0.30	3.00	3.00	-1.20	7.50	1.20
Elasticity	-0.70	-1.71	-1.36	-1.40	-1.84	-0.60	-1.94
Poverty gap, P1							
Total	-0.08	-1.24	0.03	-0.30	-2.58	-0.79	-1.55
Rural	-0.59	-1.86	-0.35	-0.89	-3.78	-2.29	-2.51
Urban	0.90	-0.05	0.76	0.83	-0.29	2.10	0.29
Elasticity	0.52	-3.04	-0.31	-7.57	-2.99	-2.77	-3.64
Squared poverty gap, P2							
Total	-0.09	-0.60	-0.02	-0.19	-1.21	-0.47	-0.76
Rural	-0.29	-0.91	-0.17	-0.44	-1.79	-1.11	-1.21
Urban	0.31	-0.02	0.26	0.29	-0.10	0.75	0.10
Elasticity	1.50	-3.98	0.59	-12.99	-3.78	-4.48	-4.83

Notes: Household consumption is real per capita consumption. Elasticities for P0, P1, and P2 are the ratios between the percent change in the poverty indicator and the percent change in aggregate per capita consumption.

results in Tables 11 and 9 shows that aggregate spending expansion leads to smaller increases in aggregate household consumption and final-year poverty headcount rates that are around two percentage points higher. In two areas (agriculture and human capital), the poverty rate still declines compared to the final-year base value whereas for the third area (transportation, which has the lowest productivity elasticity), poverty increases as a result of increased government spending. These results indicate that, unless it is sufficiently productive, expanded public spending has negative effects on economic performance. At a more disaggregated level, the changes in rural and urban household consumption growth are similar. However, given that the non-poor rural population is relatively close to the poverty line, rural poverty rates are relatively sensitive to small changes in household consumption growth.

In the next three simulations (AGRI+F, TRNS+F and HCAP+F), this spending expansion is accompanied by an expansion in foreign grants that maintains total savings at a level sufficient to finance an unchanged absorption share for private investment.[23] A comparison between the results across the different scenarios in Table 11 shows that the availability of foreign financing has a salutary impact on household consumption and poverty reduction. This is expected since it permits the country to enjoy larger current account and trade deficits and higher absorption. In 1999, the year of the spending expansion, foreign grants jump by 2.3 percentage points of GDP (from 3 percent to 5.3 percent). After this, they decline gradually, in the final year exceeding the base-year value by some 1.5-2.0 percent of GDP. This increased inflow of foreign resources generates a slight appreciation of the real exchange rate, for the period as a whole at an annual rate of 0.1 percent.

Sensitivity Analysis

The final set of simulations explores the sensitivity of the results to alternative values for model parameters that are particularly uncertain and may be important in the

[23] Technically, a new closure rule was introduced for the savings investment balance where, instead of the marginal propensity to save (which now is fixed), foreign grants (which now are flexed) assure that available savings is sufficient to finance private investment at an unchanged level relative to total absorption. Throughout the simulations, the other components of foreign savings — net foreign borrowing and net foreign investment — are fixed in foreign currency units.

context of the current set of simulations: productivity elasticities and linkages, depreciation rates for public capital stocks, and trade elasticities. The results are summarized in Tables 13 and 14.

The first two simulations analyze the sensitivity of the results to changes in public expenditure elasticities. The estimated TFP linkage elasticity for public expenditure on transportation is modest relative to some other empirical findings (cf. Hulten 1996, and Easterly and Rebelo 1993, pp. 2 and 14) . In the simulation TRNS-EL, we set the transportation elasticity at the level of the agricultural elasticity (an increase that corresponds to around 1.5 standard deviations). Apart from this, the simulation is identical to the earlier transportation scenario (TRNS). Compared to the base simulation,

Table 13. Sensitivity analysis: summary results

	BASE	TRNS-EL	HCAP-EL	DEPR-03	AGRI	AGRI-HI	AGRI-LO
	Annual growth rates, 1998-2015 (%)						
Absorption	1.83	2.22	1.99	2.06	2.17	2.21	2.07
Household consumption	1.88	2.39	2.10	2.17	2.31	2.32	2.27
Gov. consumption & inv'ment	1.91	1.91	1.91	1.91	1.91	1.92	1.82
Private investment	1.49	1.73	1.51	1.65	1.79	2.02	1.28
Exports	1.73	2.26	1.84	2.07	2.36	2.41	2.26
Imports	1.67	2.06	1.74	1.91	2.13	2.17	2.02
Real exchange rate	0.05	0.05	0.10	0.02	-0.12	-0.01	-0.50
Agric/non-agric terms of trade	0.21	0.26	-0.06	0.09	-0.55	-0.33	-1.11
Total GDP (at factor cost)	1.90	2.34	2.14	2.16	2.27	2.30	2.19
Agriculture	1.97	2.46	2.47	2.35	2.85	2.84	2.84
Mining	0.00	0.00					0.00
Other industry	1.69	2.03	1.74	1.87	1.91	1.99	1.78
Government services	2.05	2.33	2.11	2.19	2.08	2.10	2.00
Other services	2.17	2.76	2.36	2.45	2.22	2.26	2.13
TFP index	-0.01	0.37	0.22	0.21	0.29	0.29	0.29
Total factor income	1.86	2.30	2.01	2.11	2.26	2.28	2.24
Private capital	1.77	2.16	1.99	2.05	2.12	2.06	2.29
Land	3.44	4.20	3.47	3.94	3.92	4.00	3.65
Low skilled labor	1.71	2.18	1.17	1.92	2.11	2.19	1.91
High skilled labor	1.53	1.93	1.91	1.68	1.99	2.07	1.84
	Percentage point deviations from 1998 values						
Ratios to GDP (%)							
Investment	0.30	-0.02	0.25	0.06	-0.14	-0.31	0.20
Government expenditure	0.10	-0.24	0.06	-0.16	-0.42	-0.63	-0.16
Private saving	0.55	-0.19	0.76	0.13	0.57	0.54	0.76
Government saving	-0.69	0.16	-0.87	-0.20	-0.51	-0.60	-0.36
Foreign saving	0.44	0.00	0.36	0.14	-0.20	-0.25	-0.20

Poverty headcount rate (P0)	0.39	-5.83	-0.63	-3.04	-4.60	-4.95	-3.55

Notes: All quantity variables are in real terms. Income variables are deflated by the consumer price index (CPI). The real exchange rate is price level deflated; the price index used is the CPI.

the impact is a modest acceleration in aggregate GDP growth (by 0.3 percentage points, with stronger gains within services and agriculture), and a strong gain in poverty reduction as the final-year rate is 5.8 percentage points below the 1998 level. Compared to the scenario where spending is reallocated to agriculture (AGRI), aggregate growth is very similar (but slightly stronger). As opposed to the agricultural scenario, under this new scenario terms of trade shifts in favor of agriculture while the distribution of factor incomes shifts in favor of land and, to a lesser extent, unskilled labor. Given the fact that a disproportionate share of the rural population is near poor, this distributional shift is pro-poor, reducing the final-year national headcount poverty rate by 1.2 percentage points more than for AGRI. Since the urban poverty rate does not change, this decline is entirely due to what happens to rural poverty.

Table 14. Sensitivity analysis: welfare indicators

	BASE	TRNS-EL	HCAP-EL	DEPR-03	AGRI	AGRI-HI	AGRI-LO
	Annual growth rates, 1998-2015 (%)						
Household consumption per capita							
Rural upper income	0.14	0.71	0.23	0.48	0.54	0.55	0.52
Rural lower income	0.21	0.70	1.08	0.58	0.83	0.83	0.82
Urban upper income	-0.29	0.17	-0.04	-0.05	0.09	0.11	0.05
Urban lower income	-0.31	0.12	-0.67	-0.10	0.11	0.15	0.02
Average, all households	-0.08	0.43	0.14	0.21	0.34	0.36	0.31
Rural	0.15	0.71	0.45	0.50	0.61	0.62	0.59
Urban	-0.30	0.16	-0.15	-0.06	0.09	0.12	0.05
	Percentage point deviations from 1998 values						
Poverty headcount, P0							
Total	0.39	-5.83	-0.63	-3.04	-4.60	-4.95	-3.55
Rural	-1.12	-8.25	-4.87	-5.25	-6.37	-6.75	-5.25
Urban	3.30	-1.20	7.50	1.20	-1.20	-1.50	-0.30
Elasticity	-0.70	-1.84	-0.60	-1.94	-1.80	-1.85	-1.55
Poverty gap, P1							
Total	-0.08	-2.58	-0.79	-1.55	-2.12	-2.27	-1.71
Rural	-0.59	-3.78	-2.29	-2.51	-3.08	-3.25	-2.58
Urban	0.90	-0.29	2.10	0.29	-0.29	-0.38	-0.05
Elasticity	0.52	-2.99	-2.77	-3.64	-3.06	-3.11	-2.74
Squared poverty gap, P2							
Total	-0.09	-1.21	-0.47	-0.76	-1.00	-1.06	-0.82

Rural	-0.29	-1.79	-1.11	-1.21	-1.47	-1.55	-1.25
Urban	0.31	-0.10	0.75	0.10	-0.10	-0.13	-0.02
Elasticity	1.50	-3.78	-4.48	-4.83	-3.89	-3.93	-3.56

Notes: Household consumption is real per capita consumption. Elasticities for P0, P1, and P2 are the ratios between the percent change in the poverty indicator and the percent change in aggregate per capita consumption.

The second simulation in Tables 13 and 14, HCAP-EL, repeats the reallocation of spending in favor of human capital (as for the simulation HCAP) with an adjustment in the productivity elasticities to reflect the assumption that the aggregate productivity gain is solely channeled through a productivity gain for unskilled labor (as opposed to both skilled and unskilled labor in HCAP and all other simulations) without any change in the aggregate impact. Compared to the base scenario, the impact is still positive on growth and poverty reduction. Aggregate GDP growth is very similar to the HCAP scenario but the results reveal a strong slow-down in income growth for the targeted unskilled labor factor (indicative of an inelastic demand for this factor) and, to a lesser extent, for land. Production expansion in agriculture switches terms of trade against this sector. The final-year poverty rate is 1.6 percentage points higher and the absolute value of the poverty elasticity is –0.6 as compared to –1.9 for the HCAP scenario. These results reflect the role of the demand side in determining the distribution of gains from higher productivity.

Finally, economic performance is strongly influenced by the efficiency with which public spending is managed, an aspect that is reflected in the rate at which public capital depreciates. In the literature, assumptions about depreciation rates vary widely.[24] In the scenario DEPR03, we reduce the depreciation rate for public capital from 5 percent to 3 percent. Compared to the base scenario, GDP growth goes up by around 0.3 percent and final-year poverty is more than three percentage points lower. In orders of magnitude, these gains are similar to those of the preceding scenarios where public spending was switched to different target areas.

Finally, we carried out the full set of simulations with three alternative sets of trade (Armington and CET) elasticities: in additional to the a central case (which was reported above), a high and a low case for which every elasticity was doubled and halved,

[24] For example, in the literature on developing countries, the rates used by Dessus and Herrera (1996, p. 14) and Arndt et al. (2001, pp. 12-13) are 4 percent and 7.5 percent, respectively.

respectively.[25] To illustrate the impact of changing elasticity assumptions, the last three columns of Tables 13 and 14 show the summary and welfare results for the scenario with a reallocation of public spending in favor of agriculture under the three alternative elasticity assumptions. The central case results (AGRI) were reported in Tables 9 and 10 whereas the results for the high and low elasticity cases (AGRI-HI) and (AGRI-LO) have not been reported before. The major differences are related to intermediate indicators that measure or are influenced by relative price changes: the real exchange rate (here the price of traded commodities relative to CPI), real private investment (which in this model is sensitive to changes in the price index for investment goods relative to the CPI), and agricultural and non-agricultural terms of trade (here the ratio between agricultural and non-agricultural producer prices). As expected, the high-elasticity economy shows a slightly stronger performance. However, the major production and welfare indicators did not change by much, either for these or for other simulations, suggesting that the policy-relevant messages that emerge from this analysis are quite robust to changes in these trade elasticities.

5. Conclusion

When designing strategies for SSA aimed at accelerating growth and reducing poverty, it is particularly important to understand the links between economic performance and different types of public spending. We developed a model — a dynamic recursive CGE model — that incorporates these links and includes the minimum household detail needed to analyze distributional impacts and applied it to an archetype SSA country for the period 1998-2015. For the impact of public spending, we rely on econometric estimates of linkages between TFP growth and public spending in different functional areas. We used the model to simulate the impact on growth and distribution of different public expenditure strategies targeting agriculture, human capital, and transportation-communication.

[25] For commodities with both imports and domestic use of domestic output, the Armington elasticity indicates the degree of substitutability in domestic market use between these two sources. For domestic outputs with both exports and domestic sales, the CET (Constant Elasticity of Transformation) elasticity indicates the ease with which output can shift between these two destination.

Our base simulation projects a continuation of past trends in factor accumulation and TFP growth, with only modest aggregate GDP growth and little change in per-capita household consumption and the headcount poverty rate. The results indicate that economic performance can be improved significantly when government resources are reallocated from unproductive areas to the different target areas, with the most positive over-all effects when agriculture is targeted. For example, the reallocation of 10 percent of government demand (1.9 percent of GDP) from unproductive areas in the beginning of the period reduces the final-year poverty rate by five percentage points. The impact is less positive (and may be negative) when the government expands spending in target areas without cuts elsewhere and without any additional foreign financing, leaving fewer resources available for private consumption and investment. However, if additional foreign grants are sufficient to cover government financing needs, the scope for growth in domestic absorption is widened with a positive impact on household welfare and poverty reduction. The simulated impact of reducing the depreciation rates for public capital stocks suggest that the gains from raising the efficiency of public spending may be just as important as the allocation of resources to areas with high payoffs. In another simulation, we reallocated government spending to defense, utilizing empirical estimates of the TFP linkage elasticity of defense spending. These elasticities capture not only the opportunity cost of defense spending but also the broader economic consequences of wars and civil strife. The impact was very negative, including an increase in the poverty rate by 20 percentage points and zero GDP growth, clearly pointing to the importance of conflict resolution and management as a prerequisite for successful development.

On a cautionary note, these results are very sensitive to the values of the various elasticities linking TFP growth to public expenditure. It may also well be that the econometric estimates, which are based on noisy historical data for a period where many countries were undergoing changes in their economic and political systems, and some were involved in armed conflict, do not provide parameter values that we can confidently use in projections for the next 15-20 years. There is clearly a need for much more work to understand the nature of the linkages and to provide better estimates of the parameters involved.

In terms of methodology, our findings suggest that, when designing strategies for poverty reduction, including interventions favoring agriculture and different types of human capital accumulation, it is important that the framework used can consider not only aggregate returns and productivity effects but also distributional aspects manifested in relative price changes (including the terms of trade between agriculture and non-agriculture). A dynamic CGE model provides a good framework for incorporating the linkages that economic theory and empirical analysis consider important. Such models enable analysts to simulate the effects of different estimated linkage elasticities and incorporate different analytic specifications that theory indicates might be important.

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APPENDIX

GROWTH, POVERTY AND PUBLIC POLICY:

A BRIEF REVIEW OF THE LITERATURE

Over the last decades, a large body of research has improved our understanding of the determinants of growth and poverty reduction in developing countries, including the role of public policy. In this section, we will attempt to extract stylized facts from this literature, in particular those that are relevant to public policy in SSA.[26] This review will inform the structure of the dynamic CGE model and its database (presented in Section 3) and support the validation of the model, which will consider the ability of the model to capture key empirical regularities in the development process.

Our discussion is divided into sections on the roles of total factor productivity (TFP) growth and factor accumulation, the determinants of GDP growth, and links between growth and poverty.

TFP Growth and Factor Accumulation

Growth accounting is frequently used to disaggregate the sources of GDP growth into factor accumulation and TFP growth. The starting point is an aggregate production function, often a Cobb-Douglas function, which has as arguments quantities of a set of factor inputs and an efficiency term that represents TFP growth. The equation is expressed in growth rates, making it straightforward to derive TFP growth as a residual, given empirical data on GDP growth and growth in the quantities available of the different factors. The resulting TFP measure represents not only technical change but also all other sources of GDP growth that are not accounted for by factor accumulation, including resource allocation and utilization rates, x-efficiency, worker motivation, and anything else not explicitly incorporated into the measure of factor inputs.[27]

[26] The main sources for our discussion are Temple (1999), Dumont (1996), and O'Connell and Ndulu (2000).

[27] The TFP residual is smaller if quality improvements are incorporated in the treatment of factor accumulation (often done for labor by adding human capital as a factor alongside physical capital; cf. Easterly and Levine 2001, p. 182).

For developing countries, the share of TFP growth in GDP growth varies widely but may typically account for 33-50 percent (Nehru and Dhareshwar 1994, p. 3). Evidence indicates that this share has been increasing over time, at least for countries (both in Africa and elsewhere) with high or moderate GDP growth (Nehru and Dhareshwar 1993, pp. 54-55; Berthélemy and Söderling 2001, p. 330; Chenery *et al*. 1986, p. 19). Some findings suggest that TFP accounts for the bulk of cross-country differences in the level and growth rate of GDP per capita (Easterly and Levine 2001, p. 179). In SSA, average TFP growth has been slightly negative in recent decades, considerably below the corresponding figure for developing countries as a whole (Nehru and Dhareshwar 1993, pp. 54-55; Nehru and Dhareshwar 1994, p. 26; O'Connell and Ndulu 2000, p. 29). On a sectorally disaggregated level, estimates by Martin and Mitra (1999) show that TFP growth in recent decades has been more rapid for agriculture than for manufacturing for countries at all income levels, including the countries in SSA for which data are available.[28]

Determinants of GDP Growth

Alongside the growth accounting approach, an econometrically-based literature has tried to unravel the determinants of growth, typically relying on cross-country regressions of a measure of GDP (or GDP per capita) on a set of variables that are viewed as potential determinants. Although the selection of right-hand-side variables is primarily based on modern growth theory (with seminal contributions from, among others, Solow, Lucas, Romer, and Barro), the fact that there is no consensus theory has led to empirical studies that are largely inductive, seeking empirical regularities. However, the ability of this approach to improve our understanding of the growth process has been hampered by low data quality, various technical econometric problems, and shortcomings of current growth theory (Dumont 1996, pp. 5, 7).[29] The bulk of the literature is based on cross-

[28]According to the preferred estimate of Martin and Mitra (1999, p. 22), developing-country average annual TFP growth for 1967-1992 was 0.9 percent for manufacturing and 2.6 percent for agriculture. For the three SSA countries that were included, the average was also lower for manufacturing (-0.2 percent) than for agriculture (1.2 percent).

[29] The problems may be summarized under three headings: (1) data — low data quality and imperfect correspondence between available indicators and theoretical concepts; (2) theory — unclear model specification (including the treatment of dynamic issues) in the absence of a clear theoretical model; (3) econometric issues – simultaneity (the relationship between right-hand-side and left-hand-side variables may not be recursive but simultaneous); multicollinearity (of independent variables), and heteroscedasticity

country data in a single-equation framework. In recent years, improvements in data availability have permitted alternative approaches, including time-series analysis, analysis at the single-country level, and estimation of simultaneous-equation systems. These alternative approaches have mitigated some of the econometric problems faced by cross-section regressions (Easterly and Levine 2001, p. 209; O'Connell and Ndulu 2000, pp. 9-10).

The cross-country growth literature suggests that the major determinants of growth may be divided into factor accumulation, public policy, economic openness, and miscellaneous other conditions, often including aspects related to politics or geography.

Factors of production are typically divided into physical capital, labor, and human capital. Accumulation of physical capital is perhaps the most robust explanatory variable for growth (Chenery et al. 1986; Mundlak 2001, p. 1156; Rodrik 1999, p. 7). Numerous studies have found a significant link between investment in physical capital (expressed as a share of GDP) and real GDP growth. A smaller number of studies have treated investment in physical capital in a more disaggregated manner. When disaggregated into private and public, both investment types tend to be positively linked to growth, although the link seems more consistently positive for private investment.[30]

Various explanations have been proposed for lower returns to public investment. Its efficiency may be low due to insufficient spending on maintenance or low capacity utilization. Hulten (1996) develops an efficiency index for public infrastructure investment. His analysis suggests that, although the growth impact of public investment is positive, the impact of efficiency improvements would be much larger (Hulten 1996, pp. 2, 14, 23-25, 31). Along the same lines, Pritchett argues that, due to corruption and other factors, perhaps as much as half of all public investment spending in developing countries did not create equivalent public capital (Pritchett 1999). A second, related, explanation is that data for aggregate public investment cover two investment types:

(cf. Dumont 1996, pp. 37-39) . For a critique of the cross-country regression literature, see Srinivasan and Bhagwati (1999). Data problems are particularly serious for Africa (Naudet 1999).

[30] For example, in an analysis that covers 28 developing countries for the period 1981-1991, Dessus and Herrera (1996, p. 13, 23) identify a significant positive impact of both private and public capital stocks on growth; they find that the marginal return to private capital is higher, suggesting that an increase in the share of private investment in total investment would increase growth. Hulten (1996, pp. 14 and 31) generates similar results in an analysis based on data for 42 low- and middle-income countries for the period 1970-1990. For contradictory findings, see Devarajan *et al.* (1999).

investments that complement private investment (most importantly investment in physical infrastructure), and investments that compete with the private sector (public enterprise investments). The former are likely to be growth enhancing whereas the latter, often occurring in areas where the private sector is more efficient, are likely to retard growth (Hulten 1996, p. 11; Easterly and Rebelo 1993, p. 27; O'Connell and Ndulu 2000, p. 18).

This points to the need for a more disaggregated analysis of the growth effects of different government spending types, both current and capital. In such an analysis, Diamond (1989) found that, at the aggregate level, capital spending tends to have a more positive growth effect than current spending. Among current items, spending on directly productive sectors has the most positive growth impact. Among capital spending items, spending on social sectors and infrastructure tend to have a positive effect, with the stronger effect for the former, while spending on directly productive sectors has a negative effect (Diamond 1989, pp. 12, 14 and 16).[31]

Fan and Rao (2004) estimate Cobb-Douglas production functions for Africa, Asia, and Latin America with national GDP as the dependent variable, and, as independent variables, labor, non-government capital, and government capital stocks disaggregated into agriculture, education, health, transportation and telecommunication, social security, and defense. These government capital stock variables are constructed from past government spending (both current and capital) in each functional area. Most coefficients are significant at the 10 percent level with expected signs (positive except for defense). The only coefficients with the "wrong" sign are those for education in Africa and Latin America, which both have negative signs. For Africa, the strongest positive effect is for health spending followed by agriculture, while defense spending has a strong negative effect (Fan and Rao 2004, pp. 14-15).[32]

In other studies that have used a disaggregated approach, very strong growth effects have been identified for investments in transportation and communications

[31] Unfortunately, as noted by Diamond (1989, p. 17), due to collinearity, it was difficult to separate the effects of capital spending on education and infrastructure. This is a general problem – Easterly and Rebelo (1993, p. 2) point to this as a likely source of one of their stylized facts, a fragile link between fiscal variables (other than the budget surplus) and growth.

[32] The estimated elasticities of GDP with respect to health and defense are +0.21-0.22 and –0.17-0.18, respectively. For agriculture, the elasticity is around +0.05.

infrastructure (Hulten 1996, p. 18; Easterly and Rebelo 1993, pp. 2 and 14). For agriculture, the impact of infrastructure investments may be particularly strong given that transportation costs often represent a large share of output prices. Jimenez (1994, p. 19), in a cross-country analysis covering 58 countries, finds a positive impact on aggregate crop output from public infrastructure measured by irrigation, paved roads, and rural road density. For India, Fan *et al*. (2000, p. 1049) find that, in order to reduce poverty and accelerate growth in rural India, the government should give top priority to expanding investments in rural roads and irrigation, as well as agricultural research and extension. Similarly, Mitra *et al*. (1998, p. 43) have found that differences in infrastructure endowments across states explain differences in TFP growth in India's manufacturing sector.

The human factor in development may be disaggregated into a quantitative aspect, the size of the labor force, and a qualitative aspect, the amount of human capital per worker. Human capital is typically measured by the average number of years of education for the labor force (a measure of skill). In addition, it could incorporate the health and nutritional status of the workers. Theoretical growth models with human capital permit increases in human capital per worker to raise labor productivity (Easterly and Rebelo 1993, p. 4). Increases in human capital per worker may also promote technological innovation (Jimenez 1994, p. 4).

Labor force growth has a positive impact on growth in total GDP (Easterly and Rebelo 1993, pp. 27-29). For human capital (proxied by an average level of schooling measure), the evidence is less clear. On the basis of his survey of the literature, Dumont concludes that variables measuring education tend to have a positive growth effect (1996, p. 41). Nehru and Dhareshwar (1994, pp. 8 and 26) find that human capital accumulation is much more important than growth in raw labor in explaining output growth. Berthélemy and Söderling (2001, p. 332), whose analysis is limited to SSA, find an important role of human capital in the explanation of TFP growth in countries that in recent years experienced periods of rapid growth. On the contrary, Pritchett (1999) and O'Connell and Ndulu (2000, p. 1) report no significant role for human capital in explaining growth differences across countries. The literature has been even less

successful in establishing macro-level links between health indicators and growth (Dumont 1996, p. 41).[33]

Data shortcomings may at least in part explain the lack of empirical evidence of strong links between human capital and growth. A complete measure of human capital should cover not only skills (the focus of most measures), but also physical measures of nutrition and health status, especially relevant in activities where the poor are involved. However, at the aggregate level, the links between such physical measures and growth are tenuous and have not been found to be strong in empirical analyses (Jimenez 1994, pp. 16-18). Years of schooling may be an imprecise indicator of skill level since the effectiveness of schooling in generating skills (including literacy, numeracy, and problem-solving ability) may vary enormously. Moreover, one would expect the returns to human capital in the form of higher productivity to be sensitive to labor market conditions and, more broadly, the functioning of the overall economy. Demand growth for educated labor is likely to have a positive impact on its marginal product. An institutional environment in which educated labor is encouraged to move to high productivity activities should also raise its productivity, and hence growth.[34] On the contrary, a positive productivity impact of improved education may be absent if educated labor is channeled to low-productivity activities, exemplified by many jobs in government administrations (Pritchett 1999, pp. 37-38).[35]

The models referred to above incorporate measures of human capital without linking them directly to public spending. Alternatively (and more fruitfully for policy analysis), the analysis should address the impact of government spending on health, education, and nutrition on growth performance.

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[33] For an exception, see Gupta and Mitra (2004) who, for India, find an unambiguous, positive relationship between per-capita health expenditure and health status, a negative relationship between improved health status and poverty, and a two-way, positive relationship between growth and health indicators. On the micro level, evidence of a positive link between health and labor productivity is accumulating (Strauss and Thomas 1995, p. 1917).

[34] Feder (1986), and Robinson (1971), using cross-country regression analysis, find a significant impact on aggregate growth in developing countries from moving factors from low-productivity to high-productivity activities. They find significant contributions to aggregate growth from shifting resources from agriculture and toward exports sectors, using data from the 1960s and 1970s.

[35] For Tanzania, for example, the fact that the bulk of educated people are employed in the inefficient public sector may be a major reason for why there is only a weak link between growth in human capital and TFP growth (Sarris 1998, p. 24).

This approach has been followed in some studies, including Diamond (1989) and Fan and Rao (2004), whose results were discussed above. Along the same lines, Villanueva (1994, p. 23) found a positive and significant relationship between the per-capita growth rate and growth in real education and health spending. However, in general, it appears that the links between public spending on education and health are weaker since they add another layer of uncertain links.

The growth literature has also addressed aspects of policy and economic performance that are not readily summarized on the basis of government spending data, perhaps most importantly the roles of macroeconomic stability and foreign trade.[36] There is considerable agreement that macroeconomic stability, often proxied by low inflation or a low budget deficit relative to GDP, has a positive impact on growth (see for example Fischer 1993; Easterly and Rebelo 1993, p. 2; Rodrik 1999, p. 7; Easterly and Levine 2001, p. 209). In the trade area, openness (defined by indicators based on trade policy or trade outcomes, in the second case often the GDP share of total foreign trade) may have a positive impact on growth through various channels, including improved access to production inputs and technology, and exposure to competitive pressures in world markets, generating incentives to use resources efficiently and acquire new technologies. On the other hand, if openness is associated with a shift of resources toward sectors with relatively limited long-run growth prospects, the effect may be negative.

Trade openness has become an increasingly contentious topic — the last decade has witnessed a swing from near universal to mere qualified acceptance of the notion that there is a positive relationship between trade and economic growth (Jonsson and Subramanian (2001, p. 197). Earlier studies, which strongly suggested that openness promotes growth, have been criticized, in large measure on the basis of shortcomings that characterize much of the cross-country regression literature as a whole.[37] Nevertheless,

[36] The literature has also addressed the impact of total government size and financial policies. Findings regarding the impact of total government spending and growth are inconclusive, not surprisingly given large cross-country differences in terms of content and effectiveness of government actions (see for example Ram 1986; Diamond 1989; Easterly and Wetzel 1989; and Easterly and Levine 2001). Financial development or the absence of financial repression tends to have a positive impact on growth, possibly via a positive impact on TFP growth (see Beck *et al.* 2001; Easterly and Wetzel 1989; Easterly and Levine 2001, p. 209).

[37] Growth-promoting effects of openness have been identified by, among many others, Sachs and Warner (1995), Edwards (1998), and Dollar and Kraay (2000). The most prominent critique is found in Rodriguez and Rodrik (1999).

on balance, it seems that an open trade policy and a strong involvement in foreign trade tend to promote growth — or at least be associated with growth. More recent studies, which at least in part address the econometric shortcomings of the earlier literature, have tended to confirm this conclusion.[38] This does not mean that the specific mechanisms are well understood or that openness invariably is growth promoting. On the contrary, economic structure and domestic policies are likely to have a strong conditioning impact on the effects of trade liberalization and economic openness.[39]

Many cross-country analyses have found a negative and significant dummy for SSA, indicating that the performance of this group of countries was below that predicted given their values for the explanatory variables considered in the analysis (see for example Nehru and Dhareshwar 1994, p. 26) However, this finding does not necessarily imply that the countries of SSA, on the margin, respond differently than other countries to changes in the different determinants. The frequent appearance of a negative dummy for Africa stimulated a search for additional growth determinants with special relevance for this region. Such extensions have been able to eliminate the negative dummy. For example, in an analysis of SSA that included variables indicative of geography ("landlockedness"), demographics (age dependency and the gap between growth in labor force and population), and external factors (terms-of-trade shocks and trading partner growth), O'Connell and Ndulu could not reject the hypothesis of equal coefficients for Asian and African countries (O'Connell and Ndulu 2000, pp. 13 and 33).

Growth and Poverty

On an à priori basis, more rapid GDP growth should reduce poverty unless it is associated with an increase in inequality that, to a sufficient extent, skews the benefits from growth away from the population that is poor or near-poor. The empirical literature strongly suggests that more rapid GDP growth is associated with more rapid poverty

[38] Using panel data for 73 countries over the period 1960-1995, Easterly and Levine (2001, pp. 209, 212) identify a negative growth impact of a black-market exchange rate premium (an indicator of that policies distort trade and links between domestic and international prices) and a positive impact of the GDP share of foreign trade. Berthélemy and Söderling (2001, p. 332) use panel data for 27 African countries for 1960-1996 and identify a positive impact on TFP and GDP growth from increases in the value of exports per worker. In an analysis of South Africa, Jonsson and Subramanian (2001, p. 219) find that a positive impact of the GDP trade share on growth in TFP and GDP.

[39] For example, see case studies of Tanzania (Wobst 2001), Zimbabwe (Bautista *et al.* 2003), and Mozambique (Tarp *et al.* 2002).

reduction — "growth is good for the poor." Any shifts toward increased inequality have not dominated the positive impact of more rapid growth on poverty reduction. Dollar and Kraay (2000) is a prominent example in the empirical literature that supports this consensus. Applying cross-country regression analysis to a data set that covers 80 countries over four decades, they show that, on average, incomes of the poor rise one-for-one with overall growth. Similarly, Ravallion and Chen (1997) estimate the elasticity of poverty (defined as the proportion of population below $1/day at 1985 PPP) with respect to mean consumption at –3, with a value between –1 and –5 for the 95 percent confidence interval. Similarly, Adams reports an elasticity of -2.6 for the headcount rate. His estimated elasticities for the more sensitive poverty gap and squared poverty gap measures are 3.0 and 3.4, respectively (Adams 2002, pp. 17-18, 36). Easterly (2000, p. 14) notes that an elasticity of around two is commonly observed.

From a policy perspective, it is important to uncover the factors that influence the effectiveness of growth in reducing poverty. Findings indicate that rural growth has a stronger poverty-reducing effect than urban growth; and that the poverty-reducing impact of growth is stronger if initial inequality is lower, and/or if the initial state of rural development and human resource development is more favorable (Ravallion 1997; Timmer 1997; Ravallion and Datt 1996). In a study of India, disaggregated by state, Ravallion and Datt (1999) find that the absolute value of the poverty elasticity of non-farm growth is higher, for higher initial levels of farm productivity, rural living standards, and literacy. Evidence also shows that public policy can skew the benefits of growth in favor of the poor through pro-poor public expenditures (the financing of which is facilitated by growth) and land tenure reform (Ames et al. 2000; Morrison 2000). This literature indicates that there may often be synergies between different policies and structural characteristics — the consequences of any given policy (for example a tax or tariff reform) on economic indicators (including growth and poverty) may depend on the nature of other policies and structural characteristics.

Lessons for Policy Models

The empirical literature on growth in developing countries suggests a number of desiderata for theoretical and empirical models of growth and distribution. They should be able to incorporate important stylized facts concerning the relationships between

poverty reduction and GDP, including the roles of labor force growth, accumulation of private capital, economic openness, and productivity-enhancing government spending (both current and capital) on agriculture, human development (education and health) and physical infrastructure (especially transportation and communications).

In addition to permitting the government to raise productivity through different forms of public spending, models should also capture the fact that government policies influence growth and poverty reduction via policies that contribute to economic openness and enhance private capital accumulation (for example by raising the incomes of agents with high savings). Models should also be able to address the trade-offs that are involved in economic development, among other things between private capital accumulation and government spending.

The literature includes a wide range of estimates of the empirical impact of different government interventions and economic openness on growth and poverty. On a methodological level, it is important that empirical models designed to incorporate these factors be structured so that they can explore the consequences of alternative estimates of the nature and strengths of these links (*inter alia* reflecting institutional factors that condition the efficiency of government and the strength of the repercussions from economic openness).

Finally, the cross-country econometric literature has found empirical regularities, but has not adequately identified the structural mechanisms through which public policy affects growth and poverty. The estimated equations mostly represent reduced-form models. There is a great need for country-level case studies that draw on a wide range of approaches to explore the nature and empirical strength of the links between policy choices and economic performance.

Appendix

Tables

Table A.1. SAM -- Micro SAM (per mille of GDP)

			1	2	3	4	5	6	7	8
1	FACTORS	Unskilled labor								
2		Skilled labor								
3		Capital								
4		Large-scale land								
5		Small-scale land								
6	INSTITUTION	Rural upper-income		99.40	163.12	62.72				
7		Rural Lower-income	53.68		15.79		9.38			2.79
8		Urban upper-income		200.46	169.34	9.64		4.39		
9		Urban Lower-income	65.54		4.95					
10		Government						15.12	-0.45	14.03
11		Government interest payment								
12		Rest of world			57.51					
13		Savings-Investment						31.77	3.07	32.98
14	ACTIVITY	Large-scale export crop								
15		Small-scale export crop							5.77	
16		Large-scale non-export crop								
17		Small-scale non-export crop							24.58	
18		Large-scale livestock								
19		Small-scale livestock							15.07	
20		Mining								
21		Food-fiber								
22		Domestic manufacturing								
23		Import-substituting manuf.								
24		Construction								
25		Trade and transportation								
26		Public services								
27		Other services								
28	COMMODITY	Export crops								
29		Other crops						5.00	5.49	9.38
30		Livestock						14.11	3.55	
31		Mining								
32		Food-fiber						77.15	10.77	88.54
33		Domestic manufacturing						43.17	9.81	45.48
34		Import-substituting manuf						39.69	3.10	71.77
35		Construction								
36		Trade and transportation						18.96	2.20	20.13
37		Public services						7.27	2.84	5.32
38		Other services						61.86	4.21	84.63
39		Transactions costs-Domestic								
40		Transactions costs-Imports								
41		Transactions costs-Exports								
42		Direct taxes						24.79	0.37	25.98
43		Other indirect taxes								
44		Export taxes								
45		Import tariffs								
46		TOTAL	119.22	299.85	410.71	72.36	9.38	343.2	90.38	401.0

Table A.1. SAM -- Micro SAM (per mille of GDP)

			9	10	11	12	13	14	15	16
1	FACTORS	Unskilled labor						3.56	7.45	1.56
2		Skilled labor						59.55		10.34
3		Capital						39.89	2.33	9.14
4		Large-scale land						51.05		21.31
5		Small-scale land							4.07	
6	INSTITUTION	Rural upper-income				18.05				
7		Rural Lower-income	5.33			3.41				
8		Urban upper-income				17.20				
9		Urban Lower-income				6.29				
10		Government	0.18			42.55				
11		Government interest payment		11.30						
12		Rest of world			11.30					
13		Savings-Investment	0.96	61.89		70.45				
14	ACTIVITY	Large-scale export crop								
15		Small-scale export crop								
16		Large-scale non-export crop								
17		Small-scale non-export crop								
18		Large-scale livestock								
19		Small-scale livestock								
20		Mining								
21		Food-fiber								
22		Domestic manufacturing								
23		Import-substituting manuf.								
24		Construction								
25		Trade and transportation								
26		Public services								
27		Other services								
28	COMMODITY	Export crops				140.23				
29		Other crops	14.20			4.22		0.21		
30		Livestock	4.37			1.13				
31		Mining				28.13				
32		Food-fiber	18.58	1.31		9.72		0.92	0.26	0.52
33		Domestic manufacturing	14.00	2.12		4.76		0.37	0.08	0.33
34		Import-substituting manuf.	5.82	6.42		39.27	113.94	6.04	0.68	2.35
35		Construction					87.19			
36		Trade and transportation	2.16	4.94				0.45	0.21	0.20
37		Public services	1.44	76.89				0.14		
38		Other services	8.31	47.62		74.52		8.52	0.10	1.50
39		Transactions costs-Domestic								
40		Transactions costs-Imports								
41		Transactions costs-Exports								
42		Direct taxes	1.42							
43		Other indirect taxes						0.26	0.08	0.12
44		Export taxes								
45		Import tariffs								
46		TOTAL	76.78	212.49	11.30	459.94	201.13	170.96	15.25	47.37

Table A.1. SAM -- Micro SAM (per mille of GDP)

			17	18	19	20	21	22	23	24
1	FACTORS	Unskilled labor	18.88	1.04	19.11	1.28	4.98	9.27	2.72	3.29
2		Skilled labor		8.55		8.86	11.95	13.19	26.26	12.87
3		Capital	6.60	13.10	8.50	26.37	61.80	21.80	53.69	5.93
4		Large-scale land								
5		Small-scale land	5.31							
6	INSTITUTION	Rural upper-income								
7		Rural Lower-income								
8		Urban upper-income								
9		Urban Lower-income								
10		Government								
11		Government interest payment								
12		Rest of world								
13		Savings-Investment								
14	ACTIVITY	Large-scale export crop								
15		Small-scale export crop								
16		Large-scale non-export crop								
17		Small-scale non-export crop								
18		Large-scale livestock								
19		Small-scale livestock								
20		Mining								
21		Food-fiber								
22		Domestic manufacturing								
23		Import-substituting manuf.								
24		Construction								
25		Trade and transportation								
26		Public services								
27		Other services								
28	COMMODITY	Export crops					30.30	41.38	0.50	
29		Other crops		2.88	0.26		14.14		3.26	
30		Livestock		3.93			29.69	0.92	2.48	
31		Mining				3.22	1.74	0.51	30.75	9.30
32		Food-fiber	0.35	6.78	0.18	0.67	27.10	6.38	3.33	1.06
33		Domestic manufacturing	0.79			0.69	2.62	4.57	2.03	0.73
34		Import-substituting manuf.	1.16	2.90		19.49	12.85	3.27	77.58	55.64
35		Construction					0.40	0.28	0.57	3.81
36		Trade and transportation	0.32		0.20	0.86	2.35	0.76	1.99	1.98
37		Public services	0.08				0.50	0.26	0.52	5.08
38		Other services	0.14	1.87	0.58	2.23	2.61	0.64	3.25	0.90
39		Transactions costs-Domestic								
40		Transactions costs-Imports								
41		Transactions costs-Exports								
42		Direct taxes								
43		Other indirect taxes	-0.94	0.26	0.13	0.59	0.17	0.88	1.58	1.02
44		Export taxes								
45		Import tariffs								
46		TOTAL	32.71	41.31	28.96	64.26	203.20	104.09	210.50	101.61

Table A.1. SAM -- Micro SAM (per mille of GDP)

			25	26	27	28	29	30	31	32
1	FACTORS	Unskilled labor	19.69	5.55	20.84					
2		Skilled labor	46.42	56.46	45.40					
3		Capital	59.64	32.39	69.53					
4		Large-scale land								
5		Small-scale land								
6	INSTITUTION	Rural upper-income								
7		Rural Lower-income								
8		Urban upper-income								
9		Urban Lower-income								
10		Government								
11		Government interest payment								
12		Rest of world				0.53	1.05		4.27	18.50
13		Savings-Investment								
14	ACTIVITY	Large-scale export crop				170.96				
15		Small-scale export crop				9.48				
16		Large-scale non-export crop					47.37			
17		Small-scale non-export crop					8.13			
18		Large-scale livestock						41.31		
19		Small-scale livestock						13.89		
20		Mining							64.26	
21		Food-fiber								203.20
22		Domestic manufacturing								
23		Import-substituting manuf.								
24		Construction								
25		Trade and transportation								
26		Public services								
27		Other services								
28	COMMODITY	Export crops		0.45	0.29					
29		Other crops		1.64	1.22					
30		Livestock		1.25	1.09					
31		Mining	3.09	0.63	2.17					
32		Food-fiber	7.87	9.59	7.22					
33		Domestic manufacturing	4.21	1.61	4.01					
34		Import-substituting manuf.	97.65	21.18	20.72					
35		Construction	3.46	1.56	4.35					
36		Trade and transportation	6.31	1.57	6.13					
37		Public services	8.95	2.54	27.28					
38		Other services	1.98	1.17	8.61					
39		Transactions costs-Domestic				4.63	4.36	7.05	4.25	46.75
40		Transactions costs-Imports				0.15	0.23		0.61	2.97
41		Transactions costs-Exports				12.98	0.49	0.27	5.10	2.36
42		Direct taxes								
43		Other indirect taxes	1.22	1.53	1.11					
44		Export taxes				14.24				
45		Import tariffs				0.18	0.26		1.05	4.53
46		TOTAL	260.49	139.12	219.98	213.15	61.90	62.52	79.53	278.31

Table A.1. SAM -- Micro SAM (per mille of GDP)

			33	34	35	36	37	38	39	40
1	FACTORS	Unskilled labor								
2		Skilled labor								
3		Capital								
4		Large-scale land								
5		Small-scale land								
6	INSTITUTION	Rural upper-income								
7		Rural Lower-income								
8		Urban upper-income								
9		Urban Lower-income								
10		Government								
11		Government interest payment								
12		Rest of world	17.37	255.94				93.48		
13		Savings-Investment								
14	ACTIVITY	Large-scale export crop								
15		Small-scale export crop								
16		Large-scale non-export crop								
17		Small-scale non-export crop								
18		Large-scale livestock								
19		Small-scale livestock								
20		Mining								
21		Food-fiber								
22		Domestic manufacturing	104.09							
23		Import-substituting manuf.		210.50						
24		Construction			101.61					
25		Trade and transportation				260.49				
26		Public services					139.12			
27		Other services						219.98		
28	COMMODITY	Export crops								
29		Other crops								
30		Livestock								
31		Mining								
32		Food-fiber								
33		Domestic manufacturing								
34		Import-substituting manuf.								
35		Construction								
36		Trade and transportation							106.93	53.35
37		Public services								
38		Other services								
39		Transactions costs-Domestic	12.24	27.66						
40		Transactions costs-Imports	1.55	47.84						
41		Transactions costs-Exports	0.93	6.36						
42		Direct taxes								
43		Other indirect taxes								
44		Export taxes								
45		Import tariffs	5.21	53.22				1.79		
46		TOTAL	141.38	601.51	101.61	260.49	139.12	315.24	106.93	53.35

Table A.1. SAM -- Micro SAM (per mille of GDP)

			41	42	43	44	45	46
1	FACTORS	Unskilled labor						119.22
2		Skilled labor						299.85
3		Capital						410.71
4		Large-scale land						72.36
5		Small-scale land						9.38
6	INSTITUTION	Rural upper-income						343.29
7		Rural Lower-income						90.38
8		Urban upper-income						401.03
9		Urban Lower-income						76.78
10		Government		52.56	8.01	14.24	66.24	212.49
11		Government interest payment						11.30
12		Rest of world						459.94
13		Savings-Investment						201.13
14	ACTIVITY	Large-scale export crop						170.96
15		Small-scale export crop						15.25
16		Large-scale non-export crop						47.37
17		Small-scale non-export crop						32.71
18		Large-scale livestock						41.31
19		Small-scale livestock						28.96
20		Mining						64.26
21		Food-fiber						203.20
22		Domestic manufacturing						104.09
23		Import-substituting manuf.						210.50
24		Construction						101.61
25		Trade and transportation						260.49
26		Public services						139.12
27		Other services						219.98
28	COMMODITY	Export crops						213.15
29		Other crops						61.90
30		Livestock						62.52
31		Mining						79.53
32		Food-fiber						278.31
33		Domestic manufacturing						141.38
34		Import-substituting manuf.						601.51
35		Construction						101.61
36		Trade and transportation	28.49					260.49
37		Public services						139.12
38		Other services						315.24
39		Transactions costs-Domestic						106.93
40		Transactions costs-Imports						53.35
41		Transactions costs-Exports						28.49
42		Direct taxes						52.56
43		Other indirect taxes						8.01
44		Export taxes						14.24
45		Import tariffs						66.24
46		TOTAL	28.49	52.56	8.01	14.24	66.24	

Table A.2. Trade and production elasticities

	Value Added	Export	Import
Large-scale export crop	0.4	1.6	0.6
Small-scale export crop	0.4	1.6	0.6
Large-scale other crop	0.4	1.3	0.7
Small-scale other crop	0.4	1.3	0.7
Large-scale livestock	0.4	1.3	
Small-scale livestock	0.4	1.3	
Mining	0.8	1.6	0.6
Food-fiber	0.8	1.3	0.9
Domestic manufacturing	0.8	0.9	1.3
Import-substituting manufacturing	0.8	0.9	1.3
Construction	0.8		
Trade and transportation	0.8		
Public services	0.8		
Other services	0.8	0.8	1.3

Source: Literature estimates and authors' assessment

Table A.3. Household expenditure elasticities for consumption of marketed commodities

	Rural		Urban	
	Upper-income	Lower-income	Upper-income	Lower-income
Other crops	0.5	0.8	0.4	0.8
Livestock	1.1	1.2		1.2
Food-fiber	0.5	0.8	0.4	0.8
Domestic manufacturing	1.3	1.2	1.2	1.2
Import-substituting manufacturing	1.3	1.2	1.2	1.2
Trade and transportation	1.3	1.2	1.2	1.2
Public services	1.3	1.2	1.2	1.2
Other services	1.3	1.2	1.2	1.2

Source: Literature estimates and authors' assessment.
Note: Elasticities for home-consumed goods are the same as for their marketed counterparts.

Table A4. Factor value shares within sector (%)

Activities \ Factors	Unskilled labor	Skilled labor	Capital	Large-scale land	Small-scale land	Total
Large-scale export crop	2.3	38.7	25.9	33.1		100.0
Small-scale export crop	53.8		16.8		29.4	100.0
Large-scale non-export crop	3.7	24.4	21.6	50.3		100.0
Small-scale non-export crop	61.3		21.4		17.3	100.0
Large-scale livestock	4.6	37.7	57.7			100.0
Small-scale livestock	69.2		30.8			100.0
Mining	3.5	24.3	72.2			100.0
Food-fiber	6.3	15.2	78.5			100.0
Domestic manufacturing	20.9	29.8	49.3			100.0
Import-substituting manufacturing	3.3	31.8	64.9			100.0
Construction	14.9	58.3	26.8			100.0
Trade and transportation	15.7	36.9	47.4			100.0
Public services	5.9	59.8	34.3			100.0
Other services	15.4	33.4	51.2			100.0
Total	13.1	32.9	45.1	7.9	1.0	100.0
Agriculture	17.7	26.9	27.3	24.8	3.2	100.0
Non-agriculture	10.9	35.7	53.4			100.0

Source: SSA 1998 SAM.

Table A5. Factor value shares across sectors (%)

Activities \ Factors	Unskilled labor	Skilled labor	Capital	Large-scale land	Small-scale land	Total
Large-scale export crop	3.0	19.9	9.7	70.5		16.9
Small-scale export crop	6.2		0.6		43.4	1.5
Large-scale non-export crop	1.3	3.4	2.2	29.5		4.6
Small-scale non-export crop	15.8		1.6		56.6	3.4
Large-scale livestock	0.9	2.9	3.2			2.5
Small-scale livestock	16.0		2.1			3.0
Mining	1.1	3.0	6.4			4.0
Food-fiber	4.2	4.0	15.0			8.6
Domestic manufacturing	7.8	4.4	5.3			4.9
Import-substituting manufacturing	2.3	8.8	13.1			9.1
Construction	2.8	4.3	1.4			2.4
Trade and transportation	16.5	15.5	14.5			13.8
Public services	4.7	18.8	7.9			10.4
Other services	17.5	15.1	16.9			14.9
Total	100.0	100.0	100.0	100.0	100.0	100.0
Agriculture	43.3	26.2	19.4	100.0	100.0	32.0
Non-agriculture	56.7	73.8	80.6			68.0

Source: SSA 1998 SAM.

Table A6. Factor income distribution across households in base year (%)

Factors / Households	Unskilled labor	Skilled labor	Capital	Large-scale land	Small-scale land	Total
Rural						
Upper-income		33.1	46.2	86.7		38.1
Lower-income	45.0		4.5		100.0	9.2
Urban						
Upper-income		66.9	47.9	13.3		44.4
Lower-income	55.0		1.4			8.3
Total	100.0	100.0	100.0	100.0	100.0	

Source: SSA 1998 SAM.