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Structural Adjustment, Agriculture, and the Poor: A General Equilibrium Analysis of the Kenyan Economy

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Abstract: A computable general equilibrium model based on a social accounting matrix for Kenya is used to simulate the effects of 10-percent devaluation, 10-percent increased investment, and 10-percent agricultural productivity improvement on the macroeconomy and on the real incomes of the poor. For each policy simulation, two specifications for the labour markets are adopted, the first assuming unlimited supplies of labour at given nominal wages and the second assuming fixed supplies so that wages are determined endogenously. These crucially affect the results. Under the first assumption, devaluation provides a 10-percent boost to real GDP and has highly favourable effects on agricultural production, exports, the current account deficit, employment, and poverty. Under the second assumption, it has a largely inflationary impact, with attenuated effects on real GDP and other variables and no effect on the current-account deficit. Agricultural productivity improvement is less affected by the different specifications and compares favourably with devaluation except for its smaller impact on GDP. The increased investment policy is found to be inferior on most counts. All three policies decrease poverty, though income distribution remains stable.

Introduction

There has been controversy for some time among economists and international agencies about the appropriateness of structural adjustment and stabilization programmes for the economic problems of less-developed countries (LDCs), particularly those in sub-Saharan Africa. Concern has also been expressed in some quarters that such programmes, even if judged successful at the macroeconomic level, may have had deleterious effects on the incomes of the poorest in those countries, especially in the short to medium term.[2] Recently, increasing emphasis has been placed by the IMF and World Bank on "supply-side" policies to stimulate economic growth while at the same time correcting external and internal imbalances.[3] The present paper is a modest contribution to the analysis and debate on such concerns. It focuses on Kenya and attempts to trace the impact of a limited number of policies on the macroeconomy and on the real incomes of the poorest sections of the Kenyan population. The options considered are devaluation, investment, and agricultural productivity improvement.

Model and Data

It is now increasingly being accepted that such policy concerns as expressed earlier are best analysed by means of economy-wide multi-sector models that are able to incorporate the interrelationships between productive activities, factors of production, households, government, and the rest of the world in a general equilibrium framework.[4] Hence, we have used a computable general equilibrium (CGE) model based on a social accounting matrix (SAM) for the Kenyan economy. The model is medium term in outlook, short enough to ignore population growth but long enough to allow productivity changes and some factor mobility.

The CGE model consists of a large set of structural equations linking producing sectors, factor markets, households, government, and the rest of the world, with market prices as well as production, employment, consumption, savings, trade, etc. being endogenously determined. As it is based on a SAM, the accounting framework ensures internal consistency; thus, the usual national accounting identities hold.

The SAM was based on 1976, the most recent data set available, but the general pattern of the results from the simulations using this data set have relevance to the present situation in Kenya. A certain amount of aggregation, disaggregation, and other adjustments were made to the original SAM to produce a 69 × 69 matrix.[5]

Production accounts. There are three production activities representing the three sectors of agriculture, manufacturing, and services. Each activity is assumed to combine

labour of different categories, capital stock, and "operating surplus" in a constant-returns-to-scale Cobb-Douglas production function to produce value added. "Operating surplus" is a catch-all category for the input of, and returns to, entrepreneurship, management, and, in the case of agriculture, land. Factors are combined optimally, such that their marginal value products are equated to factor prices. Value added is then combined in fixed Leontief fashion with purchased intermediate inputs to produce gross output, at producer prices.

Commodity accounts. For each production sector, there are four commodity accounts: domestic, imported, exported, and composite commodities. Where applicable, indirect domestic taxes and import taxes are added to domestic production at producer prices and imports at c.i.f. prices, respectively, to produce domestic commodities and imports at market prices. They are combined as a constant elasticity of substitution (CES) aggregate (with elasticities of substitution of 1.0 for agriculture and 0.5 for the other two sectors) to produce composite commodities at minimum cost. These composite commodities are then available to meet total demand; i.e., for household consumption, government consumption, intermediate use, and investment.

Factor accounts. There are 14 labour, 3 capital, and 3 operating surplus categories. The labour categories comprise unskilled, skilled, professionals, and self-employed. Factor incomes from each of the categories are distributed to the institutions of households, companies, the government, and the rest of the world. It is assumed that, in value terms, the distribution is in the same proportions as the original SAM, which is the same as assuming that factor ownership by institutions does not change. In the urban unskilled labour market, labour moves freely between the industrial and services sector. Skilled labour and self-employed labour move freely across all sectors but are specific to either rural or urban areas. Professionals are assumed to be specific to each sector and to each area. Capital and "operating surplus" are assumed to be specific to each sector.

Institution accounts. There are four household groups in urban areas and four in the rural areas, differentiated according to income class. Other institutions are the government and companies. Incomes accruing to the various household groups are allocated to consumption, savings, direct taxes, transfers to companies, and remittance transfers to other households in fixed value shares. These shares are as in the original SAM except for remittances, which have been mapped according to other evidence.[6] Total consumption expenditure is then allocated to consumption of composite commodities in fixed proportions in quantity terms. This implies unitary income elasticity and zero price elasticity of household demand. The government account is modelled similarly.

Capital accounts. Total savings in the economy, by households, companies, the government, and foreign savings are distributed to investment in the three sectors (by destination) in fixed value shares. Within each sector, this investment is then used to purchase the three composite commodities in fixed value shares (investment by sector of origin). Foreign savings is specified as a residual. It meets the gap between total savings and total investment. By definition it is identically equal to the current balance-of-payments deficit.

Rest-of-the-world account. The rest of the world pays the Kenyan economy in foreign currency for exports and receives foreign currency for imports. There are also transfers in both directions, in fixed foreign currency, with factors and institutions. Imports of commodities are assumed to be available in perfectly elastic supply to Kenya at fixed world prices (the small country assumption). However, exports of domestic production are not assumed to face perfectly elastic demand. The demand for exports is assumed to depend on the price of exports relative to the world market price of comparable goods, with elasticities of demand of 3.0, 1.5, and 1.0 for agriculture, industry, and services, respectively. Producers are assumed to be indifferent between sales to the export and domestic markets, as they sell at the same (producer) price. Finally, the exchange rate is fixed as numeraire. However, in the devaluation experiment, it is varied exogenously.

Closure of the model. Closure of the model is essentially concerned with ensuring that the model has the same number of endogenous variables as equations.[7] As said previously, product and factor market prices are in general determined endogenously, with, in the present

model, only world prices of imports and exports in foreign currency and the exchange rate taken as exogenous. However, in the case of the labour markets, because of the uncertainty surrounding these markets in Kenya,[8] two alternative specifications are used in each simulation. The first, the so-called Keynesian closure, assumes an unlimited supply of labour at a fixed nominal wage, so that the level of employment is determined endogenously by the demand for labour. The second, the so-called neoclassical closure, assumes a fixed supply of each labour category, so that the market wage is determined endogenously in a situation of full employment. Investment is, in general, endogenously determined, but, in some of our simulations, investment is exogenously increased.

Results of Policy Simulations

As intimated in the introduction, the three policy experiments reported here are: 10-percent nominal devaluation, 10-percent increase in total real investment, and 10-percent improvement in agricultural efficiency (through adoption of new technology, improved methods, etc.). The figure of 10 percent was arbitrary; it was chosen to provide a basis of comparison between the various policy options and was considered as representing an order of change that was reasonable and attainable. No claim is made that the ease or difficulty of achieving these objectives is equal.

Table 1 presents the results. Only the important indicators are reported here. The first column contains the actual levels of the major aggregates in the base year in millions of Kenyan pounds. As all prices (including wages) are taken as unity in the base year solution, the physical quantity of (for example) employment of each category of labour is given in money terms equal to the total of wages in the base year.

Because a major concern is the impact of policy on the real incomes of the poor, we have included employment and wages of the urban unskilled and skilled labour and of rural self-employed labour, these being major sources of income for the urban and rural poor.

The results of the three policy experiments are given, as percentage changes from the base solution, in two blocks. Block A assumes an unlimited supply of labour at fixed wages. Block B assumes fixed supplies of labour. Under the latter assumption, real GDP, being the aggregate of the returns to the primary factors at constant factor prices, is inherently constrained. It can only increase under the first two policy experiments if the capital stocks or entrepreneurial inputs increase. This explains the very much smaller changes in GDP in Block B.

Devaluation. The vastly different outcomes of devaluation under the A and B assumptions highlight the critical importance of the labour market situation. With labour available in perfectly elastic supply, there is a 10-percent increase in real GDP, a 15-percent increase in exports leading to a 38-percent reduction in the current account deficit, increases in production, especially in agriculture, of 15 percent, increases in employment ranging from 8 percent in urban unskilled to 13 percent in rural self-employment and, importantly, increases in real consumption of poor households of between 6 and 9 percent. Market prices only rise by between 1.4 and 5.2 percent. There is virtually no change in the GDP deflator.

On the other hand, with fixed supplies of labour, the nominal devaluation has a large inflationary impact. Wages rise approximately in line with the devaluation, domestic market prices rise by 8 percent, and the overall GDP deflator by a similar amount. There is only a 2.5-percent rise in real GDP, production increases of, at most, 3 percent, virtually no change in the current account deficit (even though the volume of exports increases by 3.6 percent, this is outweighed by the increased cost of imports in domestic currency), and the consumption of the poor only increases by about 2 percent.

Though the magnitudes of the effects differ markedly as between the two assumptions about the labour market, the response of real GDP is positive, the elasticity of response with respect to the exchange rate varying between 0.25 and 1.0. This is in stark contrast to the estimate by Branson (1985) for Kenya, which was negative.

Table 1—Policy Simulations

	Base Solution (K£M)	Percentage Change from Base Solution					
		A*			B**		
		10% Devaluation	10% Boost to Investment	10% Rise in Agricultural Efficiency	10% Devaluation	10% Boost to Investment	10% Rise in Agricultural Efficiency
GDP at factor cost constant	1,296.1	10.2	3.2	3.4	2.5	1.2	0.8
GDP deflator price index		0.7	–0.5	0.3	7.7	1.6	2.7
Exports at constant prices***	478.1	15.7	0.8	12.1	3.6	–1.8	8.4
Imports at constant prices***	461.6	2.7	5.0	0.3	0.6	4.7	0.3
Current account deficit	51.9	–38.3	42.4	–48.7	–1.2	50.5	–35.6
Net indirect taxes	181.9	13.7	3.1	3.4	10.6	2.5	2.5
Government expenditure	215.2	12.2	2.7	3.4	10.4	2.5	2.9
Total real investment	294.2	–2.1	10.0	–4.9	–0.5	10.0	–4.2
Urban unskilled—employment	65.0	8.2	2.9	3.3	–	–	–
—wages	–	–	–	–	9.7	3.7	3.8
Urban skilled—employment	162.2	8.3	2.9	3.2	–	–	–
—wages	–	–	–	–	9.7	3.7	3.8
Rural self-employment	334.3	13.3	2.5	4.1	–	–	–
Household real consumption:							
Urban poor	89.2	6.5	3.1	5.1	1.6	1.9	3.3
Rural very poor	42.2	8.9	3.0	7.9	2.2	1.5	5.5
Rural poor	62.3	9.2	2.9	8.3	2.3	1.4	5.9
Agricultural production	513.9	15.0	2.7	14.7	3.4	0.4	10.8
Agricultural producer prices	–	1.1	–0.4	–9.2	7.9	0.9	–7.4
Industrial production	599.8	9.2	2.9	4.2	2.6	1.1	1.8
Industrial producer prices	–	3.0	–0.6	–2.0	7.6	0.7	–0.4
Service production	1,114.5	7.1	3.6	2.6	1.6	1.8	0.5
Service producer prices	–	1.8	–0.4	–0.2	8.3	1.9	2.1
Agricultural market prices	–	1.4	–0.4	–8.9	8.0	0.8	–7.2
Industrial market prices	–	5.2	–0.4	–1.3	8.4	0.5	–0.3
Service market prices	–	2.3	–0.3	–0.2	8.4	1.7	2.0

*Simulations A assume unlimited supply of labour. **Simulations B assume fixed supply of labour. ***Excludes factor payments and transfers.

The importance of the labour market situation in a particular country for the outcome of devaluation is clearly demonstrated. The model has shown that very different results can occur under general equilibrium and competitive assumptions in the labour and product markets. There is no need to call on non-competitive assumptions, mark-up pricing, institutional rigidities, or political power to explain such differences, and, in particular, the possible inflationary consequences of devaluation.

The simple analytics of devaluation with traded and non-traded sectors usually concludes that real wages have to decline, suggesting a real decline in living standards. The model shows that under Assumption A, where nominal wages remain constant and there are increases in both producer and market prices, real wages clearly decline. However, there is a large increase in employment leading to a significant rise in real household incomes and consumption. Under Assumption B, there is by definition no change in overall employment, but the rise in money wages is somewhat greater than the rise in both producer and market prices. There is in this case a small rise in real wages, which consequently feeds through to a small rise in real consumption.

Investment. In the case of increased investment, there is a very much less marked difference between the results under the two alternative assumptions about the labour market. Real GDP increases by 3.2 percent and 1.2 percent under Assumptions A and B, respectively. Because of the importance in Kenya of capital imports for investment purposes, there is an increase of 5 percent in the volume of imports. With little change in exports, the balance of payments deteriorates markedly. This, however, provides increased foreign savings, which help to finance the increased investment. Domestic savings increase only marginally. Increased wage income of between 2.2 and 3.7 percent comes from either increased employment or increased wages. With market prices virtually unchanged, these translate into real increases in household incomes and consumption of the poor of about 3 percent under Assumption A and 1.4–1.9 percent under Assumption B.

The estimates of the elasticity of GDP with respect to investment of between 0.32 and 0.12 under Assumptions A and B, respectively, imply incremental capital-output ratios for the whole economy of between 3 and 8, respectively. Though these appear to be wide differences, they are in the range of estimates given in Godfrey (1986).

Productivity improvement in agriculture. As would be expected, a 10-percent improvement in agricultural productivity results in a large boost to agricultural production, 14.7 percent and 10.8 percent under simulations A and B, respectively. This is accompanied by decreases in agricultural producer prices of 9.2 and 7.4 percent, respectively, insufficient to offset the rise in output. Agricultural exports increase significantly, leading to overall exports rising by 12.1 and 8.4 percent under the two simulations, respectively. Imports are virtually unchanged, so that there is a dramatic decrease in the current account deficit. However, there are only minor increases in production from the industrial and service sectors, so that overall GDP at factor cost improves by 3.4 percent under the assumption of unlimited supplies of labour and by only 0.8 percent under fixed supplies of labour. Indirect taxes and government expenditure both increase by about 3 percent, but there is a reduction in investment of 4 to 5 percent, allied to a drop in foreign savings. Either employment or wages of workers increases by 3 to 4 percent. In conjunction with reductions in market prices, particularly those of agricultural products, the real consumption of the poor rises significantly, especially that of the rural poor, where it is as much as 8.3 percent under simulation A and 5.9 percent under simulation B.

Conclusions

A major conclusion is that the results of the policy simulations depend crucially on whether labour is assumed to be available in unlimited supplies or fixed within the time period considered. This is clearly particularly true for the effect on real GDP but also holds for most other variables of interest. The importance of having knowledge of the labour market situation in the particular country is thus highlighted. There has been controversy over this

question for the Kenyan situation in the past, but our understanding of the present reality is that it is nearer the first assumption (Godfrey, 1986).

If that is the case, then, comparing the three policy options, a devaluation of the order of 10 percent appears very favourable. Only the productivity improvement option gives similar effects on exports, the balance of payments, agricultural production, and the real incomes of the poor. As would be expected, it does not give anything like the boost to overall GDP. We must, however, reiterate the proviso that we have no way of comparing the ease or difficulty of implementing identical proportionate changes in the three policy instruments.

Another important conclusion stems from the general equilibrium nature of the model. In discussing the impact of, say, devaluation on agricultural production, we are operating in the world of *mutatis mutandis*, not *ceteris paribus*. Under simulation A, export and producer prices for agricultural commodities only increase by 1.1 percent. Yet there is a massive 15 percent increase in production. This comes about through a large increase in employment and the use of intermediate inputs and a small reduction in the capital stock and is accompanied by a shift in demand through higher real incomes of all households. Under simulation B, agricultural export and producer prices rise by 7.9 percent, almost in line with the devaluation, yet there is only a 3.4 percent increase in production. This is principally because there is no change in employment and the rise in wages is greater than that of producer prices. There is only a small shift in demand. The great merit of the general equilibrium approach is that the results take into account simultaneously all the various linkages and feedback mechanisms between the sectors, between the product and factor markets, and between these and households, and so on, which no amount of juggling with partial equilibrium estimates can match.

Our final conclusion concerns income distribution. Though we have not dwelt on this in the paper, our results support the conclusions of many CGE analyses; i.e., that the overall household distribution of incomes remains remarkably stable in face of quite significant changes in policy variables. However, our concern was not primarily with income distribution but with the absolute incomes of the poor. We are heartened by the fact that, although the aggregative nature of our model has to be borne in mind, all three policy options point to improvements in their real incomes and consumption.

Notes

[1]University of Oxford and United Nations Development Programme, Gambia, respectively.

[2]See, for example, on the first point, Rose (1985), Helleiner (1986), Smith (1988), and Commander (1989), and, on the second point, Cornia *et al.* (1987).

[3]See, for instance, Corbo *et al.* (1987).

[4]See, for example, Dervis *et al.* (1982), Helleiner (1987), and Demery and Addison (1987).

[5]This is explained fully in Akinboade (1990).

[6]A review of the evidence on remittances in Kenya is given in Akinboade (1990).

[7]A good discussion of this problem appears in Drud *et al.* (1985).

[8]See, for instance, the divergent views of ILO (1972), Collier and Lal (1986), and Godfrey (1986).

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Discussion Opening—*James V. Stout* (US Department of Agriculture)

The paper describes the results of a model of the Kenyan economy under two assumptions on labour (unlimited supplies of labour at a fixed wage and fixed labour supply with wages determined endogenously) and for three scenarios (devaluation of the Kenyan pound, improvement in agricultural productivity, and a scenario which is described as an exogenous increase in investment).

The authors of this paper have not given us enough information to allow us to make full use of their model and results. One of the major conclusions highlighted is that the results of the model depend crucially on whether labour is assumed to be fixed or available in unlimited supply at a fixed wage. This result is qualitatively not surprising. Has this model captured some particular characteristic or characteristics of the Kenyan economy or can the results of this model can be generalized to other developing nations facing similar circumstances and similar sorts of policy alternatives? We would also benefit from more information on parameter values used in the model and a more detailed description of the model structure.

In the scenario described as an exogenous increase in investment, since the investment comes first (i.e., it spurs the economy rather than resulting from an acceleration of the economy), the economic stimulus could be better described as an exogenous increase in government spending financed by deficits. If this is the case, the fact that this scenario involves a transfer of purchasing power from the future is an important reason why it shows significant welfare benefits in the static general equilibrium framework of this model.

[Other discussion of this paper and the authors' reply appear on page 306.]