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Structural Adjustment and Rural Smallholder Welfare:

A Comparative Analysis from Sub-Saharan Africa

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CORNELL FOOD AND NUTRITION POLICY PROGRAM

STRUCTURAL ADJUSTMENT AND RURAL SMALLHOLDER WELFARE:

A COMPARATIVE ANALYSIS FROM SUB-SAHARAN AFRICA

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FOREWORD

In order to better understand the causes and dimensions of the economic crisis in sub-Saharan Africa and the impact of the policy reforms initiated in response to the unsustainable deficits, CFNPP is performing case studies of a number of countries. These studies have many components that will culminate in the development of economic models that link macroeconomic and sectoral policy reforms to household level outcomes.

An important dimension of the overall research effort is the performance of comparative analysis. The most important aspect of the integrative work will be the synthesis of the results of the case studies. However, given that these research efforts will not be completed for many months, interim efforts at comparative analysis are being made, concentrating on particular issues and sectors relevant to the effectiveness of adjustment programs on household welfare. For example, a CFNPP Monograph No. 4 reviewed fiscal and exchange rate policies in Africa during the early years of adjustment programs. This paper, then, is the next in the series of integrative analyses to be performed as part of the larger research program and focuses on the incomes of low-income smallholder farmers since the beginning of adjustment programs in five countries. The focus is on developing a model that employs data on the patterns of income, expenditures, and price movements to discern how welfare of the poor is changing over time.

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Ithaca, New York
January 1991

David E. Sahn
Deputy Director, CFNPP

1. INTRODUCTION

Stabilization and structural adjustment programs are being implemented widely in sub-Saharan Africa (SSA) in response to the macroeconomic crisis that has emerged during the 1970s. While the timing and nature of adjustment has differed markedly from one country to the next, a common aspect is that the economic opportunities faced by various agents in the economy will be changed. In particular, a key element of adjustment programs are the expenditure switching policies, which alter relative prices for various products and factors, generally with the intent of expanding the tradable goods sector. Policies that bring about changes in the price signals in the economy will affect household welfare as mediated by changes in the structure and level of incomes and consumption.

In particular, this paper is concerned with how macroeconomic adjustment policies affect low-income rural smallholder households, given that they comprise a large percentage of households in most SSA countries, many of which are appropriately classified as poor. On the one hand, it has been strongly suggested that adjustment programs bring about movements in relative prices that result in higher prices for staple commodities in the poor's consumption bundle. Since it has been shown that the rural poor are often net consumers of staple grains, especially traded goods whose prices are assumed to increase commensurate with devaluation or removal of price controls, adjustment programs are asserted to have deleterious consequences for the rural poor. The expectation that adjustment programs will induce a fall in real wages further exacerbates the negative impact of adjustment (see, for example, Pinstrup-Andersen 1988; Cornia, Jolly, and Stewart 1987).

A contrary argument has been put forth that adjustment programs stand to help the rural poor both directly or indirectly by raising producer incentives and rural incomes. Simply, relative price movements commensurate with adjustment are seen as favoring products produced by smallholders who will consequently witness a rise in their real income. A more balanced and agnostic viewpoint is that the impact of adjustment on the poor is not knowable a priori, and will be determined by their propensities to produce and consume tradables versus nontradables, as well as actual movements in relative prices (see, for example, Addison and Demery 1985; Sahn 1990).

In order to address this debate and gain some further insight into how smallholders are affected by adjustment in the short-term, there are two especially important issues that require careful analysis. The first is to examine the structure of their income and consumption; namely, the sources from which they derive income, appropriately grouped for analysis, and the products that satisfy their consumer needs. The second aspect is to analyze

how structural adjustment affects the values of these magnitudes by means of changes in relative prices.

In this paper, the emphasis will be on examining the relevant economic signals before and after policy reforms were instituted. This procedure, of course, cannot attribute any changes in the relevant signals to specific adjustment programs. However, our aim is not to examine whether the change in the fortunes of the poor is due only to adjustment or other concurrent developments, but rather to infer directions of welfare changes after reforms were instituted.[1] Also note that we will not be interested in the change in the total magnitude of poverty (Kanbur 1987) but only in the welfare changes of a typical household within a given group.

In the next section, we outline the methodological framework and analytical model that is to be employed in examining how low-income smallholder households are affected by macroeconomic adjustment. This is followed by a discussion of the data employed from the five countries included in the comparative analysis: Côte d'Ivoire, Ghana, Malawi, Madagascar, and Tanzania. This presentation and discussion of descriptive statistics will focus on characterizing the structure of consumption and sources of income, as well of price movements that have occurred during the years under which countries have been undergoing adjustment. Next we present the results of the analytical model, followed by a concluding section on the policy implications of the findings.

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[1] To analyze how policy reforms affect economic signals in an economy is a major undertaking usually necessitating the use of complex empirical models. For useful surveys of the literature, see Scobie (1989), Pinstrup-Andersen (1990), and Sarris (1990).

2. METHODOLOGY

Consider a rural smallholder household, representative of a class that has been identified as *poor* or vulnerable. The precise definition of poverty or vulnerability, of course, is a matter of considerable research, but we shall not delve into it in this section. The household will derive its income from agricultural and nonagricultural activities. The agricultural activities will be distinguished among those that produce exportable and other nonfood tradable cash crops (e.g., coffee, cocoa, cotton, tea) among those that produce tradable staple food crops (mainly maize, rice, and wheat), and finally, those that produce nontradable food products (coarse grains, roots and tubers, fruits and vegetables, livestock products, etc.).

Denote by s_a and s_r the shares of income derived from own account agricultural and other agricultural or nonagricultural activities, respectively, in some base year, including transfers and remittances, where of course

$$s_a + s_r = 1 \tag{1}$$

Also, denote by s_{ai} the shares of own-operated farm agricultural income derived from activity i (i=e,f,o) among the three types of activities mentioned above, where e,f,o denote exportable, tradable staple food and other nontradable agricultural products, respectively. Finally, denote by θ_i the base year shares of total household consumption expenditures (including subsistence consumption) (i=f,o,n) used for tradable staple food products, nontradable food products, and nonagricultural products (symbolized by i=n), respectively. Changes in the welfare of this type of household can then be monitored by examining the following index of changes of real income:

$$\tilde{Y} = \left(s_{ae}\,\tilde{P}^p_e + s_{af}\,\tilde{P}^p_f + s_{ao}\,\tilde{P}^p_o\right) + s_r\,\tilde{r} - \theta_f\,\tilde{P}^c_f - \theta_o\,\tilde{P}^c_o - \theta_n\,\tilde{P}^c_n \tag{2}$$

where the symbol (~) above a variable denotes percent change from a given period, Y is real income, P_e, P_f, P_o are the price indices of the three agricultural product groups as outlined above, with the superscript p for producer prices and c for consumer prices, P^c_n is the consumer price of the nonagricultural product, and r denotes the unit reward of any other nonagricultural activities of the given class of households.

Expression (2) can be straightforwardly derived by taking the derivative of a standard household consumer utility function, which is a function only of quantities consumed, under the assumption that the household earns income by operating on a standard production possibility frontier of agricultural and other activities. As long as smallholder activities are labor intensive

and total labor available per household as well as technology does not change,[2] the frontier will not shift outward over time, and hence only substitution among activities due to relative price changes will occur. This implies that quantity changes should not be part of expression (2).

While changes in the price of the three agricultural products faced by producers and consumers and the price of the nonagricultural product P_n^c can be observed and monitored relatively easily, the price of the "other" production activity r cannot. Given, however, that in many countries a large share of poor households' income is derived from such activities, it cannot be neglected. Indeed, several authors have emphasized the relation between the agricultural and nonagricultural wage and the price of other agricultural products (Ravaillon 1989, Sah and Stiglitz 1987). In our approach, however, r symbolizes something wider than just wages. It stands for the reward to any other type of activity, apart from work on own farm. In the annex, a model is outlined via which the change in r can be expressed as a function of the changes in the other four observable prices in equation (2) above, as well as a number of parameters discussed later in the paper. This also constitutes our methodological contribution to the issue of adjustment and smallholder income.

The upshot of the derivation of the model described in the annex is an expression for real income changes that is more complicated than (2)--that is, when we express r as a function of the other observable parameters, the result is the following expression:

$$\tilde{Y} = \left\{ \left[s_{ae} + \frac{s_r \lambda_a \beta_e}{(1-c)\Delta} \right] \tilde{p}_e^p + \left[s_{af} + \frac{s_r \lambda_a \beta_f}{(1-c)\Delta} \right] \tilde{p}_f^p + \left[s_{ao} + \frac{s_r \lambda_a \beta_o}{(1-c)\Delta} \right] \tilde{p}_o^p + \frac{s_r \lambda_n}{(1-a-b)\Delta} \tilde{p}_n^p \right.$$

$$\left. - \frac{s_r \lambda_n b \tilde{P}_m}{(1-a-b)\Delta} \right\} - \left\{ \theta_f \tilde{p}_f^c + \theta_o \tilde{p}_o^c + \theta_n \tilde{p}_n^c \right\} \qquad (3)$$

where:

$$\Delta = \frac{\lambda_n (1-b)}{1-a-b} + \frac{\lambda_a}{1-c} \qquad (4)$$

The symbols in (3) and (4) are explained in detail in the annex and they involve labor parameters of Cobb-Douglas production function (a,b,c),

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[2] The countries included in the paper have all been slow to achieve increases in yields and, in general, do not show signs of increased per capita production of total agricultural output. It is also noteworthy that if the technology is labor-using and there is full employment, little aggregate supply response to price is expected (Binswanger 1989).

aggregated labor shares in agriculture and nonagriculture (λ_a, λ_n), and shares of exportables, traded food, and other agricultural activities in total agricultural output (β_e, β_f, β_o). Also, the price P_m denotes an index of noncompetitive imported goods. Expression (3), therefore, depends on structural variables and changes in price indices that are relatively easy to estimate, as well as on a set of assumptions that are explored explicitly in the annex.

Notice that the weights multiplying producer prices inside the first bracket in the right-hand side of (3) sum to one, much like the weights in the second bracket sum to one. In other words, real income changes can be viewed as changes in the ratio of a Laspeyres index of nominal income (in combination with wages) and a Laspeyres index of consumer prices, with weights specific to the poor smallholders being examined in this study.

The use of a fixed weight index *underestimates* real income gains and *overestimates* real income losses. This is because the output and consequently the income shares in the numerator would tend to increase for products whose prices increase, and hence a fixed weight numerator would tend to be smaller than a true index.[3] In the denominator, substitution among consumed goods would tend to lessen consumption shares for products whose prices increase.[4] Hence, the fixed weight denominator would tend to be larger than the true one. A variable weight divisia index in both the numerator and the denominator would clearly be superior, but there are no data with which to implement it. Therefore, we proceed, recognizing the direction of bias being introduced into the analysis.

We could make the analysis more accurate as follows: starting with a base year t_0, use (3) to estimate to a first order the welfare changes for a subsequent period t_1, given observed price changes. Then use assumptions about demand and production transformation parameters to estimate new production and consumption shares in period t_1. Using the new shares, use (3) to estimate welfare changes for period t_2, and so on. While such an analysis of piece-wise linearization and updating will give a better estimate of welfare changes, it must be based on assumptions about the values of several parameters, which are normally not available for countries in sub-Saharan Africa. Hence, the second order gain in prediction accuracy might be lost by the parameter uncertainty. This led us to prefer the simpler and more straightforward analysis indicated above.

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[3] To capture these changes would require knowledge of elasticities of transformation in production, parameters that cannot be estimated for any of the countries included in this study due to data limitations.

[4] Once again, the parameters required to relax this assumption, including the own-price elasticities and elasticities of substitution, are simply not estimable from available data.

3. DATA AND DESCRIPTIVE STATISTICS

In order to apply the framework described above, a data set on household income sources, and the products that satisfy their consumer needs, has been organized for five countries. To do so, household-level data, including information on income and consumption, were analyzed from each of the countries. For Côte d'Ivoire, the Côte d'Ivoire Living Standards Survey (CLSS) data from 1985/86 were analyzed in order to understand the income sources and the expenditure patterns.[5] Likewise, the Ghana Living Standards Survey (GLSS) from 1987/88 was analyzed to describe income and consumption patterns in Ghana.[6] For each of these countries, two prototype households are distinguished, one for the forest region and the other for the savannah, reflecting the major agroclimatic zones for smallholder agriculture. In both surveys, the profile of the consumption/production characteristics were based on our analysis of the data tapes, which allowed us to select the bottom 20 percent of the per capita expenditure distribution.

The data from Madagascar are derived primarily from the social accounting matrix for calendar year 1984 (Dorosh 1990), which used various national accounts and regional surveys to define a group of smallholder farms cultivating between 0.25 and 1.5 hectares. The data allow us to distinguish among households in three agroclimatic regions, something of importance because of their markedly different production characteristics.

For Malawi, a regional survey conducted in Zomba district in Southern region was used to arrive at the income and consumption patterns.[7] Given that the communities surveyed were all in the densely populated region, the applicability to the more land-abundant regions in the north and center of the country is limited. In keeping with the intent to profile the poor smallholder, the mean landholding of the smallholders represented in this sample was only 1.5 hectares. However, these households are not likely the poorest of the poor, given that the high population density in the region has contributed to a large number of households having less than 0.5 hectare to cultivate (Sahn and Arulpragasam 1990). Finally, the data from Tanzania are derived from the results of a nationwide household survey performed in 1976/77. The survey, which covered 2,744 households across a larger spectrum of landholding sizes and incomes than the other surveys, nonetheless included

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5 See Grootaert (1986) and Ainsworth and Munoz (1986) for a description of the data set.

6 See Boateng et al. (1989) and Alderman (1989) for further discussion of the GLSS.

7 See Peters and Herrera (1988) for a complete discussion of the survey.

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predominantly poor smallholders with an average holding size of 1.43 hectares.

INCOME SOURCES

Initially we distinguish among three income categories: earnings from agricultural activities, earnings from nonagricultural activities, and nonearned income (see Table 1). Agricultural income includes the income derived from the sale of what is produced as well as the imputed value of consumption of own-production. Nonagricultural income includes income from wages, salaries, and own-account other than farming. And nonearned income includes income in the form of remittances, the imputed value of rent (where it was possible to estimate), and other transfers. Despite the great diversity in income shares, a few interesting features of these data are worth highlighting. First, even for smallholder households, nonagricultural earned income is a significant share of the total. For example, the nonagricultural income in Côte d'Ivoire was 21 and 17 percent for the forest and savannah regions, respectively. Similarly, figures for the two regions in Ghana were 40 and 31 percent, respectively. In Malawi, the nonagricultural income represented some 13 percent of the total, while the figure for Tanzania was 25 percent. Among the data examined, the highest income share from nonagricultural activities, including wages, salaries, and own account, were those observed in Madagascar, where they reached as high as 58 percent for poor households in the plateau.

Second, even though nonearned income is the least important category, it still makes a significant contribution in Malawi, where it comprises 36 percent of the total. This high percentage is attributable to the remittances from men working in South Africa or on estates within Malawi, which constitute an extremely important income source for smallholder households in the highly land-constrained southern region of the country.

Third, we are able to distinguish between the relative value shares of goods used for own consumption and those that are marketed. In all cases, except in Côte d'Ivoire, the value of home consumption dominates sales. This is an indication of a relatively noncommercialized agricultural sector.

Of greatest relevance to this paper, however, is to distinguish among tradable (e.g., rice, maize, groundnuts) and nontradable food products (e.g., roots and tubers, vegetables, meat, and milk), and export crops (coffee, tea, tobacco, cocoa, cloves) in the production of the average smallholder households for each country or region (Table 2). As indicated earlier, we focus on the implications of price changes among these three components of agricultural earnings, as well as nonagricultural earnings, r. By definition, virtually none of the export crops are consumed at home. While designating a commodity as a nontradable implies that it is not a direct substitute for an import good and is likewise not traded internationally, there is still considerable scope for the sale of such commodities in the local marketplace. Therefore, like tradable goods, these appear in both home consumption and marketings of the households.

Table 1 - Sources of Per Capita Income of Rural Smallholders, by Country and Region

Income Source	Ghana		Tanzania	Côte d'Ivoire		Malawi	Madagascar		
	Forest	Savannah	All	Forest	Savannah	South	Coast	Plateau	South
	(shares)								
Agricultural income	0.57	0.68	0.73	0.76	0.81	0.51	0.42	0.39	0.48
of which:									
Home consumption	0.37	0.54	0.50	0.31	0.40	0.37	0.25	0.31	0.37
Agricultural sales	0.20	0.14	0.23	0.45	0.41	0.14	0.17	0.08	0.11
Off-farm earned income[a]	0.40	0.31	0.25	0.21	0.17	0.13	0.55	0.58	0.49
Nonearned income[b]	0.03	0.01	0.02	0.03	0.02	0.36	0.03	0.03	0.03
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Sources: Computed from sources mentioned in text.

[a] Includes wages, salaries, and own-account.

[b] Includes income from transfers, remittances, and other nonearned sources.

Table 2 - Agricultural Income Shares of Rural Smallholders, by Country and Region

Shares	Ghana		Tanzania	Côte d'Ivoire		Malawi	Madagascar		
	Forest	Savannah	All	Forest	Savannah	South	Coast	Plateau	South
Traded Food[a]	0.18	0.26	0.35	0.14	0.32	0.53	0.23	0.30	0.36
Home consumed	0.09	0.16	0.27	0.08	0.18	0.52	0.23	0.28	0.33
Sales	0.09	0.10	0.09	0.06	0.14	0.01	<0.01	0.02	0.03
Nontraded Food[b]	0.70	0.73	0.61	0.41	0.46	0.24	0.46	0.69	0.58
Home consumed	0.57	0.63	0.42	0.32	0.31	0.20	0.35	0.51	0.44
Sales	0.13	0.10	0.18	0.09	0.14	0.04	0.11	0.18	0.15
Export Crops[c]	0.12	0.01	0.04	0.45	0.22	0.23	0.31	0.01	0.06
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Sources: Computed from various sources mentioned in text.

[a] Rice, maize, groundnuts, other traded food.
[b] Millet, cassava, sweet potato, yams, other nontraded food.
[c] Cocoa, tobacco, cotton, coffee, cola nuts, rubber, sugar, other exportables.

The relative importance of these classes of goods in overall agricultural incomes (including the imputed value of home consumption) and in revenue from sales varies considerably from one country and/or region to the next (Table 2). In Côte d'Ivoire, tradable food products comprise only 14 percent of the total agricultural income (including the imputed value of home consumption) in the forest region, while the comparable figure is 33 percent for the savannah. At the same time, exports crops represent 45 and 22 percent of agricultural incomes, and 75 and 43 percent of the agricultural sales revenue, in the two regions, respectively. These patterns reflect the dominance of coffee and cocoa in the former, while in the savannah, only cotton is an important export crop, with tradable and nontradable food crops (e.g., maize, rice, yams) all representing nearly equally important income sources. In other countries, export crops as a share of total agricultural incomes and as a share of sales revenue are also much lower than those observed in Côte d'Ivoire forest region. Tanzania, the savannah region of Ghana, and the plateau region of Madagascar are the extreme examples, where only 4 percent, 1 percent, and 1 percent, respectively, of the agricultural incomes are from production of export crops. The figures in other countries are more moderate, such as the 23 percent of agricultural incomes (and 83 percent of the sales revenue) in Malawi being from the primary export crop, tobacco, and the 12 percent of agricultural incomes (or 35 percent of the sales revenue) in the forest region of Ghana being from the export crops, cocoa and cola nut.

Perhaps the most interesting finding concerning the three groups of agricultural goods is that nontradable goods represent a very high share of total agricultural incomes as well as a high share of sales revenue. In Ghana, 70 percent of agricultural incomes are from nontradables in the forest region, with the comparable figure being 73 percent in the savannah. Nearly 40 and 50 percent of the sales revenue are from these sources in the two regions, respectively. In the Tanzania sample, nontradables were observed to comprise as much as 61 percent of total agricultural incomes and nearly 60 percent of the sales revenue. Even in the more commercialized Côte d'Ivoire, nontradables contribute 46 and 41 percent to total agricultural incomes in the savannah and forest regions, respectively. The relatively low level of nontradables in agricultural incomes in Malawi, 24 percent, reflects the domination of maize in the diet.

The value of home-consumed tradable food crops is generally greater than the value of sales of the same goods. This can be seen, for example, with maize and rice in both regions of Côte d'Ivoire, Tanzania, and Malawi. However, the degree to which home consumption dominates over sales of these specific commodities differs dramatically from one case to the next. In Malawi, where commercialized agriculture is by and large limited to the leasehold estate sector, the value of home-consumed maize per household is 100 times the value of sales. While in the more commercialized forest region of Côte d'Ivoire, 30 percent of the maize and nearly one-half of the rice is sold. Similarly, about one-half of the maize in Ghana's forest region is sold and the other half consumed at home.

As for nontradable goods, it is noteworthy that in some cases a sizable proportion of this category of commodities is sold, albeit locally. For example, of the total value of nontradable crops in Tanzania, 30 percent is

marketed. This is very close to the 32 percent observed for low-income smallholders in the savannah region of Côte d'Ivoire, which in turn is considerably higher than the forest region. In other cases, such as Malawi where only 15 percent of nontradable goods are sold, this is in keeping with the overall lower level of commercialization of agriculture in the region. In fact, a larger share of nontradable goods is sold locally in Malawi than the share of tradable commodities. But the important point is that local trade in "nontradables" represents a significant source of agricultural income, and undoubtedly nonfarm incomes for traders, as well as low-income smallholders.

EXPENDITURE SHARES

Having examined the structure of income sources for our prototype smallholder households, we now turn to a discussion of expenditure shares, including the imputed value of home consumption. As expected of poor smallholder households, the share of expenditures allocated to food is high. The actual numbers range between a low of 59 percent in the east Coast of Madagascar to 71 percent in Tanzania, 71 percent in the savannah in Côte d'Ivoire, and 80 percent in the savannah in Ghana (Table 3).

A more disaggregated look at expenditures indicates that the shares represented by tradable versus nontradable commodities is quite variable. In the savannah region of Côte d'Ivoire, and especially in southern Malawi, a relatively small portion of total expenditures (42 and 26 percent, respectively) is in the form of nontradable goods. However, for Ghana, 63 percent out of the 73 percent of the budget allocated to food in the forest region is in the form of nontradable goods. This reflects the importance of roots and tubers, legumes, vegetables, and meat (including fish and poultry) in the consumption bundle of these populations. For example, yams alone in Ghana forest region account for as high a budget share as rice and maize combined in the forest region of Côte d'Ivoire. In contrast, expenditures on tradables are higher in Malawi, owing to the importance of maize in the consumption bundle.

PRICES

For each country and for each group within a country that has more than one group, six price indices were constructed. Three producer price indices approximate developments in the prices of exportables, tradable food crops, and other nontradable food products, respectively. Three consumer price indices similarly summarize developments in the consumer prices of tradable food products, nontradable food products, and nonfood products.

The indices were constructed by considering time series for producer and consumer prices of a small number of products, considered major or representative for their respective class. The shares in income and consumption of the pertinent group were considered in aggregating the different price series into group specific indices. For example, for Côte d'Ivoire, the export price index was constructed by considering the producer prices of cocoa and

Table 3 - Expenditure Shares of Rural Smallholders

Shares	Ghana		Tanzania	Côte d'Ivoire		Malawi	Madagascar		
	Forest	Savannah	All	Forest	Savannah	South	Coast	Plateau	South
Food	0.73	0.80	0.71	0.65	0.70	0.61	0.59	0.65	0.62
Traded	0.10	0.26	0.23	0.15	0.28	0.35	0.19	0.16	0.16
Rice	0.02	0.08	0.05	0.06	0.11	0.00	0.13	0.16	0.13
Maize	0.06	0.16	0.17	0.05	0.10	0.33	<0.01[a]	<0.01	<0.01
Groundnuts	0.01	0.01	0.01	0.01	0.05	0.02	<0.01	<0.01	<0.01
Other	0.01	0.01	0.00	0.02	0.03	0.00	0.05	0.00	0.03
Nontraded	0.63	0.54	0.48	0.50	0.42	0.26	0.46[b]	0.49[b]	0.49[b]
Millet	0.00	0.16	0.04	0.00	0.03	0.01	<0.01	<0.01	<0.01
Cassava	0.12	0.05	0.02	0.04	0.03	0.01	0.00	n.a.[c]	n.a.
Other	0.51	0.33	0.41	0.46	0.37	0.25	0.00	n.a.	n.a.
Nonfood	0.27	0.20	0.29	0.35	0.30	0.39	0.41	0.35	0.38
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Sources: Computed from sources mentioned in text.

[a] <0.01 means a positive share between 0 and 0.005.

[b] The data for Madagascar did not permit us to distinguish the role of cassava versus other goods in the nontraded goods share.

[c] n.a. means not available.

coffee, with different weights for the forest and savannah rural poor reflecting their respective income shares from Table 2, scaled up so as to sum to one. Similarly, maize and paddy producer prices were considered representative for the tradable food price index, while plantain, cassava, and yams producer prices were considered representative of other agricultural products. For the consumer price indices in Côte d'Ivoire, consumer prices of maize and milled rice were considered representative of the tradable food price index; plantain, cassava, and yams were considered representative for the products consumed under the category "other nontradable foods"; and the nonfood consumer price index was taken to represent the consumer prices of nonfood products. Similar procedures were followed for the other countries and groups.

Note that in equation (3), one other price must be specified: the price of importable intermediate products P_m. As a proxy for this we used the nominal exchange rate, multiplied by the import unit value index for African countries published by the IMF (1990c).

Table 4 exhibits the evolution of the ratios of producer price indices of exportable agricultural products (P_e^p) to the price indices of tradable foods (P_f^p) and nontradable agricultural products (P_o^p) for each country and income group. Given that exchange rate depreciation is a pillar of policy reform efforts in sub-Saharan Africa, one would generally expect a rise in the price of exportables compared to the price of nontradable agricultural products. At the same time, the price of exportables with respect to tradable food crops is not expected to exhibit a significant trend due to expenditure switching policy. Despite these expectations, a number of caveats should be needed. The following conditions may result in outcomes differing in practice. First, parallel free markets may be operating so that observed prices in the marketplace before adjustment were already reflecting what could be viewed as an approximation of the equilibrium exchange rate toward which adjustments will move the official market. Second, exchange rate devaluation is often undertaken alongside with other domestic and international trade and marketing reforms, such as adjustment of quotas and tariffs that may offset some of the gains to farmers and/or losses to consumers, that would be a consequence of higher relative prices for tradables and export goods. Third, there is often a considerable lag between the beginning of adjustment programs and effectuating real policy changes.

With these points in mind, it is no surprise that the results of price ratios are mixed. For Ghana, it appears that the ratio of exportables versus tradable foods is higher after 1984 in both regions, and, likewise, the ratio of exportables to nontradable agricultural products also appears to have reversed a decline prior to 1984. In Côte d'Ivoire, the trends appear to be quite different. While the ratio of P_e^p/P_f^p appears to have risen after adjustment, the ratio P_e^p/P_o^p exhibits a clear downward trend. This likely reflects in part the appreciation of the CFA during this period.

In Malawi and Tanzania, no significant trend is apparent in either ratio. In the case of the former, this is explained by understanding pricing policy for export crops, specifically the tobacco varieties that smallholders are

Table 4 - Evolution of Producer Price Ratios of Exportable to Tradable Foods and Nontradable Agricultural Products

Year	Ghana		Tanzania	Côte d'Ivoire		Malawi	Madagascar		
	Forest	Savannah	All	Forest	Savannah	All	Coast	Plateau	South
	(1984=100)		(1986=100)	(1981=100)		(1980=100)	(1982=100)		
	Ratio of Exportables to Tradable Food Prices (P_e^p/P_f^p)								
1975	175.3	180.9	123.6	79.8	143.7	95.8	178.8	196.4	196.4
1976	98.0	105.2	146.3	76.3	135.6	87.6	195.5	212.4	212.4
1977	67.8	77.8	117.1	74.0	122.7	98.5	192.0	211.2	211.2
1978	140.2	157.9	107.8	86.3	103.5	128.8	199.0	214.5	214.5
1979	152.4	168.9	108.9	85.1	97.7	123.3	194.7	189.9	189.9
1980	74.6	84.4	120.0	112.6	110.7	100.0	167.4	164.4	164.4
1981	124.6	141.0	94.9	100.0	100.0	100.0	161.4	159.5	159.5
1982	115.3	118.3	93.9	98.0	91.4	64.5	100.0	100.0	100.0
1983	39.9	44.1	101.6	93.1	84.5	107.5	107.8	101.0	101.0
1984	100.0[b]	100.0	78.6	126.5	78.5	95.0	126.9	125.9	125.9
1985	205.7	214.7	88.9	111.3	90.4	113.2	106.8	112.2	112.2
1986	196.5	205.9	100.0	127.5	125.4	107.1	71.6	82.8	82.8
1987	200.1	212.8	105.2	124.9	126.1	114.8	117.4	139.3	139.3
1988	179.0	191.5	116.8	106.0	106.9	97.9	172.7	199.5	199.5
1989	n.a.	n.a.	137.3	n.a.	n.a.	97.7	n.a.	n.a.	n.a.

(continued)

Table 4 (continued)

Year	Ghana		Tanzania	Côte d'Ivoire		Malawi	Madagascar		
	Forest	Savannah	All	Forest	Savannah	All	Coast	Plateau	South
	(1984=100)		(1986=100)	(1981=100)		(1980=100)	(1982=100)		
	Ratio of Exportables to Nontradable Agricultural Products (P_e^p/P_o^p)								
1975	n.a.	355.3	112.9	191.9	275.1	65.1	145.3	178.0	163.9
1976	n.a.	207.8	113.4	159.3	229.7	69.6	176.5	213.5	194.2
1977	122.1	107.3	65.2	86.3	136.5	78.3	136.5	176.3	153.0
1978	224.8	188.8	58.8	101.0	119.1	96.8	131.1	168.5	143.2
1979	227.2	225.6	70.7	85.6	101.9	95.6	118.3	143.4	117.4
1980	131.8	119.1	87.0	99.9	101.2	100.0	106.8	118.3	105.7
1981	153.9	153.7	98.0	100.0	100.0	100.2	93.0	99.6	92.9
1982	115.8	116.5	97.8	96.0	96.3	107.4	100.0	100.0	100.0
1983	45.1	50.4	100.7	80.6	80.4	85.8	103.7	95.7	96.4
1984	100.0	100.0	85.8	85.7	77.9	66.2	106.4	105.8	105.5
1985	279.2	277.7	88.9	97.0	97.5	75.0	102.5	108.7	107.1
1986	242.6	298.7	100.0	90.1	98.1	66.9	88.9	116.9	103.2
1987	182.6	265.8	107.0	87.8	94.5	71.7	129.7	173.9	152.6
1988	242.0	229.9	120.7	85.1	90.7	74.1	171.6	209.3	197.6
1989	n.a.[a]	n.a.	128.2	n.a.	n.a.	82.2	n.a.	n.a.	n.a.

[a] Data not available to compute these values.
[b] The indices are set equal to 100.0 in the first year of adjustment programs.

Sources: Computed from the following:

Ghana: Harold Alderman (1990), "Downturn and Economic Recovery in Ghana: Impacts on the Poor" (Washington, D.C.: Cornell University Food and Nutrition Policy Program); Republic of Ghana, "Ministry of Agriculture Price Series for Selected Commodities, 1970-1990, collected data); Republic of Ghana (1989), Quarterly Digest of Statistics (Accra: Statistical Service); World Bank (1987), Ghana: Policies and Issues of Structural Adjustment (Washington, D.C.: World Bank).

Table 4 (continued)

Tanzania: Government of the United Republic of Tanzania (1988), Annual Review of Maize, Rice, and Wheat (Dar es Salaam: Ministry of Agriculture and Livestock Development); Govt. of the United Republic of Tanzania (1989), Basic Data, Agriculture, and Livestock Sector (1983/84-1987/88) (Dar es Salaam: Planning and Marketing Division, Ministry of Agriculture and Livestock Development); Economic Research Bureau (various years), Tanzania Economic Trends: A Quarterly Review of the Economy (Dar es Salaam: Economic Research Bureau, University of Dar es Salaam and Bureau of Statistics, Ministry of Finance, Economic Affairs and Planning); World Bank (1983), Tanzania: Agricultural Sector Report (Washington, D.C.: World Bank).

Côte d'Ivoire: International Monetary Fund (1990), Côte d'Ivoire: First Review and Modification of a Stand-by Arrangement (Washington, D.C.: IMF); World Bank (1986), Côte d'Ivoire: Agricultural Sector Review (Washington, D.C.: World Bank); Government of Côte d'Ivoire (various years), Ministere de l'Economie et des Finances: Bulletin Mensuel (Abidjan: Ministere du Plan, Direction de la Statistique).

Malawi: Government of Malawi (various years), Malawi Monthly Statistical Bulletin (Zomba: National Statistical Office); David E. Sahn and Jehan Arulpragasam (1990), "The Stagnation of Smallholder Agriculture in Malawi: A Decade of Structural Adjustment" (Washington, D.C.: Cornell University Food and Nutrition Policy Program); World Bank (1990), Malawi: Growth Through Poverty Reduction (Washington, D.C.: World Bank).

Madagascar: Ministere de la Production Agricole et de la Reforme Agraire (1988), Characteristiques Generales du Milieu Rural, Campagne Agricole, 1984/85. Projet Recensement National de l'Agriculture et Systeme Permenent des Statistiques Agricoles, Tome II (Antananarivo: Repoblika Demokratika Malagasy); Paul Dorosh, Rene E. Bernier, and Alexander Sarris (Forthcoming), Macroeconomic Adjustment and the Poor: The Case of Madagascar, CFNPP Monograph (Washington, D.C., and Ithaca, N.Y.: Cornell University Food and Nutrition Policy Program); Paul Dorosh, Rene Bernier, Armand Randrianarivony, and Christian Rasolomanana (1990), A Social Accounting Matrix for Madagascar: Methodology and Results (Washington, D.C.: Cornell University Food and Nutrition Policy Program).

permitted to produce. In particular, the government administers the price of tobacco, and parastatals assume all the responsibility for procuring and marketing the crop. Therefore, the potential benefits of expenditure switching policies cannot be transmitted to the farmer. In Madagascar, the trend in P_e^p/P_o^p takes a big jump in 1987 and 1988, back to levels observed in the 1970s. After falling dramatically in 1982 and 1983, the years that marked the formative stages of Madagascar's adjustment program, P_e^p/P_f^p showed signs of increasing from 1984 to 1988. The notable exception was 1986, when rice prices soared owing to a failure to import needed quantities to avoid shortages.

A similar set of consumer prices and ratios, including tradables to nontradables, tradables to nonfood, and nontradables to nonfood, were constructed. While these prices are also employed in the simulations which are discussed in the following section, like those for producer prices, there is little indication of generalizable trends that correspond to the priors of what is expected during adjustment: expenditure-switching policies that favor exportables, or at least tradable goods relative to nontradables. The explanation for this is that the developments in terms of movements in prices in each country must be related not only to the specific exchange rate regime but also to the commercial policies being pursued, institutional reforms that allow prices to clear the market, as well as stochastic events such as rainfall.

But perhaps of equal note is the instability in some of the price ratios in some of the countries. Let us, for the sake of illustration, examine the most dramatic fluctuations. In Madagascar, for example, the large decline in P_e/P_f in 1986 reflected the shortfalls in imports when a lack of coordination between ministries resulted in the government distribution system running out of stocks (Shuttleworth 1989). In Malawi, P_e/P_f went from 100.0 in 1981 to 64.5 in 1982. This is due to the dramatic increase in the price of tradable food crops. Maize prices increased from Mk6.6 to Mk11.0, and groundnuts increased from Mk33.8 to Mk51.9, while tobacco, the predominant export crop, witnessed a very small price change. In the year following, however the tobacco price took a dramatic jump from Mk45.1 to Mk75.9, while maize prices did not change. This drove the ratio back up to 107.5. All of this illustrates that price policy in Malawi was reacting year by year to a variety of signals, such as a maize shortage in 1981, and the pressures to increase foreign exchange commensurate with the signing of the second adjustment loan in 1983 (Sahn and Arulpragasam 1990).

Another example of a marked incongruity in price ratio is found in Ghana in 1983, when both P_e/P_f and P_e/P_o plummeted. The explanation is to be found in the food shortages due to the drought and bush fires that decimated production of food crops, driving prices of rice, maize, and subsequently roots and tubers to dramatic highs (Alderman 1990).

If space permitted, many interesting stories could be told about observed price fluctuations. The data clearly indicate the lack of clear adjustment-induced trends in prices, as well as the buffeting that smallholders have endured and continue to endure from price shocks. The combination of the

stochastic nature of the weather, coupled with the vagaries of government decision making, clearly results in large year-to-year and unpredictable fluctuations.

OTHER PARAMETERS

The remaining necessary parameters for the simulation of the model were estimated from a variety of sources for each country (Table 5). These parameters refer to the national level, so they are not specific to any income group. They were compiled generally by examining national accounts, input-output, and labor force statistics in the various countries, using some adjustments and approximations where the exact figures were not available.

Table 5 - Values of Other Structural Parameters

Parameters[a]	Ghana	Tanzania	Côte d'Ivoire	Malawi	Madagascar
a	.48	.65	.58	.49	.56
b	.13	.18	.12	.22	.20
c	.66	.90	.66	.66	.58
λ_a	.53	.61	.64	.81	.74
λ_n	.47	.39	.36	.19	.26
β_e	.15	.16	.44	.28	.07
β_f	.16	.17	.07	.43	.26
β_o	.69	.67	.49	.29	.67

[a] Symbols are explained in Section 2.

Sources: Computed from:

Ghana: World Bank (1983), Ghana: Policies and Programs for Adjustment (Washington, D.C.: World Bank); World Bank (1987), Ghana: Policies and Issues of Structural Adjustment; World Bank (1987), Ghana: Structural Adjustment for Growth; World Bank (1990), World Development Report; national accounts data; and production data from the Government of Ghana.

Tanzania: 1976 Input-Output table, and national accounts data; World Bank (1990), World Development Report (Washington, D.C.: World Bank).

Côte d'Ivoire: World Bank (1987), The Côte d'Ivoire in Transition, from Structural Adjustment to Self-Sustained Growth; World Bank (1986), Côte d'Ivoire Agricultural Sector Review; World Bank (1986), Côte d'Ivoire: Macroeconomic and Public Expenditure Strategies in the Context of Structural Adjustment: A Review.

Malawi: Government of Malawi (1985), National Accounts Handbook; Government of Malawi (various years), Economic Report; Government of Malawi (various years), Annual Economic Survey; World Bank (1990), Malawi: Country Economic Memorandum; trade data from National Statistics Office.

Madagascar: Paul Dorosh, Rene Bernier, Armand Randrianarivony, and Christian Rasolomanana (1990), A Social Accounting Matrix for Madagascar: Methodology and Results (Washington, D.C.: Cornell University Food and Nutrition Policy Program).

4. MODEL RESULTS

From the analysis in Section 2, we derived expression (3), which enables us to simulate the changes in the rural income of a typical member of a poor smallholder household. The procedure we used in implementing this expression was to construct two Laspeyres indices of nominal income and nominal consumer prices for each class, corresponding to the two brackets in expression (3). In other words, the index of nominal income was computed by multiplying the weights by the various producer price indices mentioned in the previous section, where the parameters in the weights and the price series were those described in Tables 2 and 4. Similarly, as shown in the second bracket of (3), we multiply the index of nominal consumer prices discussed in the previous section by the weights θ_i derived from Table 3. The ratio of these weighted nominal income to nominal consumer price indices gives an index of real incomes of a given class of rural smallholders.

Table 6 exhibits the evolution of this index of real incomes for each country and class of poor rural households identified, from 1975 to 1989. For each country the index is set to 100 in the first year of implementation of structural adjustment programs in each country, and they differ by country.[8] It must be emphasized that the index describes changes in real incomes arising only from relative price changes and does not incorporate changes that would arise from random fluctuations in the production. So, for instance, in a year of drought and high food prices, the index might indicate high real income for the typical rural smallholder under the assumption that his production was not affected by the drought. While this is clearly not correct, it isolates the effects of prices from the effects of random shocks in quantities produced. Even this, however, is a simplification; random shocks in production will affect observable prices and might bias the results. In any case, the objective of the exercise is to discover any noticeable trends.

In Tanzania, the results indicate a decline in rural smallholder incomes, which occurred after the 1976-1977 coffee boom and became more acute beginning in the major pre-SAP crisis years 1984 and 1985. In 1987 the real rural incomes appeared to rise, but this was not sustained into 1988. It is noteworthy, however, that this decline in the last half of the 1980s was largely attributable to the liberalization of maize meal in 1984, which led to a threefold increase in its price and had adverse consequences on the large number of smallholders who are net consumers, given that many consumers were

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8 There is some arbitrariness to deciding when SAPs begin. For the sake of consistency, we use the first year in which loans from the World Bank are approved.

already paying the open-market price before liberalization. Nonetheless, the actual decline in incomes shown in Table 6 is overstated. However, in the absence of a comprehensive data series on the price of open-market maize and the share purchased on the open versus official market, it is not possible to determine how much the decline is exaggerated.

In Côte d'Ivoire, since 1981 when adjustment programs were first implemented, a small but significant trend towards declines in real rural smallholder incomes is apparent in both the forest as well as the savannah regions. This is especially obvious in 1987 and 1988, which witnessed a considerable appreciation of the CFA concurrent with falling world prices for cocoa and coffee. But it also reflects the contraction of the economy as a whole which has occurred since the beginning of adjustment.

In Malawi, the results also correspond to expectations. In particular, the negative GDP growth rates reported for Malawi in 1980 and 1981 in fact correspond to the low values in the index. Similarly, the index fell temporarily in 1987 and 1988 because the real prices for the major traded agricultural good, maize, and the major export crop, tobacco, were lower during those two years than the entire period between 1975 and 1989 (Sahn, Arulpragasam, and Merid 1990). But, in addition to the movement of the income index corresponding to our priors, it is of equal importance to note that production and yields of all major exports, traded and nontraded goods, were at best stagnant during the period covered by the model (Sahn and Arulpragasam forthcoming). This implies that not incorporating the supply response is once again not a serious compromise in the Malawi case.

Madagascar also witnessed no significant trend in rural incomes in any of the three regions since 1982, the year of initiation of adjustment operations. This is not surprising, since the initial years of Madagascar's reform program were dedicated primarily to stabilizing the account balances through reducing absorption. In addition, a examination of government policies regarding the taxation of agriculture reveals that at least through 1987, the last year for which data are available, the extremely high level of taxation of coffee, vanilla, and cloves has not abated during adjustment (Dorosh 1990). Similarly, other indicators on the performance of the food crop sector, such as total rural rice consumption and rice production per capita, were actually in decline between 1982/83 and 1986/87 (Dorosh 1990). This adds further credence to the results of the model, namely, that smallholders have not been early beneficiaries of adjustment.

The most questionable results of the model regard the case of Ghana. In particular, the index of real incomes of poor rural smallholders suggests that they were highest in the years 1981 to 1983. Certainly, this seems counterintuitive given Ghana's impressive macroeconomic performance after 1984, which was partially driven by an increase in incentives for the production of exportable crops, particularly cocoa. The explanation for the surprising results of the model is to be found in (i) referring back to earlier tables on the structure of incomes and expenditures and price trends, (ii) recognizing the limitations of the model itself in incorporating aggregate supply response, and (iii) reconsidering the importance of rewards to nonagricultural activities that are captured in the model.

Table 6 - Evolution of Index of Real Incomes of Rural Smallholders Before and After Adjustment

Year	Ghana		Tanzania	Côte d'Ivoire		Malawi	Madagascar		
	Forest	Savannah	All	Forest	Savannah	All	Coast	Plateau	South
	(1984=100)		(1986=100)	(1981=100)		(1980=100)	(1982=100)		
1975	n.a.[a]	n.a.	148.6	102.0	105.2	95.3	108.2	100.2	101.8
1976	n.a.	n.a.	145.3	103.2	110.5	102.6	106.8	97.6	100.0
1977	146.9	123.0	154.4	91.1	102.3	101.9	107.3	98.3	100.1
1978	88.9	88.5	164.4	116.1	119.6	106.0	107.0	97.5	99.2
1979	83.5	78.4	166.7	100.0	105.7	106.4	106.9	96.8	98.4
1980	97.5	93.1	154.1	106.9	103.9	100.0	106.8	99.2	99.6
1981	109.5	100.2	125.0	100.0	100.0	88.8	104.9	99.5	98.3
1982	101.8	100.9	134.1	98.7	99.5	101.6	100.0	100.0	100.0
1983	108.5	123.4	147.4	84.8	91.5	125.6	98.2	98.2	97.4
1984	100.0	100.0	133.9	90.3	89.8	116.2	97.8	96.8	95.7
1985	97.6	90.0	118.5	90.3	91.6	124.2	99.7	99.1	99.3
1986	89.5	85.6	100.0	97.8	96.3	118.4	104.9	104.3	108.8
1987	99.9	88.5	111.1	87.0	86.6	105.0	102.8	97.9	102.4
1988	89.1	88.0	91.6	89.3	91.7	104.2	98.5	93.0	95.2
1989	n.a.	n.a.	n.a.	n.a.	n.a.	118.1	n.a.	n.a.	n.a.

Source: Computed.

[a] Some of the necessary prices for the relevant years for these countries were not available.

To amplify, regarding the first point, the fact that export crops, particularly cocoa, make up such a small share of overall incomes in the savannah (i.e., 0.7 percent of total incomes and 1.0 percent of agricultural incomes) and in the forest region (i.e., 6.8 percent of total incomes and 12 percent of agricultural incomes) partially explains the reason why increased incentives to export crop producers has not resulted in higher real incomes for the rural poor. A related reason is the prominence of nontraded crops in the income shares. In keeping with expectations about the consequence of large-scale currency devaluation, the relative prices of nontraded commodities have not been increased during adjustment, providing for little increased income to households so heavily engaged in producing roots and tubers.

Regarding the second point, this model is limited (as discussed earlier) in that it does not capture aggregate increases in output that result from adjustment programs or unrelated stochastic events. This represents a noteworthy shortcoming for Ghana given the evidence that, unlike the other countries included in the study, increases in aggregate output have been sustained since the beginning of adjustment. Certainly part of this represents simply improved weather conditions. The fact is, nonetheless, that the model's limitations in accounting for aggregate supply response are most seriously manifested in the Ghana case.

The third and perhaps most interesting point in explaining the counterintuititve results for Ghana lies in reconsidering an innovation of the methodology used here: the incorporation of nonfarm smallholder income in the index of total real income. It is interesting to investigate whether the trends indicated in Table 6 are common for different components of income. To illustrate this, we separated the total real income index into two components, the first one representing real income from agriculture, while the second representing real income or rewards from nonagricultural activities. In terms of expression (13), the first index, denoted by Y_{RA}, consists of a numerator of nominal agricultural income composed of the three agricultural producer price indices, P_e^p, P_f^p, P_o^p, with weights the shares s_{ai}/s_a (so that they sum to one), and the same denominator of consumer prices used in the overall index. The second index of real income from nonagricultural sources is denoted by Y_{RN}. It consists of a numerator that incorporates all the five producer price indices indicated in (3), with the weights indicated there, but without the s_{ai}'s, and divided by s_r, so that the weights add to one. This is then divided by the same consumer price index as the overall index.

Table 7 indicates the results. Examining the trends for Ghana, it becomes clear that it is not agricultural prices that are the major factor leading to the mild decline in real income, but the decline in nonagricultural income. To the extent that adjustment programs in fact bring about shifts in relative prices that lower returns to labor, this finding is not altogether surprising. Furthermore, it is plausible that, in the face of the large devaluation of the cedi in 1984 that led to a sharp rise in the costs of capital and intermediate inputs, to say nothing of consumables, there was a sharp rise in the costs of nonagricultural activities with subsequent decline in activity and hence nonfarm income earning opportunities by the rural poor. However, the possibility that there were increases induced in,

Table 7 - Decomposition of Agriculture and Nonagriculture Components of the Index of Real Incomes of Rural Smallholders

	Ghana				Tanzania		Côte d'Ivoire				Malawi		Madagascar					
	Forest		Savannah		All		Forest		Savannah		All		Coast		Plateau		South	
	Y_{RA}	Y_{RN}	Y_{RA}	Y_{RN}	Y_{RA}	Y_{RN}	Y_{RA}	Y_{RN}	Y_{RA}	Y_{RN}	Y_{RA}	Y_{RN}	Y_{RA}	Y_{RN}	Y_{RA}	Y_{RN}	Y_{RA}	Y_{RN}
	(1984=100)				(1986=100)		(1981=100)				(1980=100)		(1982=100)					
1975	n.a.[a]	n.a.	n.a.	n.a.	150.7	138.4	103.5	93.7	104.8	103.6	93.6	93.6	115.8	97.0	96.0	96.8	101.2	96.6
1976	n.a.	n.a.	n.a.	n.a.	147.8	134.4	104.1	96.5	110.2	108.5	102.0	99.9	113.6	94.9	88.6	96.1	96.3	96.4
1977	157.1	123.3	130.4	99.3	156.8	145.1	92.4	84.7	103.5	95.0	101.0	99.8	114.2	97.0	93.5	95.6	99.2	95.6
1978	88.8	83.6	87.3	86.1	170.4	147.3	117.2	110.7	120.6	113.4	105.0	104.9	113.0	98.8	92.4	96.7	97.9	96.7
1979	83.7	82.0	76.0	82.3	172.6	151.5	100.8	96.6	106.9	99.8	105.0	106.6	112.8	101.2	93.5	97.3	98.0	97.4
1980	98.7	100.0	94.6	93.4	156.5	149.5	107.8	103.8	104.3	102.1	100.0	100.0	112.7	103.0	100.1	99.2	101.0	98.7
1981	107.1	116.7	96.7	111.6	126.5	122.2	100.0	100.0	100.0	100.0	87.7	89.9	108.5	102.5	101.5	98.7	99.4	97.6
1982	100.4	106.9	99.2	108.0	135.6	131.3	98.1	100.6	99.5	99.6	103.1	99.9	100.0	100.0	100.0	100.0	100.0	100.0
1983	121.5	93.6	135.3	99.9	148.9	144.5	84.3	86.0	91.9	89.3	126.9	124.0	96.4	99.6	95.8	99.7	95.1	99.7
1984	100.0	100.0	100.0	100.0	137.8	124.1	90.0	90.6	90.6	85.8	116.1	115.4	96.4	97.6	93.5	97.7	92.7	97.3
1985	92.1	99.3	82.0	102.1	118.7	117.9	89.8	90.9	91.8	89.6	123.4	123.7	99.7	97.5	98.2	97.6	98.8	97.6
1986	98.9	73.3	87.6	76.7	100.0	100.0	97.1	99.4	95.5	99.4	116.5	119.3	110.5	100.0	111.5	98.9	117.1	100.5
1987	117.0	76.7	95.4	72.8	113.0	106.8	86.4	88.8	85.8	89.8	101.4	107.9	109.9	97.2	98.0	97.4	105.9	98.7
1988	102.0	69.4	94.3	71.8	91.9	90.5	88.9	90.5	91.5	92.2	99.4	108.2	102.1	94.8	83.8	97.8	90.8	98.2
1989	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	115.5	120.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Source: Computed.

[a] Data were not available to compute these indices.

for example, marketing services and other forward and backward linkages with agriculture are not fully captured, given that aggregate output is fixed. This latter point once again admonishes caution in interpreting the results.

Examining the trends of Y_{RA} and Y_{RN} for other countries indicates that for Tanzania, both components of real incomes exhibit similar trends. In Côte d'Ivoire, while in the forest region the indices exhibit similar trends, in the savannah real agricultural income shows a declining trend while non-agricultural income does not exhibit any clear direction of change. In Malawi, both components of real income also generally show similar trends. However, the increase in incomes in 1989 shown in Table 6 is largely attributable to the increase in Y_{RA}, reflecting the large jump in the producer prices for maize and tobacco, while consumer price increases for the staple tradable foods, maize and groundnuts, were moderate. Finally, in Madagascar, the overall indices do not exhibit significant trends, and this appears also to be the case for both agricultural as well as nonagricultural incomes. It therefore appears that with the exception of Ghana, the trends in agricultural real incomes appear to be similar to those of nonagricultural real incomes in all the countries.

5. SUMMARY AND CONCLUSIONS

This paper presents a model that enabled us to examine trends in real incomes of rural smallholders in several countries and regions of sub-Saharan Africa. The results indicate that there is no unequivocal pattern of increase or decline in real welfare of the rural poor and that the effects differ markedly by country and region. This highlights the importance of structure of incomes and expenditures of the rural smallholders as well as, of course, the evolution of relative prices. However, the evolution of relative prices, specifically the changes in the ratio of tradable to nontradable prices, are not sufficient indicators or predictors of developments in real welfare. Ghana seems to be a good case in point, where while the agricultural exportable good prices clearly seem to be favored after adjustment, this has not led to major rises in the real incomes of rural smallholders in either the forest or the savannah regions.

It must be realized that our analysis suffers from a number of limitations. For example, as discussed above, the simulation model is unable to capture adjustments made by producers and consumers to price signals. This implies, as discussed earlier, that the results are more pessimistic than in reality. Hence, indications that rural smallholder welfare does not change in fact might imply small improvements. Similarly, our price indices do not include prices for all products that make up the tradable and nontradable groups. However, we do not believe that more detailed analysis of prices would reverse the general conclusions since we captured a large proportion of income and expenditure shares for each country. Of course, we have stopped short on the type of modeling required to explain how policy has influenced the observed price trends, and hence cannot attribute the evolution of smallholder real incomes to adjustment programs or any other specific factor. Nonetheless, we believe that we have shown that the issue of structural adjustment and rural poverty is complex and that earlier efforts that arrive at simplified statements of the harmful or beneficial effects of adjustment based on stylized facts were not useful. Quite simply, they failed to account for the basic facts of sources of income, patterns of expenditures, and movements of relative prices in the wake of adjustment.

In particular, we have shown that the direction and level of changes in real incomes brought about by structural adjustment are determined by a variety of factors. Outcomes will be different and, by and large, unpredictable without, at a minimum, a careful analysis of an extensive range of data, including information on income, expenditures, and prices found in this paper. This is a consequence of the considerable variation in the shares of tradables, nontradables, and exportables in the consumption bundle as well as in the outputs of smallholders; the fact that changes in nonagricultural incomes can offset or reinforce changes in agricultural earnings, and that

these shifts are in turn conditioned by a variety of parameters that characterize the economy as a whole; and the fact that relative prices do not move in a predictable fashion in the wake of adjustments because of the range of domestic and international commercial and trade policies that affect these patterns. Indeed, further research to construct dynamic and general equilibrium models is needed to define, using counterfactual analysis, the changes brought about by adjustment. The loss in precision in some of the simplifying assumptions in the model presented in this paper does not, however, distract from its ability to indicate the direction and order of magnitude of changes in smallholder welfare in the years since adjustment programs began. Thus, while the search for generalizations will continue, at this juncture it is safe to conclude that there is little evidence of large welfare gains or losses accruing to smallholders in the wake of policy reforms in the countries studied.

ANNEX

A MODEL FOR ANALYZING REAL INCOME CHANGES OF RURAL SMALLHOLDERS

Consider an economy composed of two sectors--agriculture and nonagriculture. The agricultural sector produces three products (exportables, traded foods, and other agricultural ones indexed by e, f, and o) and, apart from land, uses only labor. The nonagricultural sector produces one product using labor and an imported intermediate product. Technology is Cobb-Douglas. The nonagricultural sector can be thought of as composed of a formal and an informal sector, producing largely consumer products that are imperfect substitutes in consumer preferences. The formal sector, which includes all the public enterprises, is in many analyses modeled as a fix-price nonagricultural sector; namely, one with excess capacity and fixed nominal wages. The informal sector, composed of many individual and small-scale unincorporated enterprises, can be thought of as a flex-price one with ease of entry and exit and where a lot of self-employment takes place. The two sectors are lumped together here as one sector that operates so as to maximize short-run profit.

The lumping together of two sectors that apparently behave very differently might appear strange. However, from our perspective, what is of interest is first that the reward to nonagricultural activities varies, and that labor can shift between the agricultural and nonagricultural sectors. The labor rewards to the flex-price nonagricultural sector certainly vary in response to labor supply and demand. However, although it might appear that nominal wages are fixed in the so-called fix-price sector (e.g., the public sector), it is well known that when real wages decline there, people reduce their labor input and engage in other activities, agricultural and nonagricultural. Hence a decline in the output of the fix-price sector might just mean an increase in the activity of the informal sector. In the aggregate, it is reasonable to expect that the output of both sectors together will respond to total expected rewards in both formal and informal activities, and this is what justifies our assumption that the total nonagricultural sector behaves as if it maximizes profits. The profit maximization assumption is just a convenient way to describe our belief that output varies with prices, and labor and other input demands will also respond to prices.

Denote by X_n the output of the nonagricultural sector, by L_n the demand for labor in the same sector, by M the amount of the imported intermediate that is demanded in n, by w the effective unit labor reward, and by P_m the domestic price of M. The sector will maximize profit, π, where:

$$\pi = P_n X_n - w L_n - P_m M \tag{A.1}$$

The technology producing X_n is as follows:

$$X_n = K_n L_n^a M^b \tag{A.2}$$

with a,b positive parameters (a+b<1) denoting the share of labor and imported intermediates, respectively, in the production of the nonagricultural products. Substituting (A.2) into (A.1) and maximizing, yields a function for the demand for labor L_n and the demand for M. Log-differentiating the demand for labor, we obtain:

$$\tilde{L}_n = \frac{1}{1-a-b} \left(\tilde{P}_n - (1-b)\ \tilde{w} - b\ \tilde{P}_m\right) \tag{A.3}$$

Equation (A.3) expresses how the demand for nonagricultural labor changes, with changes in the price of the nonagricultural product, and its two main inputs.

The other major labor-using sector is agriculture. Agriculture supplies labor to the nonagricultural sector depending on the relative rewards of agricultural versus nonagricultural activities. At this point, we introduce two structural assumptions that seem to be quite relevant for countries in sub-Saharan Africa. First, most of agricultural production is organized along individually operated farm units. This implies that the reward of a unit of agricultural labor is on aggregate close to the *average* product of labor in agriculture. The second assumption has to do with the types of nonagricultural activities in which the rural poor engage. They usually involve either wage employment in rural or urban areas, or some type of small-scale, owner-operated enterprise. Given capital requirements, risks, etc., it might not be too far-fetched to assume that the effective reward offered by the nonfarm enterprise to a unit of nonagricultural labor is not far off the effective reward of farm operator labor. This fact has been supported by some empirical evidence (Collier et al. 1986). We consider this as being true for all countries in our sample.

Given the above reasoning, the behavioral relation that will govern the supply of labor from agriculture to nonagriculture is the following:

$$r = w = \frac{P_a X_a}{L_a} \tag{A.4}$$

where X_a is the aggregate output of the agricultural sector, L_a is the labor employed in agriculture, and P_a is the aggregate price of agricultural output. If the production of X_a is governed by the following Cobb-Douglas relation:

$$X_a = K_a L_a^c \tag{A.5}$$

then (A.4) gives a relation between L_a and r. Log-differentiating that equation, we obtain a relation between the aggregate use of agricultural labor and the nonagricultural wage:

$$\tilde{L}_a = \frac{1}{1-c} \left(\tilde{P}_a - \tilde{r}\right) \tag{A.6}$$

Under the assumed Cobb-Douglas technology, equation (A.6) is also valid if the unit reward is equal to the marginal product of labor in agriculture.

The final consideration has to do with the structure of the aggregate labor market. In sub-Saharan Africa unemployment rates are very low and in the rural areas virtually zero, as has been found by household surveys (see, for example, Glewwe 1988). The reason is that people move in and out of various low-skilled activities quite easily. Albeit it is more difficult to find permanent wage work in the rural sector (e.g., as a public employee), even that submarket is not separated from the rest of the labor market. In fact, it is quite prevalent that underpaid civil employees are involved in other activities by effectively diminishing their labor input into their official activity. The upshot of these arguments is that it is reasonable to suggest that the labor market is characterized in sub-Saharan Africa by full employment, and it is this that determines returns to labor.

The implication of this consideration for our simple model is that we can use equations (A.3) and (A.6) in an aggregate labor market clearing equation to determine $\tilde{r}$. The aggregate labor market equilibrium condition is:

$$L_a + L_n = L \tag{A.7}$$

where L is exogenously given. Log-differentiating (A.7), and using (A.3) and (A.6), we obtain:

$$\tilde{r} \left[\frac{\lambda_n (1-b)}{1-a-b} + \frac{\lambda_a}{1-c}\right] = \frac{\lambda_n \tilde{P}_n}{1-a-b} + \frac{\lambda_a \tilde{P}_a}{1-c} - \frac{\lambda_n b \tilde{P}_m}{1-a-b} \tag{A.8}$$

In equation (A.8) λ_a, λ_n are the base year shares of total labor employed in agriculture and nonagriculture, respectively.

Notice that we have abstracted from secular trends in wages caused by changes in the capacity of the two sectors (summarized by the all-inclusive indices K_a and K_n in the model) as well as exogenous growth in the labor force. These influences could easily be included by adding to the right-hand side of equation (A.6) another term $\tilde{w}^*$, where:

$$\tilde{w}^* = \frac{\lambda_n \tilde{K}_n}{1-a-b} + \frac{\lambda_a \tilde{K}_a}{1-c} - \tilde{L} \tag{A.9}$$

and is the exogenous natural growth rate of the labor force. Lacking much information on which to empirically estimate $\tilde{K}_a$ and $\tilde{K}_n$, we simply neglect the term $\tilde{r}^*$ altogether.

Before substituting equation (A.8) into our original equation (2) in the main text, we note that the log-change in the index of agricultural prices $\tilde{P}_a$ can be written as a function of the three agricultural product groups, as follows:

$$\tilde{P}_a = \sum_i \beta_i \tilde{P}_i^p \tag{A.10}$$

where β_i (i=e,f,o) are the base year shares of each group's output in the total agricultural output of the country. With these conventions, equation (A.8) can be substituted in equation (2) in the main text and yield the following equation that will be used to trace the real welfare of a typical poor household:

$$\tilde{Y} = \left\{ \left[s_{ae} + \frac{s_r \lambda_a \beta_e}{(1-c)\Delta} \right] \tilde{P}_e^p + \left[s_{af} + \frac{s_r \lambda_a \beta_f}{(1-c)\Delta} \right] \tilde{P}_f^p + \left[s_{ao} + \frac{s_r \lambda_a \beta_o}{(1-c)\Delta} \right] \tilde{P}_o^p + \frac{s_r \lambda_n}{(1-a-b)\Delta} \tilde{P}_n^p \right.$$

$$\left. - \frac{s_r \lambda_n b \tilde{P}_m}{(1-a-b)\Delta} \right\} - \left\{ \theta_f \tilde{P}_f^c + \theta_o \tilde{P}_o^c + \theta_n \tilde{P}_n^c \right\} \tag{A.11}$$

where:

$$\Delta = \frac{\lambda_n (1-b)}{1-a-b} + \frac{\lambda_a}{1-c} \tag{A.12}$$

Expression (A.11) depends on structural variables that are relatively easy to estimate and on changes of price indices that again can be readily estimated. There are, nevertheless, several points of clarification and caveats about an expression such as (A.11) that deserve mentioning. The behavioral relation (A.4) is meant to imply that agricultural owner operators essentially equate the marginal reward to other activities with their average reward to their own agricultural activities. In other words, they regard agricultural activities as basic. In practice considerations such as risk and food security might make any specific test of (A.4) difficult to implement. For instance, agricultural daily wages might appear higher than

returns per man-day from own production, but we still do not observe small farmers abandoning their plots to work for large-scale operators or plantations. This implies that the "effective" wage, or the nominal wage adjusted for other factors is lower than the apparent nominal one. This is already well known from the Harris-Todaro model.

Another salient feature of our assumption about sources of income of the poor rural household is that their reward to nonagricultural activities is basically assumed to be reward to the labor input r. In other words, they do not share much in the aggregated "profits" of the nonagricultural sector. This basically means that because of ease of entry in the informal sector, whatever businesses the rural poor engage in will be mostly own labor intensive, and owner operated, earning effective rewards, which will be roughly equivalent to other labor activities when adjusted for risk, etc.

Another assumption underlying our framework is that remittances and transfers, which in our model are included with non-own account agricultural income, change proportionately with the unit rewards to nonagricultural activities. Private transfers and remittances are important parts of rural income in many African countries. They are usually generated by former household members that have moved temporarily or permanently to work off-farm for wages or own business. If the income accruing to a rural smallholder household from remittances is regarded as reward to a portion of the household labor that is occupied with off-farm work, then it is reasonable to regard these transfers as part of non-own account agricultural income and include it with other nonagricultural income. If remittances come from abroad, then it is reasonable to consider them exogenous. However, the available statistics usually do not allow the breakdown of nonearned income into that originating within the country and abroad, and in the empirical part of the paper they are lumped with nonagricultural income.

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