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Household Welfare During Crisis and Adjustment in Ghana

Alexander H. Sarris

CORNELL FOOD AND NUTRITION POLICY PROGRAM

HOUSEHOLD WELFARE DURING CRISIS AND ADJUSTMENT IN GHANA

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ABBREVIATIONS

CET	Constant elasticity of transformation
ERP	Economic recovery program
GDP	Gross domestic product
GLSS	Ghana Living Standards Survey
GOG	Government of Ghana
NCPI	National consumer price index
PURUNC	Price index of the urban uncontrolled goods
QDS	Quarterly Digest of Statistics
RSAV	Rural households in the Savannah
RSNP	Rural southern nonpoor
RSP	Rural southern poor
SSAP	Stabilization and structural adjustment program
URNP	Urban nonpoor
URP	Urban poor

FOREWORD

Tracing changes in household incomes in sub-Saharan Africa is difficult without household consumption and expenditure surveys. This dearth of information is an acute problem, given the importance of gaining insight into changes in living standards that have occurred commensurate with structural adjustment programs that have been widely implemented.

In attempting to compensate for the absence of survey data, this paper outlines a model that is employed to project changes in real income of various types of households during the past decade. It is applied to Ghana, a country that instituted a relatively successful economy recovery program in 1983 after a protracted period of economic decline. Results show that adjustment has not harmed the incomes of the poor; nor has it dramatically improved them. Perhaps equally important, however, factors such as instability in key prices have caused large income fluctuations.

While tracing the evolution of incomes is indeed an important accomplishment, the empirical model does not attribute any observed changes to specific policies. This suggests the need to analyze how the economic signals, and particularly price changes that are exogenous in this model, in fact depend on policy. Future research on Ghana, and the other countries included in the multicountry study being performed under a Cooperative Agreement between the Cornell University Food and Nutrition Policy Program and the Africa Bureau of the U.S. Agency for International Development on the impact of adjustment on economic growth and poverty will address this question.

Ithaca, New York
October 1992

David E. Sahn
Director, CFNPP

1. INTRODUCTION

Prior to its independence in 1957 Ghana was considered one of the richest countries in sub-Saharan Africa. However, between 1973 and 1983, Ghana experienced a severe economic decline which culminated in 1983 with a crisis of calamitous proportions (Bequele 1983; Tabatabai 1986). In 1983 the Government of Ghana (GOG) adopted an Economic Recovery Program (ERP), which has been supported with several multilateral and bilateral stabilization and structural adjustment loans. Since 1984 Ghana has experienced healthy GDP growth rates, averaging above 5 percent annually. Despite this, Ghana is still a very poor country with per capita income in 1989 of only US$ 390 (World Bank 1991). Recent empirical studies have shown that absolute poverty is massive, with at least 36 percent of the total population falling below a poverty line, with poverty incidence in the rural areas and the savannah regions of the north being much higher (Boateng et al. 1990; Sarris and Shams 1992).

Given that the economic opportunities and the policy framework in Ghana changed drastically in the decade between the late 1970s and the late 1980s, it is interesting to inquire whether the real welfare of different groups in the economy has evolved in unison, or at different rates. This important issue concerns not only Ghana but most countries undergoing stabilization and structural adjustment programs (SSAPs). In particular, opposition to these programs has rallied around the hypothesis that stabilization and adjustment adversely affect the poorer households (Cornia, Jolly, and Stewart 1987). This hypothesis, however, has not been supported by counterfactual empirical analysis. On the contrary, some recent preliminary empirical analysis seems to cast some doubt on its generality, at least as far as rural smallholders in Africa are concerned (Sahn and Sarris 1991).

The purpose of this article is to outline a method for tracing the real welfare of representative households in an economy with the characteristics of sub-Saharan African countries, and to apply this framework to Ghana. The

framework, which is based on recent theories of the household, does not attribute changes in welfare to one or another cause, but instead uses microeconomic structural information and observable economic time series to project changes between periods. Hence, it becomes possible to trace the evolution of real incomes over time.

The issue of the impact of macroeconomic and other policies on households is old, but it has received renewed attention in the context of SSAPs. In this context, two general types of methodologies have been developed (Maasland 1990). On the one hand, there are those based on analysis of the economic environment and household structure before and after policy changes. While easier, adequate and comparable household-level microsurveys for the periods of interest rarely exist. A second type of analysis relies on counterfactual empirical economywide models that relate the macroenvironment to household structure (e.g., Bourguignon et al. 1991; Kuwenaar 1988; Sarris 1990). While usually more comprehensive and precise, this type of methodology is quite cumbersome and data-intensive to implement. Furthermore, it rarely yields estimates of household welfare over a long period. The methodology outlined in this paper can be regarded as intermediate between these two approaches, but with the advantages that it is less data intensive, and that it yields time series estimates of welfare.

Section 2 outlines the basic model. Section 3 extends the two-period model to a multiperiod case. Section 4 outlines the empirical information utilized to implement the model for Ghana. Section 5 presents and discusses the results and outlines the sensitivity of the results to various assumptions. Finally, Section 6 summarizes the main conclusions.

2. MODEL OF HOUSEHOLD WELFARE CHANGES BETWEEN TWO PERIODS

The model outlined here has broad similarities with the general class of household models analyzed by Strauss (1986a). Consider a representative member of a class of households identified by the letter h. The income of this household will derive from six different types of activities: wage employment in the public sector, wage employment in the private formal productive sector (including parastatals), wage employment in the private small scale and informal sector, own-account agricultural production, own-account self-employment or other business sector, and miscellaneous other sources. Expected income from agriculture can be split into income from several product groups such as staple foods, livestock, export crops, etc. Because of environmental shocks, actual agricultural income will be different from expected or "trend" income. The household will consume different types of staple food out of own production, as well as purchased, other types of food, and nonfood products.

The household will be assumed to maximize a utility over the goods consumed and leisure, subject to a budget constraint and a production function. The utility will be denoted as:

$$U(C_f^h, C_n^h, T_l^h) \tag{1}$$

where C_f^h is per capita quantity index of food (consumed out of own production and purchased) of household type h; C_n^h is per capita quantity index of nonfood purchases of household h; and T_l^h is per capita time devoted to leisure.

The full per capita income of the household is the following:

$$YF_h = w(T^h - T_f^h - T_g^h) + w_f T_f^h + w_g T_g^h + (P_{ah} Q_{ah} + P_{uh} Q_{uh} - wL_h) + E_h \tag{2}$$

where T^h is per capita total time available to the household; T_f^h is per capita amount of labor time spent working for formal sector private and publicly owned enterprises; T_g^h is per capita amount of labor time spent working for the

government; w_f, w_g are wages in the formal and public sectors; P_{ah} is price index of agricultural product (net of purchased material inputs) for household h; P_{uh} is price (or price index) of nonagricultural small-scale and informal product (net of purchased material inputs); Q_{ah}, Q_{uh} is quantity indices of expected or "trend" agricultural and nonagricultural products, respectively, produced by household type h; L_h is total amount of labor (family and hired) used in the production of the agricultural and nonagricultural products. Family and hired labor are assumed to be perfect substitutes; and E_h is other income of the household (remittances, profits and dividends from formal enterprises, etc.).

If we divide the total time endowment of the household into work and leisure time:

$$T^h = T_w^h + T_l^h \tag{3}$$

where T_w^h denotes the household per capita supply of time for work, then the amount of household time available for informal wage employment, as well as work on agriculture and household enterprises is $T_w^h - T_f^h - T_g^h$.

The budget constraint of the household will be given by:

$$YF_h = P_{cf}C_f^h + P_{cn}C_n^h + wT_l^h \tag{4}$$

where P_{cf}, P_{cn} are the consumer price indices of food and nonfood goods.

If we subtract wT_l^h from both sides of (2), we obtain the normal "observed," nominal "trend," or "expected" income, which we denote by Y_h, namely, full income minus the value of leisure:

$$Y_h = YF_h - wT_l^h. \tag{5}$$

The production technology for the household that will be postulated is separable in primary inputs and outputs, with the output index given by a CET (constant elasticity of transformation) function of agricultural and nonagricultural products, while the primary input index will be given by a Cobb-Douglas function of labor and nonlabor inputs.

$$Q_h = \left[a_{1h}Q_{ah}^{\frac{\tau_h+1}{\tau_h}} + a_{2h}Q_{uh}^{\frac{\tau_h+1}{\tau_h}} \right]^{\frac{\tau_h}{\tau_h+1}} = A_h L_h^{\alpha_h} \tag{6}$$

where Q_h is the index of total production of farm and informal household activities; τ_h is the elasticity of transformation; A_h is a constant summarizing capital and other fixed inputs; and $\alpha_h, a_{ih}(i=1,2)$ are parameters. Such a production structure has been used before for empirical analysis of household models (Strauss 1986b).

The index Q_{ah} will be assumed to be a two-level CET index of agricultural products. The first level will aggregate exportable and an index of all other agricultural products with transformation elasticity τ_{ha1}, while the second level will aggregate the index of other agricultural products from quantities of various types of staple foods and other agricultural products, with transformation elasticity τ_{ha2}.

Maximizing household utility subject to the budget constraint (4) and the technology (6), further assuming that the amount of household time devoted to formal and government work is exogenously given, leads to a two-stage optimization problem. One obtains first that the full income is determined independently of the consumption decisions, and second that the demand for the consumed quantities and leisure are functions of the prices of the consumed goods, the wage w and the value of full income YF_h^* obtained in the first stage. This recursiveness of the household optimization is well-known in household models (Strauss 1986a) and is due to the assumed perfect substitutability of family and hired labor.

The assumption that formal and government wage labor is exogenous to the household is relevant in Ghana and other African countries, where many large-scale firms (private or parastatal), and government, offer employment with steady wages and other benefits that make them attractive for most households. However, these jobs are usually few and access to them is largely rationed. Although total demand for formal labor, as will be seen below, responds to economic conditions, it is postulated that all households exhibit excess supply for this type of employment.

The indirect utility of the household is obtained by substituting the optimizing functions in the original utility function. Differentiating the indirect utility, utilizing the envelope theorem, and dividing by the marginal

utility of full income and by trend normal nominal income Y_h, we can obtain an expression for the log-change of welfare, which equals the log change of "observed" real income as follows [the symbol ($\sim$) denotes log-change]:

$$\begin{aligned} Y\tilde{R}_h = & \frac{w(T^h - T_l^h - T_f^h - T_g^h - L_h)}{Y_h}\tilde{w} + \frac{w_f T_f^h}{Y_h}(\tilde{w}_f + \tilde{T}_f^h) + \\ & + \frac{w_g T_g^h}{Y_h}(\tilde{w}_g + \tilde{T}_g^h) + \frac{P_{ah}Q_{ah}}{Y_h}\tilde{P}_{ah} + \frac{P_{ah}Q_{ah}}{Y_h}\tilde{\epsilon}_{ah} + \\ & + \frac{P_{uh}Q_{uh}}{Y_h}\tilde{P}_{uh} + \frac{E_h}{Y_h}\tilde{E}_h - \sum_{i=1}^{n}\vartheta_{ih}\tilde{P}_{ci} \end{aligned} \tag{7}$$

where, in addition to the variables already defined, $Y\tilde{R}_h$ is log change of actual real observed income; ϑ_{ih} is budget share of good i; and $\tilde{\epsilon}_{ah}$ is percentage exogenous agricultural output shock relative to the "trend" value Q_{ah} (induced by environmental uncertainty).

Notice that the term multiplying the log change in market wage equals the share of wages received minus total wages paid to hired labor by the household, in total household income. This is because $(T^h - T_l^h - T_f^g - T_g^h)$ represents the amount of household time (on a per capita basis) devoted to working both for others as well as on the household businesses (agricultural and other), while L_h denotes the total amount of labor time demanded by the household for work on its own businesses (including agriculture). Clearly, the amount of household time devoted to its own productive activities is included in both terms. The terms multiplying the log changes in the agricultural and informal sector prices are not the shares of family income arising in the two sectors, but instead the shares of the total value added of output of the two types of activities (namely gross value of production minus cost of purchased inputs) in household income. Note also that the change in real income in (7) is composed of a deterministic part representing predictable change in real income, and a stochastic unpredictable part. The stochastic shocks influence only current but not future yincome. As such they serve to incorporate current income changes resulting from shocks such as weather-induced agricultural production declines. In the absence

of such adjustments the changes in real incomes of households would appear unrealistically smooth.

The real income changes projected with the model do not consider the aggregate demand side, and hence do not explain economywide producer or consumer prices. In other words, the model regards prices as exogenous to any given household, and simply traces real incomes, without attributing the changes to policies or other events.

Finally, note that income change between two periods in equation (7) can be visualized as follows. Given price changes and changes in other exogenous variables, one can compute the change in the trend value of real income between the two periods. Given the predicted trend real income, the actual income will be given by this trend plus or minus a random shock. This means that shocks are computed relative to trend values, and not relative to the income of the previous period.

3. MULTIPERIOD EXTENSION OF THE MODEL

The model outlined in the previous section can be used to project changes in real incomes of various types of households between two periods, if the shares multiplying the logchanges of the changing variables do not shift too much. However, if the same technique is to be used to sequentially predict real income changes for a series of periods, over which the structure of income will change, this should be accounted for. The procedure followed here amounts to piecewise linearization. In other words, equation (7) is estimated between periods t and $t+1$, using shares computed for period t. Then the new shares for period $t+1$ are computed and used for projecting real incomes for period $t+2$ and so on.

Consider first the changes in the income shares in (7). All shares are computed using trend values. The index of total household output Q_h among agriculture and nonagriculture is given by (6). If Q_h is allocated to Q_{ah} and Q_{uh} so as to maximize household value added subject to (6), then the allocative rule is the following:

$$Q_{ih} = a_{ih}^{-\tau_h} \left(\frac{P_{ih}}{P_h} \right)^{\tau_h} Q_h \qquad i = a,u \tag{8}$$

where

$$P_h = \left(\sum_{i=a,u} a_{ia}^{-\tau_h} P_{ih}^{1+\tau_h} \right)^{1/1+\tau_h}. \tag{9}$$

It is also true that:

$$P_h Q_h = \sum_i P_{ih} Q_{ih}. \tag{10}$$

Given (8)-(10), the change between two periods in the share of household nonwage value added arising from agriculture is:

$$\tilde{s}'_{ah} = \tilde{P}_{ah} + \tilde{Q}_{ah} - \tilde{P}_h - \tilde{Q}_h = (1 + \tau_h) \left((1 - s'_{ah}) \tilde{P}_{ah} - s'_{uh} \tilde{P}_{uh} \right) \tag{11}$$

where

$$s'_{ah} + s'_{uh} = 1. \tag{12}$$

The new shares $s_{ih,t+1}$ in period $t+1$ can be simply found as follows

$$s'_{ah,t+1} = (1 + \tilde{s}'_{ah}) s'_{ah,t} \tag{13}$$

$$s'_{uh,t+1} = 1 - s'_{ah,t+1} \tag{14}$$

where $\tilde{s}'_{ah,t+1}$ is given in (13).

Given that the index Q_{ah} is a CET index of export crops, and food and remaining agricultural products, allocation of Q_{ah} to the two subaggregates, and changes in the relevant shares, will be governed by relations identical to (8)-(14). Similarly, allocation of the index of food and remaining agricultural products to its subcomponents and changes in the relevant shares will be governed by relations similar to (8)-(14).

In the original equation (7) the terms multiplying $\tilde{P}_{ih}(i = a,u)$ are not equal to s'_{ih} but instead are equal to s'_{ih} multiplied by $P_h Q_h / Y_h$, namely, the share of nonwage value added in total trend income. In order to predict the new shares in (7), we must therefore also predict the change in the above term. Since the proportional change in trend income Y_h between two periods is already given by the first part (comprising the positive nonstochas[illegible] terms) of equation (7), and the change in P_h is easily found from (9), the on[illegible] change that remains is the one in Q_h. This in turn can be found from the production function (6). Under the assumption of household profit maximization, one first obtains the value of Q_h as a function of P_h and w. Log differentiating this, one obtains:

$$\tilde{Q}_h = \frac{\alpha_h}{1-\alpha_h}(\tilde{P}_h - \tilde{w}.) \tag{15}$$

Since the variables concerning formal sector employment are assumed exogenous to the household, projecting changes in these shares is straightforward. We also assume that changes in the "other" type of income E are exogenous to the household. This leaves only the share multiplying $\tilde{w}$ to be projected. Since the changes in all the other shares have been analyzed, they

presumably can be projected for period $t+1$. The final share multiplying $\tilde{w}$ can thus be found residually as the difference between one and all the other shares.

This procedure for computing the new wage share is somewhat unsatisfactory. The changes in all the terms in the share expression multiplying $\tilde{w}$ in equation (7) can be predicted through the model exhibited thus far, except the change in the amount of leisure time. Given the utility maximization problem posed in the very beginning of Section 2, the demand for leisure can be found to depend, like any other normal consumed good, on full income and on the prices of all goods, including the price of leisure, namely, the wage w. Hence, to predict changes in leisure or, equivalently, in household labor supply, one would need estimation for each household class of a demand system including full rather than normal monetary income, which would involve techniques and data beyond what was available in this study. A simpler procedure would be to consider household labor supply as fixed (a hypothesis that has found some empirical support in Ghana by Beaudry and Sowa [1990]) and predict changes in all the other variables of the relevant wage share expression. If this procedure had been followed, then the residual share would have been the one concerning the other sources of income. However, to do this one would need information on allocation of household labor time, which was not available in the case of Ghana.

Turning to between period changes in the budget shares ϑ_{ih}, these can be predicted by using estimated normal demand systems. In the empirical results below for each income group, a linearized Almost Ideal Demand System (AIDS) was utilized (Deaton and Muellbauer 1980). For such a system the n budget shares ϑ_i ($i = 1,\ldots,n$) can be expressed as follows (we drop the household subscript h for ease of notation):

$$\vartheta_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log P_{cj} + \beta_i \log(Y/P^*) \tag{16}$$

where Y is expenditure and P^* is an exact price index defined as follows:

$$\log P^* = \sum_{j=1}^{n} \vartheta_j \log P_{cj} \tag{17}$$

and $\alpha_i, \beta_i, \gamma_{ij}$ are parameters that satisfy the restrictions:

$$\sum_{i=1}^{n} \alpha_i = 1, \quad \sum_{i=1}^{n} \beta_i = 0, \quad \sum_{i=1}^{n} \gamma_{ij} = 0. \tag{18}$$

Furthermore, Slutsky symmetry requires that:

$$\gamma_{ij} = \gamma_{ji} \tag{19}$$

which in turn implies along with equation (18) homogeneity, namely, the condition that:

$$\sum_{j=1}^{n} \gamma_{ij} = 0. \tag{20}$$

Given (16), period-to-period changes in budget shares can be projected via the formula:

$$d\vartheta_i = \beta_i \tilde{Y}_h + \sum_{j=1}^{n} (\gamma_{ij} - \beta_i \vartheta_j) \tilde{P}_{cj} \tag{21}$$

for $i = 1, \ldots, n$. Given the restrictions (18) and (20) the changes in (21) sum up to zero, so that the adding-up restriction is satisfied.

The linearized procedure outlined above for projecting shares between two periods is basically a comparative statics exercise and will be valid if changes in prices and the other variables are not too large between periods. However, there are occasions when some price changes are quite substantial (even exceeding 100 percent). In these cases where one-step linearization would essentially not be valid, the price changes between two periods can be broken up into many smaller changes, and the above procedure can be implemented for the successive price steps so as to approximate the large change as a sequence of linear approximations. This was found necessary in the empirical exercise below for some periods with large price swings.

4. EMPIRICAL IMPLEMENTATION FOR GHANA

The model outlined in the previous sections was empirically implemented for Ghana. An important part of the model concerns the structural information for the different types of households for a given year. For Ghana the data from the 1987/88 Ghana Living Standards Survey (GLSS) was utilized to compile the household-specific information. This survey covered several thousand households and was representative of the country.

Five household classes were specified, three of which are generally considered poor and the rest nonpoor. Group 1 consists of all urban households, which, according to the survey, have a per capita expenditure less than a cutoff urban poverty line. This poverty line was defined with the help of an equation that predicts per capita calorie consumption as a function of expenditure and other household characteristics (Alderman and Higgins 1991). The per capita expenditure corresponding to predicted calorie consumption equals to 85 percent of the mean urban daily per capita calorie consumption was defined as the poverty line. This group of "urban poor," is abbreviated as URP. The rest of the urban households, the "urban nonpoor," constitute group 2 and this group is abbreviated as URNP. Group 3 constitutes all rural households in the savannah (north) zone of Ghana, abbreviated as RSAV. The rural savannah is generally regarded in Ghana as poor. A rural household is classified as belonging in the savannah zone if it does not produce cocoa or cocoyam, two typically southern crops. It turned out that this criterion turned up only minor geographical misclassifications of households (namely rural households in the northernmost region of Ghana that produce cocoyam).

Group 4 consists of rural households in the south (that is, not the savannah), that fall below a rural poverty line, and is abbreviated as RSP (rural south poor). The rural poverty line was defined in the same way as outlined above for the urban households, except that the 85 percent cutoff was considered relative to the mean daily per capita calorie consumption in the rural south.

Group 5, abbreviated as RSNP (rural southern nonpoor), consists of the remaining rural households in the south.

The survey data were used to derive the average incomes from various sources and expenditures for various types of income sources and expenditure of different types for each group. As with most household surveys, average declared incomes invariably fell short of average declared expenditures. By projecting the different types of incomes to the whole economy, it turned out that agricultural incomes as declared in the survey are higher than those stated in the national accounts, while income from wages, self-employment, and other sources is lower. It was therefore decided to increase for each household class all nonagricultural incomes proportionately, so as to bring total household income to par with per capita expenditure. This procedure implicitly assumes that savings is proportional to total income for each household class.

Table 1 indicates the results of this procedure, as well as some additional information. Agricultural income is split into income arising from the three food staples (maize-rice, millet-sorghum, and roots-tubers), from cocoa (the main export crop), and all other products. It can be seen that agriculture provides more than 60 percent of income for all rural classes, but also a significant portion of income of the urban poor. The structure of agricultural income is quite different between rural south and the savannah with millet and sorghum being quite important in the north, while cocoa is important for both rural classes in the south.

Wage income is significant in the urban areas. Wages from the public sector accrue mostly to the two wealthy classes, URNP and RSNP. In fact, if one computes the total public wages in the economy accruing to these two classes, they comprise 93 percent of the total reported public wages of 22.1 billion (indicated in the right-most column). However, private wages also largely accrue to these two classes (88.5 percent of the total), despite the fact that they constitute a significant share of income of the poor, especially in the urban areas.

Notice that a large share of income — certainly, a larger share than from wages for the three poor classes — comes from self-employment. This is most of

Table 1 — Structure of Average Incomes and Expenditures for Five Household Classes in Ghana

	Urban Poor (URP)	Urban Nonpoor (URNP)	Rural Savannah (RSAV)	Rural South Poor (RSP)	Rural South Nonpoor (RSNP)	Total Income in Country (billion cedis)
Percentage Share of Income						
Agriculture	23.9	16.1	77.4	62.7	59.9	335.2
Maize-rice	(8.2)	(2.2)	(20.2)	(13.0)	(7.9)	(56.5)
Millet-sorghum	(1.9)	(0.3)	(22.9)	(0.0)	(0.1)	(20.9)
Roots-tubers	(9.6)	(4.9)	(21.4)	(27.9)	(25.3)	(126.5)
Cocoa	(0.4)	(0.6)	(0.0)	(13.3)	(11.1)	(41.6)
Other agriculture	(3.7)	(8.1)	(12.9)	(8.5)	(15.5)	(89.8)
Wages	24.7	35.9	6.1	8.2	11.7	168.8
Public	(1.8)	(4.5)	(0.7)	(0.5)	(2.0)	(22.1)
Private formal	(7.8)	(10.8)	(1.9)	(2.6)	(3.3)	(50.3)
Private informal	(15.0)	(20.6)	(3.6)	(5.1)	(6.4)	(96.4)
Self-employment (nonagriculture)	40.3	36.5	13.3	20.8	21.2	217.6
Other	11.2	11.6	3.2	8.3	7.2	69.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**791.2**
Percentage Share of Expenditures						
Food	59.1	57.1	74.4	68.5	68.2	505.7
Maize-rice total	(9.8)	(7.0)	(14.5)	(8.7)	(7.5)	(64.9)
Own production	(2.9)	(0.8)	(12.5)	(5.6)	(3.9)	(28.2)
Millet-sorghum total	(1.6)	(0.5)	(20.0)	(0.1)	(0.1)	(19.3)
Own production	(1.3)	(0.3)	(19.1)	(0.0)	(0.0)	(17.3)
Roots-tubers total	(15.6)	(13.2)	(15.3)	(25.5)	(24.6)	(147.1)
Own production	(6.6)	(2.9)	(13.1)	(21.6)	(18.8)	(89.4)
Other food total	(32.1)	(36.3)	(24.6)	(34.2)	(36.0)	(274.3)
Own production	(4.0)	(1.6)	(10.2)	(8.4)	(8.4)	(44.5)
Total food own produced	(14.7)	(5.6)	(54.8)	(35.6)	(31.0)	
Nonfood total	40.9	42.9	25.6	31.5	31.8	285.6
Own production	(2.9)	(2.2)	(2.0)	(1.5)	(1.9)	(16.2)
Price controlled	(22.6)	(27.7)	(13.3)	(18.8)	(18.5)	
Uncontrolled	(18.3)	(15.2)	(12.3)	(12.7)	(13.3)	
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**791.2**
Per capita income and expenditure (cedis/annum)	31,268	93,936	38,138	21,590	61,565	58,327
Wages, paid out (cash and in kind) (cedis/capita/annum)						
• for agriculture work	436	620	1,691	570	2,480	
• for household business	31	16,798	17	17	3,850	
Group population (1,000)	1,388	3,363	2,175	1,495	5,144	13,565

Source: Computed from GLSS and national accounts data.

the income for the majority of the informal sector, and as observed in the last column it amounts to 27.5 percent of all economywide income.

To show how the survey information compares to published economywide totals, several aggregate figures were computed by averaging the reported 1987 and 1988 figures. The total private consumption expenditures in the economy reported by the national accounts thus computed amount to 722.4 billion cedis compared to 791.2 estimated from the survey. Official cocoa producer income computed by multiplying the published figures on quantity produced and official prices is 37.9 billion cedis compared to 41.6 from the survey. This implies that there is likely to be some amount of cocoa marketed unofficially, a phenomenon known to have existed in Ghana for a long time and at significant rates during the periods of overvalued exchange rates (May 1985). However, the proximity of the figure computed from the survey to the one computed from official statistics implies that this phenomenon, which at times accounted for as much as 40 percent of total cocoa produced, has subsided.

Noncocoa total agricultural and livestock income according to the national accounts is 316.6 billion cedis compared with 293.7 here, a close correspondence. The government paid its employees 49.2 billion cedis in 1987 and 1988 according to the national accounts, which includes contributions to social security, compared with 22.1 billion cedis according to the survey. The reasons for such a large discrepancy are not clear. It may be that in the GLSS the civil servants are underrepresented, or the government wage bill includes payments to many "phantom" workers. In fact, this last reason could be significant as the early civil servant retrenchment efforts of the government consisted of exactly that, namely, eliminating phantom workers from payrolls.

The total wages of the (presumed) formal sector, obtained by multiplying aggregate reported public (namely, parastatal) and private employment by reported respective wages is 50.3 billion cedis. This amount was apportioned to the five income classes in proportion to the amount of private wages they received; thus informal private wage income was derived as a residual between the reported total private wages in the survey and computed formal ones. This particular allocation of formal wages is somewhat unsatisfactory, as most of the formal wage earners

are likely to belong to the higher income classes, but there is no information on which to base another allocation.

Given that the model requires that the share multiplying the market wage is the share of wages received minus wages paid out, the survey was used to obtain reported wages paid out in cash and kind for agriculture and household business. The computed figures were large underestimates; when aggregated for the economy, the computation yielded a total of only 21.6 billion cedis of wages paid, compared to reported private wage income from informal activities (as estimated above) of 96.4 billion cedis. This discrepancy could be due to under-reporting of wage payments of household-owned business, or to the fact that wages paid from a business owned by members of many households are not reported by any one household. Since for consistency of the model, for the whole economy total informal wages paid must equal total informal wages received, the aggregate difference between the wage bill totals of 96.4 and 21.6 billion cedis was allocated to the category of wages paid for business of the two wealthy groups (namely, URNP and RSNP) in proportion to the contribution to total informal sector wages received by the urban and rural sectors, respectively. In the bottom of Table 1, these figures are exhibited. The figures for wages paid for agriculture and business reported in the table were added to the respective total incomes originally reported from the survey, total incomes from agriculture and self-employment (which can be readily computed from Table 1) to arrive at the base period shares required by the model (which, as mentioned earlier, involve the household value added from agriculture and business).

Turning to the expenditure distribution among different goods, it can be noticed that the share of food is very large for all groups, and in fact does not appear to be significantly smaller for the two richer groups despite the much larger per capita total expenditures for these groups. This appears rather strange. Possible explanations include food composition effects, or biases within the GLSS sample itself. A different partitioning of the households, however, using a different poverty line (discussed later) did not change the situation. However, for the three rural groups the share of food expenditures out of own production, as expected, is quite large. In the savannah zone, for instance, 54.8 percent of total expenditures are accounted for by food consumed

out of own production. Nonfood consumption is split among goods, which were or are largely price controlled (beverages and tobacco, rent fuel and power, transport and communications) and all others. It can be seen that the urban rich group consumes a proportionately larger amount of price controlled goods than the urban poor, while among the rural groups in the south there does not appear to be a significant difference. However, the rural savannah group consumes much smaller amounts of the controlled goods than the rural south groups. For each one of the five household groups an AIDS expenditure system was empirically estimated.[1]

Concerning the time series utilized to project real incomes in different periods with base year 1987/1988, the following information was used. For informal sector wages the published series of unskilled construction wages was used. For the formal and public sector wages and employment, they were assumed for all households to evolve according to the aggregate totals. The aggregate formal sector wage bill was computed from published statistics on employment and wages, while the public sector wage bill was obtained from the *Quarterly Digest of Statistics* (QDS).

The prices of the three agricultural staple groups were computed as follows: starting with national monthly wholesale prices for individual products, annual averages were computed, and finally group prices were value weighted. Both calendar year and crop year prices were computed but there was little difference between the two sets of results. In the sequel calendar year prices are exhibited to conform to the other time series that are in calendar years. The cocoa producer price is obtained directly from the Cocoa Board, and for the other agricultural products, the implicit GDP deflator for agriculture was used. For the price of the informal sector, the urban consumer price index for the uncontrolled goods was used. Finally, for the index of other income, the per capita national disposable income was used.

For consumer prices of the three staples, the same estimated group prices reported above were used. The prices of other foods in rural and urban areas were derived from the overall rural and urban food price indices reported in QDS,

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[1] I would like to thank Paul Higgins for these estimates.

and the staple food prices for the groups were computed as indicated above, using aggregate rural and urban food shares implied by the GLSS. For the other categories, separate rural and urban annual consumer price indices were used, as published in QDS. The controlled and uncontrolled good price indices were made up from their respective constituent series.

To estimate the agricultural production deviations, the per capita quantities produced of the three staple goods were first estimated. It must be noted that the population figures used are not simple extrapolations between census years, because the population growth rate declined until 1983 due to outmigration, and sharply increased in 1983 due to massive repatriation from Nigeria. To obtain the population series, the official figures were adjusted so as to capture these shocks. The adjustments follow the methodology of Tabatabai (1986). It turns out that the per capita quantities produced do not exhibit marked trends over time. Hence the deviations in per capita quantities were computed relative to the means over the 1977-1990 period that was considered in the projections.

All nominal magnitudes were deflated by the national consumer price index (NCPI) in order to avoid spurious numerical problems. As the sum of all the shares multiplying the deterministic terms in Equation 7 is zero, this does not affect the results. Finally, since the model was implemented for the period 1977-1990 there were some cases where the relevant time series were incomplete or ended in earlier years. The way these series were completed was by using growth rates from suitable proxies (in turn chosen by the constancy of the ratios between the observed parts of the series).

Tables 2, 3, and 4 exhibit several time series of relevance to the model. In Table 2 it can be seen that all the real wage indices declined dramatically from 1977 until 1984. In 1985 and 1986 there was a recovery. Since 1987 there seems to have been a slight deterioration in the open market and government wages, while the formal sector wages have been stable. Concerning the share of employment in the economy, while the share of public sector employment has stayed constant, the share of formal sector employment declined sharply until 1983, recovered in 1984/85, but has since declined. Of course, this implies that

Table 2 — Population, Informal and Formal Wages (Deflated by NCPI), and Aggregate Labor Shares

		Indices of Real Wages in:			Percent of Labor Employed in:		
	Population (million)	Informal Sector (Unskilled Construction)	Public Sector	Formal Sector	Agriculture and Informal Sectors	Government	Parastatals and Other Formal Sector
1977	9.85	100.00	100.00	100.00	81.9	6.6	11.6
1978	9.99	81.46	77.17	62.60	80.7	7.8	11.5
1979	10.12	62.21	72.58	50.63	82.2	6.4	11.4
1980	10.24	60.92	66.60	52.85	85.8	6.5	7.7
1981	10.37	46.90	37.60	31.47	88.5	6.8	4.7
1982	10.50	38.62	32.05	26.86	87.2	6.5	6.3
1983	11.99	23.58	22.12	21.67	87.9	6.0	6.1
1984	12.39	31.45	22.05	31.90	85.5	5.9	8.6
1985	12.72	61.13	53.27	45.99	85.3	6.1	8.6
1986	13.05	67.74	76.57	75.38	86.3	6.2	7.5
1987	13.39	56.68	71.85	76.33	86.7	6.3	6.9
1988	13.74	55.73	65.09	76.23	88.1	6.7	5.3
1989	14.10	55.29	68.39	77.03	87.7	6.8	5.5
1990	14.47	52.58	62.21	78.32	87.8	7.0	5.2

Source: Computed by author.

Table 3 —Individual Consumer Price Series Relative to the National Consumer Price Index (NCPI)

	Food Staples			Other Food		Other Goods —Urban		Other Goods —Rural	
	Maize/ Rice	Millet/ Sorghum	Roots/ Tubers	Urban	Rural	Controlled	Uncontrolled	Controlled	Uncontrolled
1977	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1978	59.5	64.2	69.4	112.0	114.0	96.9	107.8	117.6	109.8
1979	52.9	47.8	58.9	115.0	145.9	86.6	107.7	109.1	110.6
1980	77.8	79.2	55.7	98.1	159.6	90.9	98.4	113.3	107.2
1981	61.7	68.1	50.8	106.1	155.4	87.5	104.3	114.0	111.4
1982	61.7	70.2	53.6	125.5	174.2	72.2	97.0	94.6	106.1
1983	123.1	110.3	102.8	112.8	133.9	59.3	76.8	108.6	96.4
1984	61.9	76.4	57.7	106.2	133.7	80.8	80.8	130.9	133.5
1985	48.6	41.8	39.7	83.9	121.3	103.9	119.5	130.8	140.0
1986	56.1	47.3	57.5	71.7	101.0	120.4	120.2	130.2	136.3
1987	65.6	49.3	77.0	64.5	79.5	121.2	125.5	123.0	138.3
1988	63.6	66.3	61.8	74.8	88.6	122.4	123.0	122.1	134.1
1989	42.0	50.4	50.2	85.6	101.5	123.2	124.2	123.8	132.0
1990	43.4	29.6	34.3	98.0	112.6	124.5	122.4	134.1	123.1

Source: Computed by author.

Table 4 — Other Prices Relevant to the Projections (Relative to the NCPI)

	Cocoa Producer Price	Agriculture GDP Deflator	Per Capita National Disposable Income
1977	100.0	100.0	100.0
1978	107.9	84.4	108.6
1979	101.1	64.8	93.1
1980	68.1	66.4	93.0
1981	91.8	52.4	72.2
1982	84.7	58.7	69.4
1983	63.4	59.9	58.7
1984	68.1	44.6	59.3
1985	116.4	44.2	65.3
1986	140.4	52.5	76.6
1987	165.3	57.0	79.3
1988	148.3	56.5	82.6
1989	125.2	54.9	88.9
1990	117.4	60.4	91.1

Source: Computed by author.

agriculture and the informal sector whose labor share is computed residually have provided an increasing share of employment.

Table 3 exhibits price indices of the three food staple groups (which are used as consumer as well as producer prices), and the consumer price indices of the other food and nonfood categories in both rural and urban areas. The most remarkable observation from these figures is that agricultural staple food prices, except during the drought year 1983, deteriorated sharply relative to the NCPI both before and after the onset of the ERP. The other food price index, on the contrary, has not deteriorated either in the urban or rural areas. It is the nonfood prices in fact that have risen most sharply after the onset of the ERP and that account for the sharp rise in the NCPI relative to the staple food prices.

Interestingly, the behavior of the prices of goods largely controlled by the government is similar to that of the prices of uncontrolled goods, despite the fact that there was significant price liberalization from 1983 to 1985. This might be because, despite our efforts to the contrary, both sets of price indices include controlled goods that cannot be further isolated from the aggregate indices used to construct the controlled and uncontrolled series.

Table 4 reports some other price series relevant to the projections. It can be noticed that the real producer price for cocoa has not followed the trend noted for the staple foods. Its real price after a decline grew sharply from 1984 until 1987 but has declined since then, although not to the pre-ERP levels. Interestingly, the GDP deflator for agriculture does not exhibit the sharp rise in 1983 exhibited by the staples, possibly because prices of products other than cocoa, such as livestock, did not rise as much, or might even have fallen, relative to those of the staples. Another possibility is that the agricultural prices used in the national accounts are official ones, and, hence, bear little relation to market prices. The use of this index for the "other" agricultural income would thus tend to somewhat bias the results, but fortunately this portion of income is not too large. Finally, the index of national real disposable income after a fall during the period 1981 to 1985, appears to have risen since 1986.

5. EVOLUTION OF REAL HOUSEHOLD INCOMES

Since the survey covered a period that spanned both 1987 and 1988, and given that the interest is in projecting longer term trends, the 14-year period 1977 thru 1990 time series were aggregated into seven 2-year averages, with 1987/88 as the base. Given that the model is a comparative static one it does not matter whether projections are done forward or backward. In the actual projections the base year 1987/88 information was used both for forward projection into 1989/90 as well as backward projection into the five previous two-year periods. Note that in this manner the two unusual years 1983 and 1984 are averaged. Since 1983 was a record drought year, while 1984 was a record crop year, and also since in 1983 the population increased sharply, averaging these two years is likely to lessen the spurious effects due to the unusual events.

For the projections one must utilize empirical values for the household elasticities of transformation τ_h, τ_{ah1}, and τ_{ah2}, and for the parameters α_h of the household production functions. There are no empirical estimates for these parameters for Ghana. In general one expects τ_{ha2} to be larger than τ_{ha1}. For the parameter α_h, from Equation 15 the household elasticity of per capita total supply of agriculture and informal sector goods Q_h with respect to price is equal to $\alpha_h/(1 - \alpha_h)$. Given the primitive technology in agriculture in the informal sector, this elasticity (which refers to per capita and not total supply) should be quite small.

The procedure followed in specifying these parameters was the following. First in the base period 1987/88 the implied national quantities produced of the three food staple groups and cocoa were computed from the household-level information by dividing the implied total incomes by appropriately adjusted national wholesale prices, so as to conform exactly to the published national production figures. The model projected household incomes from these four products for the other periods (including random shocks), and these were also translated into national quantities produced by utilizing the relevant prices, and household populations proportional to the base year figures but scaled to the

total national population. These implied production estimates were then compared to the published national totals and the four parameters above were adjusted by extensive trial and error so as to make the differences as small as possible. This procedure is not wholly satisfactory, as the populations belonging to different household classes might have evolved at rates different from those of the total population, as implied by the above procedure. In fact, one would expect that during the pre-1983 economic decline the proportion of the population belonging to poorer groups would have increased, while during the recovery after 1983, the population of poorer groups would have declined. However, there is no information on which to base such adjustments. In any case, it turned out that after the adjustments outlined above, the percentage errors between the implied and the actual national quantities produced were not large for any period. For maize and rice, the mean absolute percentage error over all six two-year periods of the simulation (of course not counting the base period for which by calibration the error is zero) was 8.6 percent, for millet and sorghum 15.4 percent, for roots 14.1 percent, and for cocoa 18.5 percent.

Given the rather simple nature of the model and the limitations imposed by lack of household-specific populations, these statistics for dynamic goodness of fit must be judged as satisfactory. The above statistics were produced with the values of the free parameters the same for all households and with the following values: $\tau_\eta = 0.2$, $\tau_{ha1} = 0$, $\tau_{ha2} = 0.1$, and $\alpha_h = 0.1$. While at first glance these values appear small, it turned out that higher values produced larger errors by the method outlined above. The fit could probably have been improved by adjusting separately the parameters for each household. This, however, would have necessitated a very large number of trials with meager improvement in the overall fit and was not done.

Table 5 presents the indices of real incomes in index form, with 1977/78 equal to 100. The levels of the indices are computed first by using the estimated forward and backward one-period changes using Equation 7 and a level of 100 for 1987/88, the overall base year, then renormalizing the resulting index so that 1977/88 is set at 100.

The figures in Table 5 suggest first that in the pre-ERP period, namely, from 1977 to 1982, per capita incomes of all classes of households declined

Table 5 — Indices of Real Per Capita Income of Households When Informal Sector Prices are Equal to the Urban Uncontrolled Good Consumer Price Index

	Group				
	URP	URNP	RSAV	RSP	RSNP
1977/78	100.0	100.0	100.0	100.0	100.0
1979/80	87.2	94.8	101.5	94.6	95.2
1981/82	70.5	79.7	89.6	78.0	79.3
1983/84	65.9	66.3	89.7	76.4	77.6
1985/86	101.8	108.6	90.8	101.3	100.0
1987/88	105.1	111.8	109.5	114.4	111.3
1989/90	96.4	105.1	98.6	96.3	97.2

Source: Computed by author.

substantially. The declines were quite large for all classes of households, ranging from 29.5 percent for the urban poor to 11.4 percent for those in the rural savannah. The turbulent years 1983 and 1984 appear to have affected households quite differently. Both poor and nonpoor urban households appear to have experienced large further overall declines in real incomes, while all rural groups appear to have experienced only small further declines in real income.

After the onset of the ERP, the results suggest that urban households recovered real income and that the rich urban households gained the most. The real incomes of all rural households seem to have exhibited a strong recovery up until 1987/88 to levels at least 10 percent higher than those of the precrisis peak of 1978/79, but declined in the last two-year period (1989/90) to levels close to those of 1977/78.

These results need to be further analyzed. Given that the change in real income in Equation 7 is composed of terms relevant to the evolution of income (those with positive coefficients in 7), as well as terms relevant to the evolution of the cost of expenditures (those with negative coefficients in Equation 7), it seems appropriate to examine the extent to which the evolution of real incomes is due mostly to changes in incomes or to the cost of expenditures. To this end the two parts of the change in real income outlined in Equation 7 were computed separately, and appropriate indices of income and the price of expenditures were computed separately. Since all nominal magnitudes in the model have been deflated by the National Consumer Price Index (NCPI) the indices computed exhibit the evolution of group-specific nominal incomes and consumer price indices when deflated by the NCPI. Since the income and expenditure shares change over time, variable weight indices were computed.

Table 6 presents the results of these computations with the same underlying assumptions as those behind Table 5. (The indicated indices have been computed separately for incomes and consumption. Hence their ratios, although exhibiting similar trends, are not equal to the indices in Table 5.) The results suggest that there are different evolutions of "nominal" incomes and group-specific consumer price indices. For instance, the index of income indicated in the first column of Table 6 for group 1, the urban poor, is what would be reported if one used the fixed weight NCPI to analyze real incomes of the urban poor. This index

Table 6 — Indices of Per Capita Incomes and Group-Specific Consumer Prices

	Group									
	URP		URNP		RSAV		RSP		RSNP	
	Y[a]	C[a]	Y	C	Y	C	Y	C	Y	C
1977/78	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1979/80	81.4	92.3	84.7	88.6	84.5	82.1	82.7	86.1	84.8	87.8
1981/82	65.6	92.0	70.2	87.1	72.7	80.0	67.2	84.7	70.5	87.7
1983/84	61.2	91.9	59.7	89.2	84.2	92.1	76.1	97.8	74.1	93.9
1985/86	81.2	79.9	85.7	79.1	63.4	67.8	76.9	75.4	75.8	75.2
1987/88	89.0	84.6	91.9	82.4	86.6	75.8	94.5	81.3	91.1	80.4
1989/90	82.1	85.1	90.4	85.8	69.4	68.9	77.7	79.8	79.1	80.0

Source: Computed by author.

[a] Y denotes the index of "nominal" income while C denotes the group specific consumer price index.

exhibits a decline until 1983/84, and an increase afterwards, but to a level much below that of the 1977/78 level. Note, however, that in the second column, the variable weight consumer price index specific to this group suggests that relative to the NCPI the cost of living for this group declined much less than income before the ERP, while it has evolved in line with group income afterwards. It is these effects that, when combined with the income effects, lead to the results of Table 5, namely, that the urban poor are better off after the ERP than before.

Notice that the group-specific consumer price indices have all declined compared to the NCPI, which has been compiled in Ghana with weights relevant to 1977. This result suggests that the NCPI weights must have changed drastically since then, and it turns out that this is true. As computed from the survey, the shares of total expenditures allocated to food in Ghana in 1987/88 were 57.3 percent in the urban areas and 69.4 percent in rural areas. The NCPI, however, is computed using food shares equal to 48.6 percent for the urban areas and 49.8 percent for the rural ones. Even if beverages and tobacco are added to these, the NCPI weights are only 54.1 and 56.7 percent, respectively, much below those computed from the survey. Since food prices have declined relative to nonfood prices especially after 1983 (Table 3), the group-specific variable weight consumer price indices are all expected to be lower than the NCPI.

Turning to the causes of the changes in real incomes, one can examine each specific real income change between two periods using Equation 7 and splitting the change into each one of its component parts. If from each income term in Equation 7 the same consumption term (comprising the negative terms in Equation 7) is subtracted, then one can envision the parts of the overall real income change accounted for by changes in specific components of income. Table 7 presents the results of this exercise for the indices of real incomes reported in Table 5. The changes in real incomes reported in the first column are simply the absolute differences between periods, of the values of the indices reported in Table 5.

In general, no one component consistently accounts for the bulk of the real income changes. For the urban groups, before 1983/84, most of the decline in real incomes can be attributed to declines in wage incomes, both informal and

Table 7 — Allocation of the Changes of the Real Income Index Between Periods to Different Causes

	Absolute Change in Index of Real Income from Previous Period	Informal Labor (1)	Formal Labor (2)	Agriculture (3)	Self-Employment and Business (4)	Other (5)
	(Amounts of Change (in Absolute Terms) due to Different Causes)[a]					
			Group 1: Urban Poor			
1979/80	-12.8	-5.6	-5.6	-3.3	2.2	-0.5
1981/82	-16.7	-4.3	-4.6	-4.4	-0.6	-2.8
1983/84	-4.6	-3.5	0.8	5.7	-6.1	-1.5
1985/86	35.9	10.9	6.9	-3.3	18.3	3.0
1987/88	3.4	-2.8	-0.1	6.4	-0.8	0.8
1989/90	-8.8	-0.6	-0.4	-8.4	-0.5	1.2
			Group 2: Urban Nonpoor			
1979/80	-5.2	-0.9	-8.6	-1.4	5.6	0.1
1981/82	-15.2	-0.7	-8.2	-2.7	-0.3	-3.2
1983/84	-13.4	-0.6	0.7	-0.6	-10.9	-2.0
1985/86	42.3	1.8	12.0	-1.6	26.8	3.3
1987/88	3.1	-0.4	0.3	2.4	-0.2	1.1
1989/90	-6.7	-0.2	-1.1	-3.2	-3.1	0.9
			Group 3: Rural Savannah			
1979/80	1.5	0.2	-0.8	0.2	1.7	0.3
1981/82	-11.9	0.2	-1.0	-10.5	0.0	-0.7
1983/84	0.0	0.2	0.0	2.9	-2.4	-0.7
1985/86	1.2	-0.8	2.0	-9.0	7.6	1.3
1987/88	18.7	0.2	-0.1	19.5	-1.0	0.1
1989/90	-10.9	-0.0	0.2	-12.9	1.2	0.7
			Group 4: Rural South Poor			
1979/80	-5.4	-0.8	-1.7	-5.9	2.5	0.4
1981/82	-16.6	-0.7	-1.6	-11.9	-0.1	-2.3
1983/84	-1.6	-0.7	0.1	5.9	-4.9	-2.0
1985/86	24.9	2.2	2.7	4.5	12.2	3.4
1987/88	13.1	-0.6	-0.1	14.2	-0.9	0.5
1989/90	-18.1	-0.1	-0.1	-19.4	0.3	1.2
			Group 5: Rural South Nonpoor			
1979/80	-4.8	1.4	-2.4	-6.9	2.9	0.2
1981/82	-15.9	1.3	-2.6	-12.1	-0.5	-2.1
1983/84	-1.7	1.2	0.0	4.2	-5.6	-1.4
1985/86	22.3	-3.7	4.6	2.7	16.0	2.8
1987/88	11.3	1.0	0.0	10.8	-1.0	0.5
1989/90	-14.1	0.2	-0.0	-15.1	-0.1	1.0

Source: Computed by author.

[a] The sum of columns (1) - (5) for each period is equal to the amount in the first column.

formal (which in turn are composed of both public sector and other formal wages). In 1983/84, self-employment and business incomes fell the most as all economic activity was significantly slowed down. Immediately after the onset of the ERP, for both urban groups there was a big boost to real income due to increases in self-employment and business income, even though agricultural incomes declined. Furthermore, it appears that the urban poor received a significant boost to their initial post-ERP incomes from informal wages, although this did not continue in the later part of the ERP. For the urban nonpoor, this further boost was given instead by formal wages. After the initial sharp post-ERP real income rises, urban incomes have not varied much. Nevertheless, since 1985/86, agriculture seems to have caused most of the income fluctuations.

For all rural groups, as expected, agriculture has accounted for the major part of real income changes both before and after the ERP. The exception is 1985/86, when informal business and self-employment income accounted for most of the sharp real income recovery. Since 1985/86 agriculture has contributed mostly negatively to real incomes with the exception of 1987/88. Note that although self-employment contributed a significant part of base year income for the rural poor, it does not appear to have contributed much to real income changes after 1985/86.

Interestingly, the results of Table 5 indicate a real income decline of all groups in 1989/90 even though the national accounts show an aggregate small real income increase in the same period. Perusal of Table 7 clearly shows that this is almost totally due to a decline in real agricultural incomes, which in turn results from declines in real staple food agricultural prices (of Table 3). This discrepancy suggests that the methodology of the national accounts deserves further scrutiny.

In the results reported above the price of the output of the nonagricultural informal sector was proxied by the price index of the urban uncontrolled goods (PURUNC). While we regard this as the most suitable proxy, the model was also run using the NCPI as the price of the informal sector. From Table 3 it can be noticed that the NCPI, although growing in line with the PURUNC until 1983, grew at a slower rate afterwards. This would imply that if it is used instead of PURUNC, then the real income indices should exhibit slower post-ERP recovery, as

it was seen above that much of the sharp recovery in 1985/86 was due to informal incomes.

Table 8, which exhibits the real income indices analogous to those of Table 5, indeed bears this expectation out. While the evolution of real income follows the same trends indicated by the data of Table 5, the early post-ERP recovery (for 1985/86), although still sharp, is much smaller than indicated by the figures of Table 5.

Since the structure of incomes is important for the evaluation of welfare, the whole previous analysis was also carried out with a different classification of households. Urban and rural poverty lines equal to half the per capita expenditure in urban and rural areas were first established. Then households in the urban, rural south, and rural savannah areas were split among those falling above and below the respective urban and rural poverty lines. The structure of income and expenditure for each one of the six classes was re-estimated using the survey data, and the model was rerun.

The results turned out to be quite similar to those reported in Tables 5 and 6, and are not exhibited for lack of space but are available on request. The reason for the similarity of results is that the income and expenditure structures of the new groups are not much different from those exhibited in Table 1. In particular, the two rural savannah groups under the new classification exhibit very similar income and expenditure shares, despite substantial differences in per capita income, which justifies lumping them together as in the tables exhibited earlier.

The above sensitivity analyses confirm that the general pattern of real income changes is not sensitive to alternative reasonable specifications of some of the key prices of the model, or the particular poverty lines chosen. These results add considerable confidence to the model.

The model developed and applied has the capacity to disaggregate real income changes to both the income and expenditure parts, as well as to different causes. It was seen that this is quite important, as real incomes of the various groups, if computed on the basis of published aggregate national deflators, appear not to have fully recovered after the ERP. On the other hand, if variable weight group-specific consumer price indices are computed, as suggested by the model,

Table 8 — Indices of Real Per Capita Income of Households When Informal Sector Prices are Equal to the National Consumer Price Index

	Group				
	URP	URNP	RSAV	RSP	RSNP
1977/78	100.0	100.0	100.0	100.0	100.0
1979/80	88.8	96.7	102.2	95.7	96.2
1981/82	73.8	83.8	91.0	80.2	81.6
1983/84	76.1	81.0	92.0	81.0	83.8
1985/86	97.6	102.0	89.5	98.8	96.8
1987/88	99.4	102.9	107.3	110.6	106.6
1989/90	91.4	97.2	96.7	93.3	93.3

Source: Computed by author.

real incomes in Ghana at the end of the eighties appear quite close to their pre-crisis peaks.

The disaggregation of real income changes to various causes suggested that fluctuations in agricultural and other key prices such as wages, and informal sector prices, lead to substantial fluctuations in real incomes. This is most apparent in the post-ERP period in Ghana, where yearly income swings of ±10-20 percent are not uncommon. In reality, of course, these income fluctuations would not lead to similar variations in household real consumption, since households would tend to dissave in periods of income declines and save in periods of income boosts. This effect would tend to mitigate the impact of real income shocks, but the investigation of its smoothing tendencies, while important, is beyond the scope of this paper.

6. CONCLUSIONS

The results of this paper suggest that contrary to popular hypotheses, it is not likely that incomes of the poor in Ghana have deteriorated after the onset of the ERP. The empirical model outlined and implemented suggests that although real income declined for all groups before the ERP, since 1983/84 incomes of different groups have risen, to different degrees. Comparing the real incomes in 1989/90 to those of the preadjustment peak of 1977/78, the urban nonpoor group seems to be better off, while the real incomes of the other groups although they surpassed this peak in 1987/88, were slightly below this level in 1989/90.

The model does not attribute the evolution of real incomes to specific policies. It rather computes real incomes on the basis of economic signals before and after the ERP. The extent to which these economic signals in turn depend on specific policies should be investigated with appropriate macroeconomic or sectoral models, and is a subject for further research.

Finally, although the analysis has permitted the investigation of per capita real income of representative members of different household groups, it has not dealt with the question of changes in the overall degree of poverty. It is quite possible, for instance, that while per capita real income of a representative household in a poor group is increasing, the membership in this class of households is also increasing. This could result in increases in overall poverty, although the welfare of the typical members of the classes of poor is not deteriorating. The consistency checks reported in the context of choosing the structural parameters of the model suggested that this phenomenon is not too strong in Ghana, otherwise it would lead to much larger than the observed discrepancies in production. Nevertheless, analysis of this quite difficult problem is important, albeit beyond the scope of the present study.

The model of this paper and its application have suggested that it is possible to obtain some indication of the evolution of household welfare without always resorting to elaborate multisectoral models, which, while allowing a more comprehensive counterfactual analysis, are quite difficult and time consuming to implement.

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