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Poverty Analysis and Measurement within a General Equilibrium Framework

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I. Introduction

The fundamental reason for analyzing and measuring poverty within a general equilibrium framework rather than a partial equilibrium framework is that interaction and interdependence within a socioeconomic system matters as does the prevailing structure of the economy. Policy measures and shocks have direct effects on sectors of production, institutions (such as different socioeconomic groups and firms) and factors of production. However, indirect effects of policies and shocks are often as, or more, important than the direct effects.

For example socioeconomic interaction affects poverty alleviation in a differential way through the sectoral pattern of growth. The impact of a sector's output growth on poverty alleviation can be direct, through the increase in incomes accruing to poor households who contributed through their labor or land to that sector's output growth. But another part of poverty alleviation results from the indirect effects operating through the interdependence of economic activities, i.e.,, the closed loop effects familiar in the Social Accounting Matrix (SAM) literature. Assume that we are interested in the main paths through which a new textile factory in a rural site affects, directly and indirectly, the incomes of small farmers. The increase in textile output will require unskilled labor that is to be provided typically by two household groups, i.e.,, small farmers and landless agricultural workers. Because those two groups are likely to be relatively poor, a significant part of the incremental incomes accruing to them from earnings from work in the factory will be spent on food crops. The subsequent increase in food crop production, in turn, requires unskilled family labor from small farm households thus further raising their incomes and lowering poverty incidence in that group.

Another example of the importance of interaction can be seen when a government subsidizes specific socioeconomic groups (e.g., the urban poor) as part of its poverty alleviation strategy. The initial effects will be to reduce poverty among this group but because of the indirect effects of this group's spending (presumably largely on foodstuffs) the incomes of other groups (such as small farmers producing domestic food crops) may well increase. In this case, interaction in the economy would lead to an indirect reduction in poverty through the spending and respending effects of the initial beneficiaries of subsidies. A large part of the increase in income received by the initial beneficiary group would spill over into an increased demand for goods and services that, in turn, have to be produced with different factors of production (e.g., unskilled labor, skilled labor, capital).

The household groups that are endowed with the required factors to satisfy this additional demand for food and consumer goods would be compensated through additional wages and other factor incomes, lowering thereby the incidence of poverty among the poor in those socioeconomic groups.

Still another example of a policy measure likely to have significant direct and indirect effects on poverty is a devaluation and trade liberalization program within a structural adjustment framework. The immediate impact of a devaluation is to increase the relative prices of tradeables vs. non-tradeables thereby benefiting tradeable production activities. In some poor developing countries at least, farmers and agricultural workers producing agricultural export crops would benefit, assuming adequate supply response and a favorable environment. Since a part of the higher incomes is likely to be spent on consumer goods and informal services, indirect spillover effects could benefit rural nonagricultural households and urban households involved in the production of those consumer goods and services. Poverty might accordingly be reduced among those groups through those indirect effects.

There are essentially two analytical methods to estimate and simulate the effects of exogenous shocks (including policies) on poverty. The first approach relies on a SAM framework that is assumed to reflect closely the underlying socioeconomic structure and interdependence of the country or region under consideration. SAM multipliers are derived from the base year SAM in such a way as to focus specifically on the extent to which different exogenous shocks affect household groups' incomes and, ultimately, poverty alleviation and the structural mechanisms and linkages through with the initial shock contributes, directly and indirectly, to poverty alleviation. This approach is based on some limiting assumptions, such as the existence of excess capacity, unused resources and constant prices.

The second approach relies on building a Computable General Equilibrium (CGE) model calibrated on an underlying SAM and reflecting not only the initial structure of the socioeconomic system but also the behavior of the various agents and institutions. In contrast with the first method above that describes a Keynesian world, the CGE approach attempts to capture a more likely world (and set of conditions) in that, at least, some sectors in the economy operate at full capacity and some factors of production (skilled labor) are fully employed. Under those circumstances, prices can no longer be assumed to remain constant. In such a model prices are endogenously determined so as to generate the set of prices that is consistent with “equilibrium” in an economy. When an economy is affected by an exogenous shock or a policy change, a new set of prices obtains, which, in turn, determines production, consumption, employment and incomes.

Both approaches, i.e., SAM multiplier modeling and CGE models are based on two fundamental pillars, i.e., that interaction and interdependence within a socioeconomic system matters as does the prevailing structure. What CGEs add to the simple SAM framework is that they capture the behavior of the main actors in response to price changes.

In what follows, these two approaches are described with relevant examples of their applicability to estimate and simulate the impact of the shocks on poverty.

II. The SAM Multiplier Approach to Estimate Poverty Impact of Shocks

A. The SAM as an Accounting System and as a Conceptual Framework

As a data framework, the SAM is a comprehensive and disaggregated snapshot of the socioeconomic system during a given year. It provides a classification and organizational scheme for the data useful to analysts and policymakers alike. It incorporates explicitly various crucial relationships among variables such as the mapping of the factorial income distribution from the structure of production and the mapping of the household income distribution from the factorial income distribution. Table 1 presents a basic SAM. It can readily be seen that it incorporates all major transactions within a socioeconomic system. Whereas the SAM in Table 1 is a snapshot of the economy, Figure 1, which reproduces all of the transformations appearing in Table 1, can be interpreted more broadly as representing flows (over time) which, in turn, have to be explained by structural or behavioral relationships.

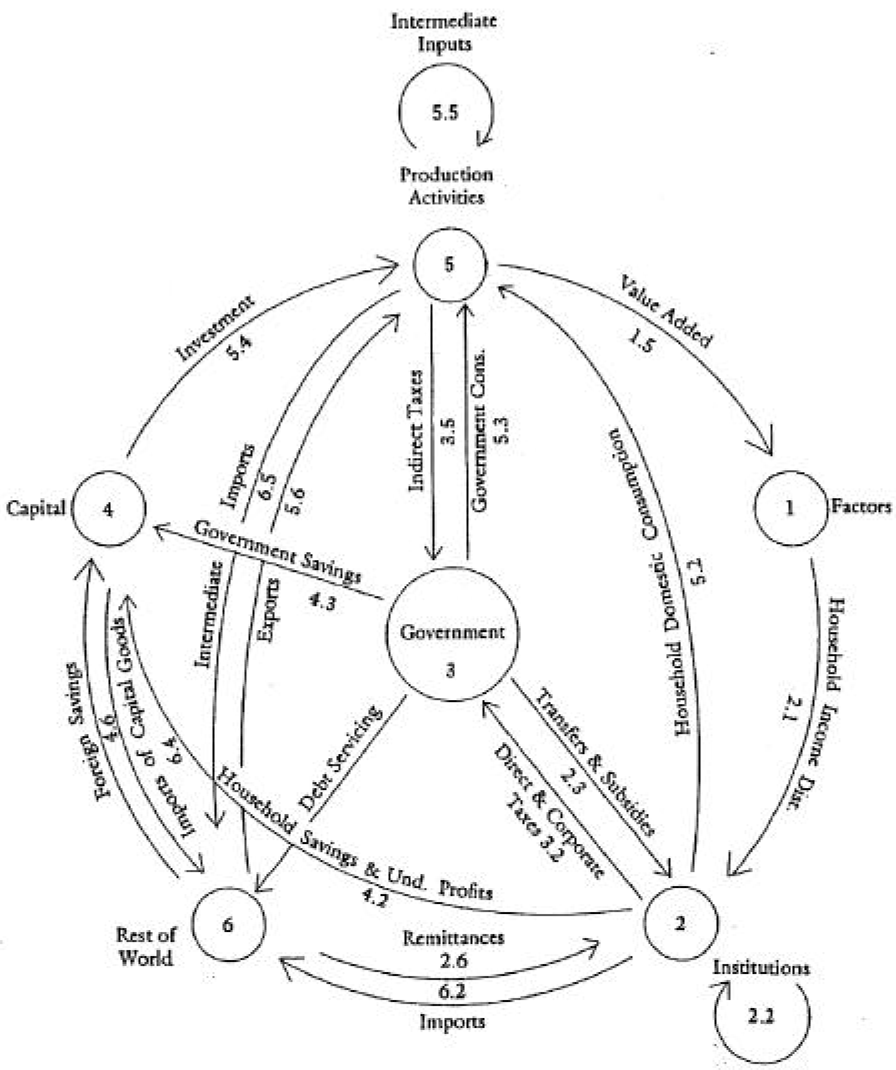
Table 1 presents all the above flows in a basic SAM. A SAM is a square matrix in which each transactor or account has its own row and column. The payments (expenditures) are listed in columns and the receipts are recorded in rows. As the sum of all expenditures by a given account (or subaccount) must equal the total sum of receipts or income for the corresponding account, row sums must equal the column sums of the corresponding account. For example, the total income of a given institution (say a specific socioeconomic household group) must equal exactly the total expenditures of that same institution. This is the economic analog of the physicists’ law of

Table 1
A basic social accounting matrix (SAM)

			Expenditures							
			1	2a	2b	3	4	5	6	
			Factors of production	Institutions: Current accounts: Households	Institutions: Current accounts: Companies	Institutions: Current accounts: Government	Institutions: Combined capital account	Production activities	Rest of the world combined account	Totals
Receipts	1	Factors of production						Value added payments to factors	Net factor income received from abroad	Incomes of the domestic factors of production
Receipts	2a	Institutions: Current accounts: Households	Allocation of labour income to household	Current transfers between households	Profits distributed to domestic households	Current transfers to domestic households			Net non-factor incomes received from abroad	Incomes of the domestic institutions after transfers
Receipts	2b	Institutions: Current accounts: Companies	Allocation of operating surplus to companies			Current transfers to domestic companies				
Receipts	3	Institutions: Current accounts: Government		Direct taxes on income and indirect taxes on current expenditures	Direct taxes on companies plus operating surplus of state enterprises		Indirect taxes on capital goods	Indirect taxes on inputs	Net non-factor incomes received plus indirect taxes on exports	
Receipts	4	Institutions: Combined capital account		Household savings	Undistributed profits after tax	Gov't current account surplus			Net capital rec'd from abroad	Aggregate savings
Receipts	5	Production activities		Household consumption expend. on dom. goods		Government current expenditure	Investment expenditures on domestic goods	Raw material purchases of domestic goods	Exports	Aggregate demand — gross outputs
Receipts	6	Rest of the world combined account		Household consumption expend. on imp. goods			Imports of capital goods	Imports of raw materials		Imports
		Totals	Incomes of the domestic factors of production	Total outlay of households	Total outlay of companies	Total outlay of government	Aggregate Investment	Total costs	Total foreign exchange receipts	

Source: Thorbecke (1988)

Figure 1
Flow Diagram of SAM Transactions



[1]The flow diagram reflects exactly the transactions and transformations appearing in the SAM on Table 1. Note that transactions are numbered in a way consistent with the numbering of the Accounts in Table 1. For example, the allocation of value added is a receipt for the Factor Account (#1) and a payment by the Production Activities Account (#5); hence, the corresponding transformation (matrix) is denoted by 1.5.

Source: Thorbecke (1988)

conservation of energy. Hence, analysts interested in understanding how the structure of production influences the income distribution can obtain useful insights by studying the SAM.

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In the basic SAM of Table 1, six accounts are distinguished. Production activities produce different sectoral goods and services (e.g., textile products) by buying raw materials and intermediate goods and services. In addition these accounts pay indirect taxes to the government and the remainder is, by definition, value-added that is distributed to the factors of production (see column 5). Production activities receipts (row 5) derive from sales to households, exports, and the government. In the present formulation of the SAM no distinction is made between production activities and commodities. For the sake of simplicity, it is assumed that a production activity is equivalent to a corresponding commodity. In some instances, the SAM format distinguishes between production activities and commodity accounts. This would be the case when a given production activity produced different commodities, for example, so that these two sets of accounts would require different sectoral breakdowns. For this reason, many SAMs include both production activities and commodities accounts. When commodity accounts appear in a SAM they can best be seen as representing a region's or nation's product markets.

Factors of production accounts typically include labor and capital subaccounts. They receive income (recorded in row 1) from the sale of their services to production activities in the form of wages, rent, and net factor income received from abroad or from other regions (corresponding to the value-added generated by the production activities). In turn, these revenues are distributed (column 1) to households as labor incomes and to companies as distributed profits.

Institutions include households (typically further broken down by socioeconomic groups), companies (i.e., firms) and the government. From row 2a, it can be seen that households receive factor income (wages and other labor income, rent, interest, and profits) as well as transfers from government and from the rest of the nation and world (e.g., remittances). Households' expenditures (in column 2a) consist of consumption on goods from the region, from other regions and from abroad, and income taxes with residual savings transferred to the capital account. Companies (2b) receive profits and transfers and spend on taxes and transfers with their residual savings channeled into their capital account.

The government account (3) is distinct from administrative public activities included in the production activities' account. These public services (such as education) buy intermediate goods, pay wages, and deliver public and administrative services. The government account per se allocates its current expenditures on buying the services provided by the production activities account. Other government expenditures (column 3) are transfers and subsidies to households and companies and the remaining savings are transferred to the capital account. On the income side, the government receives tax revenues from a variety of sources and current transfers from abroad (row 3).

The fifth account is the combined capital account. On the income side (row 4) it collects savings from households, companies, government, as well as foreign savings and, in turn, channels these aggregate savings into investment (col. 4).

Finally, transactions between domestic residents, and foreign residents, respectively, are recorded in the rest of the world accounts (6). These transactions include, on the receipt side, households' consumption expenditures on imported final goods as well as imports of capital goods and raw materials (row 6). The economy receives income from the rest of the nation and world (column 6) from exports and factor and nonfactor income earned. The difference between total foreign exchange receipts and imports is by definition net capital received from abroad or the rest of the nation and extraregional and foreign savings.

The SAM framework can also be used as a conceptual framework and as a basis for modeling. In this case the generating mechanisms influencing the flows appearing in Figure 1 have to be spelled out explicitly and quantitatively. Whereas the SAM in Table 1 is a snapshot of the economy, Figure 1 which reproduces all of the transformations appearing in Table 1, can be interpreted more broadly as representing flows (over a period of one year) which, in turn, have to be explained by structural or behavioral relationships.

B. The Social Accounting Matrix and Multiplier Analysis

We assume that there exists excess capacity that would allow prices to remain constant and that expenditure propensities of endogenous accounts remain constant[1]. We also assume that production technology and resource endowments are given for a period.[2] Under these assumptions, the SAM framework can be used to estimate the effects of exogenous changes and injections, such as increases or decreases in the demand for specific products (sectoral outputs) on the whole socioeconomic system. To derive and illustrate the underlying logic of this methodology, the SAM accounts need to be partitioned into endogenous and exogenous accounts. It has been customary to consider the government, rest of the world, and capital accounts as exogenous and the factors, institutions (household groups and companies), and sectoral production activities as endogenous.[3] The resulting simplified SAM is presented in Table 2 and the corresponding endogenous flows in Figure 2. Note that the exogenous accounts have been combined together in Table 2 and the sum of the exogenous injections is also consolidated into one vector (hence x_i, i = 1, 2, 3 represents the sum of injections from abroad, investment, and government expenditures affecting i). Likewise l_i's represent the corresponding leakages.

Thus the above simplified and truncated SAM consolidates all exogenous transactions and corresponding leakages and focuses exclusively on the endogenous transactions and transformations. Five endogenous transformations appear in Table 2. T_{13} is the matrix that allocates the value added generated by the various production activities into income accruing to the various factors of production; T_{33} shows the intermediate input requirements (i.e., the input/output transactions); while T_{32} reflects the expenditure pattern of the various institutions including the

1. Subsections IIB to IID follow closely the methodology developed in Thorbecke-Jung (1996) and Pyatt and Round (1979).

2. The SAM is basically a snapshot of transactions occurring at one point in time (a given year). Dynamic changes in technology or resource endowment would be reflected by a new SAM with different coefficients.

3. The standard justification for taking the government account as exogenous is that policy measures are, at least in a limited way, under the control of the government—an assumption that would, incidentally, be debated by public choice advocates. In the absence of a sound and robust theoretical explanation of private investment behavior, it is also conventional to assume private investment and its pattern to be given exogenously. Finally, with regard to the rest of the world account, it is assumed that exports (but not imports) and some other transactions depend on overseas variables and can hence be taken as exogenous.

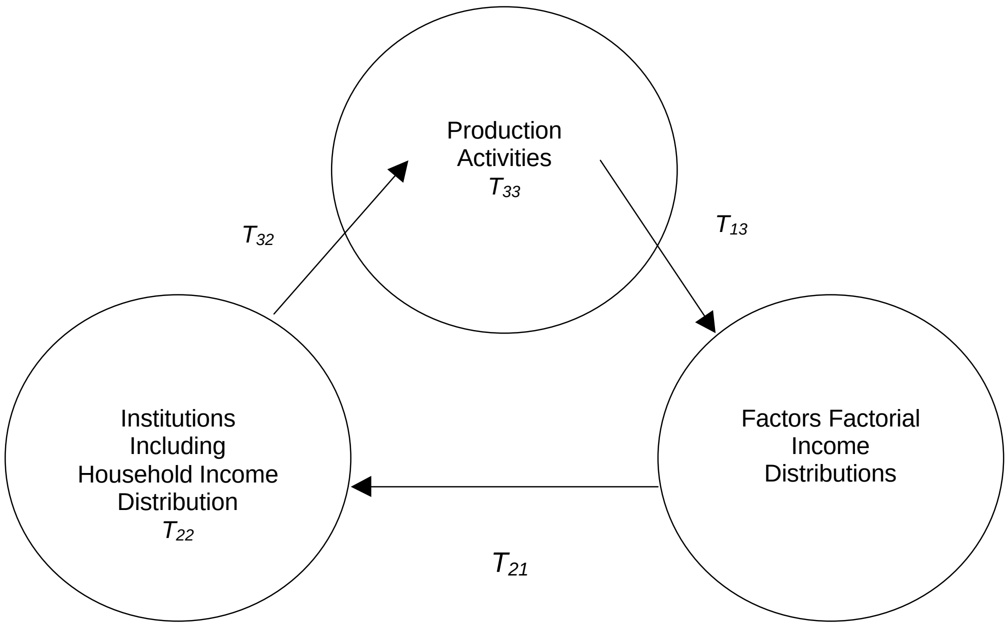
different household groups on the commodities (equivalent to production activities) which they consume. T_{21} reflects the mapping of the factorial income distribution into household income distribution (by household groups). It tells us the various sources of income of the different categories of households which, in turn, reflect the resource endowment possessed by the various types of households. Finally, T_{22} gives the interinstitutional transfers such as transfers among different types of households or between companies and households.

The logic underlying the scheme in Table 2 and Figure 2, as will be seen shortly, is that exogenous changes (the *x'*s) in Table 2 determine, through their interaction within the SAM matrix, the incomes of the endogenous accounts, i.e., (i) the factor incomes [vector y_1]; (ii) the household and companies incomes [y_2]; and (iii) the incomes of the production activities [y_3].

Table 2. **Simplified Schematic Social Accounting Matrix**

		Expenditures				
		Endogenous accounts			**Exogenous**	**Totals**
		Factors	**Institutions (Households and companies**	**Production Activities**	**Sums of other accounts**	
		1	**2**	**3**	**4**	**5**
Receipts		*Endogenous accounts*				
Factors	1	*0*	*0*	T_{13}	x_1	y_1
Institutions, i.e., households and companies	2	T_{21}	T_{22}	*0*	x_2	y_2
Production activities	3	*0*	T_{32}	T_{33}	x_3	y_3
		Exogenous accounts				
Sum of other accounts	4	l_1'	l_2'	l_3'	t	y_x
Totals	5	y_1'	y_2'	y_3'	y_x'	

Figure 2. **Simplified Interrelationship among Principal SAM Accounts (production activities, factors, and institutions)**



Source: Thorbecke and Jung (1996).

For analytical purposes, the endogenous part of the transaction matrix is converted into the corresponding matrix of average expenditure propensities. These can be obtained simply by dividing a particular element in any of the endogenous accounts by the total income for the column account in which the element occurs.[4] From Table 2 it can be seen that A_n is partitioned as follows

$$A_n = \begin{bmatrix} 0 & 0 & A_{13} \\ A_{21} & A_{22} & 0 \\ 0 & A_{32} & A_{33} \end{bmatrix} \qquad (1)$$

From the definition of A_n, it follows that in the transaction matrix, each endogenous total income (y_n) is given as

$$y_n = A_n y_n + x \qquad (2)$$

4. In fact, to be exact, the matrix of average expenditure propensities consists of two parts; A_n, which is the square matrix of average expenditure propensities for the endogenous accounts, while the second part, A_l, consists of the so-called leakages, i.e., the proportions of each endogenous variable that leak out as expenditure into anyone of the three accounts. While the transaction matrix is expressed in money flows, the A_n and A_l matrices are expressed as ratios with each column adding up to exactly unity.

which states that row sums of the endogenous accounts can be obtained by multiplying the average expenditure propensities for each row by the corresponding column sum and adding exogenous income x.

Equation (2) can be rewritten as

$$y_n = (I - A_n)^{-1} x \quad (3)$$
$$= M_a x$$

Thus, from (3), endogenous incomes y_n (i.e., factor incomes, y_1; institution incomes, y_2; and production activity incomes, y_3, as shown in Table 2) can be derived by premultiplying injection *x* by a multiplier matrix M_a. This matrix has been referred to as the accounting multiplier matrix because it explains the results obtained in a SAM and not the process by which they are generated. The latter would require the specification of a dynamic model including the different SAM accounts and variables.

One limitation of the accounting multiplier matrix M_a, as derived in equation (3), is that it implies unitary expenditure elasticities (the prevailing average expenditure propensities in A_n are assumed to apply to any incremental injection). While this assumption may be defensible for all other elements of A_n, it is certainly unrealistic for the expenditure pattern of the household groups (A_{32}). A more realistic alternative is to specify a matrix of marginal expenditure propensities (C_n below) corresponding to the observed income and expenditure elasticities of the different agents, under the assumption that prices remain fixed.[5] In this case, C_n formally differs from A_n in the following way $C_{13} = A_{13}, C_{33} = A_{33}, C_{21} = A_{21}, C_{22} = A_{22}$ *but* C_{32} ¹ A_{32}.

Expressing the changes in incomes (dy_n) resulting from changes in injections (dx), one obtains

$$dy_n = C_n dy_n + dx$$
$$= (I - C_n)^{-1} dx = M_c dx \quad (4)$$

5. Since the expenditure (income) elasticity for household group h and commodity (product) i: ey_{hi} is equal to the ratio of the marginal expenditure propensity (MEP_{hi}) to the average expenditure propensity (AEP_{hi}), it follows that the matrix of marginal expenditure propensities, C_{32}, can be readily obtained once the expenditure elasticities and average expenditure propensities (i.e., A_{32}) are known, i.e.,

$$ey_{hi} = \frac{MEP_{hi}}{AEP_{hi}}; \; MEP_{hi} = ey_{hi} AEP_{hi}.$$

M_c has been coined a fixed price multiplier matrix (see Pyatt and Round 1979) and its advantage is that it allows any nonnegative income and expenditure elasticities to be reflected in M_c [6].

C. Multiplier Decomposition to Estimate Impact of a Change in Demand for and Output of Different Production Activities on Mean Incomes

In the present context we are interested in estimating the impact that different production activities have on poverty alleviation, which requires identification of the effect of each production activity on each household group income, incidence of poverty in each group, and the extent to which the poor in each group share in their group's income growth.[7] Depending on the technology used, the factor endowment of the socioeconomic groups and the extent of interlinkages on the demand and supply sides (i.e., the degree of integration of the economy), certain production activities contribute more to the growth of household groups' incomes than others. As is shown subsequently, income growth in turn contributes to poverty alleviation depending on the sensitivity of the adopted poverty measure to income.

Equation (5) shows how the matrix of marginal expenditure propensities (C_n) is partitioned;

$$C_n = \begin{bmatrix} 0 & 0 & C_{13} \\ C_{21} & C_{22} & 0 \\ 0 & C_{32} & C_{33} \end{bmatrix} \tag{5}$$

Hence equation (4) can be written in explicit form as

$$\begin{aligned} dy_1 &= && C_{13}dy_3 + dx_1 \\ dy_2 &= C_{21}dy_1 + C_{22}dy_2 && + dx_2 \\ dy_3 &= C_{32}dy_2 + C_{33}dy_3 + dx_3 && \end{aligned} \tag{4a}$$

6. Note that the consumption function implicit in the above formulation has total household income as its argument. So the expenditure elasticities have to be estimated as a function of total income rather than as a function of disposable income or total consumption. Furthermore, price effects are ignored by definition. Notwithstanding the clear superiority of fixed price multipliers compared to accounting multipliers in reflecting actual consumption behavior, the latter continue to be used in much applied work because they can easily be derived from limited data.

7. It should be noted that the methodology developed here is applicable to any exogenous shock such as government subsidies to specific socioeconomic groups and an increase or decrease in specific export activities. In the present illustration we assume that an exogenous shock such as public investment or a change in export demand originating abroad generates an increase in sectoral output.

that yields

$$dy_1 = C_{13}dy_3 + dx_1$$
$$dy_2 = (I - C_{22})^{-1} C_{21}dy_1 + (I - C_{22})^{-1} dx_2 \qquad (5b)$$
$$dy_3 = (I - C_{33})^{-1} C_{32}dy_2 + (I - C_{33})^{-1} dx_3$$

We are focusing on the contribution that different production activities make to income growth. Starting with an exogenous change in demand for a given production activity (dx_3, above) we want to know the impact on the incomes of the different household groups (dy_2, above) and, more specifically, on the additional incomes accruing to the various household groups. Thus, we concentrate on that part of the fixed price multiplier matrix that links production activities to household groups (i.e., M_{c23}).[8] Let m_{ij} be an element of this matrix; it shows the total direct and indirect effects of an increase of one unit in the demand for (and the output of) production activity j on the incremental incomes received by socioeconomic (household) group i.

Thorbecke and Jung (1996) have shown that M_{c23} can be decomposed multiplicatively into two different matrices, which represent what they coin distributional (*D*) and interdependency (*R*) effects, respectively,

$$M_{c23} = R \cdot D \qquad (6)$$

where dimensions of matrices M_{c23}, *R* and *D* are (household groups x production activities), (household groups x household groups) and (household groups x production activities), respectively. Fixed price multipliers and distributional effects corresponding to each pair of production activity and household group can be obtained directly from matrices M_{c23} and *D*, respectively.

The distributional effects represent the initial effects of a change in output of the respective production activities on the incomes of the various socioeconomic groups. The strength of the distributional effects depends mainly, as is shown next, on the technology in use (e.g., how labor-intensive it is, how much it relies on the factors of production possessed by household groups), and the factor endowment of the households (e.g., how much unskilled labor and land they possess). In turn, the interdependency effects capture the direct and indirect effects of spending and respending by the particular household group, under consideration, and other groups that benefited, income-

8. M_{c23} is the matrix constituted by the columns of production activities and rows of socioeconomic household groups of the fixed price multiplier matrix, M_c.

wise, from the exogenous output injection. Interdependency effects reflect the extent of integration within the economy on both the demand and supply sides. The more consumers spend on domestic goods and services, and the more diversified their consumption pattern, the larger these effects. Likewise, the greater the intersectoral linkages on the production side and the transfer linkages among household groups, the higher the interdependency effects. In the following subsections, distributional and interdependency effects will be defined and discussed in more detail, respectively.

(i) Distributional Effects

Distributional effects originate with an exogenous change in output of a given production activity (dx_3). Say that textile output is increased by one unit. In order to produce this additional unit, intermediate inputs such as cloth, other fibers, and fuel may be required, which in turn need other intermediate inputs to be produced. The first, second, and higher order effects are captured by the matrix $(I - C_{33})^{-1}$. Likewise any increase in sectoral output requires primary inputs such as unskilled labor, capital, and land. The demand for these factors of production is given by matrix C_{13}. In turn, additional income will flow to the household groups depending on their factor endowment (how much of the factors used in the production of textiles they possess). This transformation is represented by C_{21}. If the prevailing textile technology requires much unskilled labor, such socioeconomic groups as the rural landless and the urban uneducated, that are well endowed with this factor, will benefit. When factors owned mostly by a household group composed mostly of poor are used intensively by a specific production activity, the distributional effects will be large and vice-versa. Finally, income transfers occur between and among different socioeconomic groups and are captured by $(I - C_{22})^{-1}$.

Thus, from the above discussion, the total distributional effects are defined as

$$D = (I - C_{22})^{-1} C_{21} C_{13} (I - C_{33})^{-1} \tag{7}$$

D can be broken down multiplicatively into its three components[9], $D_3 = (I - C_{22})^{-1}$; $D_2 = C_{21}C_{13}$, and $D_1 = (I - C_{33})^{-1}$, i.e.,

$$D = D_3 D_2 D_1 \tag{7a}$$

where D_3 stands for the transfer effects, D_2 for the direct distributional effects, and D_1 for the intersectoral production effects.

9. An additive decomposition is impossible in this case since the dimensions of the matrices differ.

To recapitulate, D_3 represents the interhousehold transfers, D_2 represents the income flows accruing to household groups from the factors used in the production process and owned by those groups; and D_1 represents input–output interlinkages on the production side.

(ii) Interdependency Effects

While the distributional effects capture the initial impact of a change in sectoral output on incomes, the interdependency effects capture the spending and respending effects. The initial incremental incomes received by the households are, in turn, spent on food, clothing, and other commodities. To satisfy this additional demand, a corresponding output has to be produced requiring intermediate and primary inputs that ultimately generate an additional indirect flow of incomes for the poor. Thus, interdependency effects aggregate the impact of the initial first round of spending and subsequent rounds of respending by the household groups. As mentioned previously, interdependency effects reflect the degree of integration in the socioeconomic system on the production and expenditure sides. What we call interdependency effects (R), in the present context, are equivalent to the closed loop effects that have been identified by Pyatt and Round (1979) in their alternative multiplier decomposition method. Thus going back to eguation (6) above

$$M_{c23} = RD \qquad (6 \bullet)$$

If m_{ij} is an element of M_{c23}, then, in turn, it can be decomposed multiplicatively into two components

$$m_{ij} = r_{ij} d_{ij} \qquad (8)$$

We have shown that the distributional effects can be decomposed further into distributional transfer effects, direct distributional effects and distributional effects resulting from intersectoral production linkages (see 7a).

Therefore, a multiplier m_{ij} can be decomposed as

$$m_{ij} = r_{ij} d_{ij} = r_{ij} d_{3ij} d_{2ij} d_{1ij} \qquad (9)$$

In equation (4), $dy_2 = M_{c23} dx_3$, let dy_{2i} be an element of vector dy_2, and dx_{3j} be an element of vector dx_3. Then,

$$dy_{2i} = m_{ij} dx_{3j} = r_{ij} d_{ij} dx_{3j} = r_{ij} d_{3ij} d_{2ij} d_{1ij} dx_{3j} \qquad (10)$$

D. Incorporating Poverty Sensitivity Effects into the Previous Multiplier Decomposition Procedure

To assess the impact of a given sectoral output change on poverty alleviation requires the adoption of an appropriate poverty measure. One such class of additively decomposable poverty measures that has become popular in empirical applications is the Foster–Greer–Thorbecke (1984) (F-G-T) P_a measure that we adopt here. For different values of α the F-G-T P_a measure becomes, respectively, the headcount ratio (α=0); the poverty gap (α=1); and the F-G-T distributionally-sensitive measure (α=2). In the preceding section we have derived the impact of change in sectoral output on household groups' mean incomes. In this section we derive the sensitivity of the adopted poverty measure to changes in group mean incomes. Poverty sensitivity is determined by the elasticity of the selected poverty measure with respect to mean incomes for the various household groups and their growth rates.

As a first step in computing the change in a poverty measure caused by a sectoral output change, the impact of income change on a poverty measure needs to be clarified. Kakwani (1993) showed that a change in a poverty measure can be decomposed into two parts: one part is the change in the mean per capita income (i.e., the effect which we have derived and decomposed in the preceding section) and the other by the change in income distribution,

$$dP_{aij} = \frac{\partial P_{aij}}{\partial \bar{y}_i} d\bar{y}_i + \sum_{k=1}^{l} \frac{\partial P_{aij}}{\partial q_{ijk}} dq_{ijk} \tag{11}$$

where P_{aij} is the F-G-T P_a measure linking sector j to household group i, $\bar{y}_i$ is the mean per capita income of household group i, and q_{ijk} reflects the income distribution parameters. Let us assume that the change in the output of production activity j is distributionally neutral so that[10],

$$\frac{dP_{aij}}{P_{aij}} = h_{ai} \left(\frac{d\bar{y}_i}{\bar{y}_i} \right) \tag{12}$$

where h_{ai} is the elasticity of P_{aij} with respect to the mean per capita income of each household group i resulting from an increase in the output of sector j.[11]

10. Although the assumption of distribution neutrality is common in this type of modeling, this cannot be taken for granted. A very detailed comparison of income distribution by sector of employment in Indonesia between 1984 and 1987 revealed significant changes in intragroup distributions for the same sector between these two years (see Huppi and Ravallion 1991).

The next step is to link the increase in mean income $(d\bar{y}_i)$ to the previously derived fixed price multiplier (m_{ij}). From equation (4) it follows that:

$$d\bar{y}_i = m_{ij}\, dx_j \tag{13}$$

where dx_j is the change in the output of sector j defined on a per capita basis for group i. Therefore, equation (14) becomes,

$$\frac{dP_{aij}}{P_{aij}} = h_{ai} m_{ij} \left(\frac{dx_j}{\bar{y}_i} \right) \tag{14}$$

Poverty tends to be pervasive in developing countries and to be spread among the different household groups. In order to obtain the aggregate poverty alleviation effects, these effects have to be summed across the various household groups.

Thorbecke and Jung (1996) derived the following relationship, where j stands for production sector and i for household group and alpha for 0, 1, and 2 respectively.

$$\frac{dP_{aj}}{P_{aj}} = \sum_{i=1}^{m} r_{aij} d_{3aij} d'_{2aij} d_{1aij} q_{aij} \tag{15}$$

In other words, the total poverty alleviation effects of an increase in the output of sector j ($-dP_{\alpha j}/P_{\alpha j}$) can be decomposed into the (i) mean income change of the poor across all household groups further decomposed into interdependency effects and three types of distributional effects (transfer effects, direct distributional effects and intersectoral production linkages effects); and (ii) the sensitivity of the selected poverty measure to the mean income change ($q_{\alpha j}$).

An application of the above methodology to the case study of Indonesia revealed that agricultural and service sectors contribute significantly more to overall poverty alleviation than industrial sectors. The case study also revealed that differences in the contribution of different sectors to poverty alleviation were primarily accounted for by two types of distributional effects: the direct distributional effects and intersectoral production activity linkages (see Thorbecke and Jung 1996).

As countries develop and undergo a process of industrialization, it becomes increasingly important to strengthen the distributional and interdependency effects.

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11. In order for poverty alleviation to occur $\eta_{\alpha j}$ has to be negative. In what follows this is the convention we adopt.

In this context, the decomposition analysis in Thorbecke and Jung (1996) provides potentially important insights about how socioeconomic groups with a high incidence of poor can participate in, and benefit more from industrialization. It was shown that low poverty alleviation effects of manufacturing activities are mostly due to low distributional effects (especially direct linkages). These direct linkages depend on the factor endowment of the poor household groups and the prevailing technology in the different production sectors. Since the poor household groups' factor endowment consists mainly, if not exclusively of, unskilled labor, while manufacturing activities tend to rely on skilled rather than unskilled labor, the decomposition analysis suggests strongly that the human capital of the poor must be enhanced through education and vocational training if they are not to be sealed off from participating in modern production activities. Likewise, in the transition period towards full scale industrialization certain production activities (such as food processing and textiles) relying on relatively traditional technologies and relatively unskilled labor should not be prematurely and inappropriately displaced by modern capital intensive technologies.

E. Budgetary Rules to Minimize Societal Poverty in a General Equilibrium Framework

Suppose that a government of a developing country is intent on allocating an exogenously given budget, B, (e.g. from a foreign aid grant) to minimize societal poverty. Society is made up of k mutually exclusive socioeconomic groups whose intragroup income distributions are known. For practical and administrative reasons the government can only target groups rather than individual households. Assume, furthermore that the societal measure of poverty to be minimized is P •. If reducing P • is society's goal, then the answer is clearly that the increment should be given to the group whose receipt of the increment will reduce P • the most (i.e., it should be given to the group *i* for which

$\partial P_{\bullet} / \partial B^{i}$ is the most negative, where B^i is the incremental poverty budget provided to group *i*).

Thorbecke and Berrian (1992) have derived budgetary rules to maximize the reduction in societal poverty from a given budget dedicated to poverty alleviation with and without interaction in the economy. What is relevant in the present context is that they have shown that failure to incorporate interactive (indirect) effects leads to misallocation of a poverty alleviation budget among groups leading to a welfare loss. Interactive effects can account for a not insignificant part of the reduction in societal poverty. More specifically, the sequence of allocation of benefits and the choice of groups under the budgetary rules—assuming interaction in the economy—are different than under budgetary rules assuming no interaction.

III. Poverty Analysis and Measurement within Computable General Equilibrium Modeling

The preceding SAM multiplier analysis rests on some limiting assumptions, namely that excess capacity prevails and unused resources are available. Under this type of Keynesian world, any exogenous increase in demand can be satisfied by a corresponding increase in supply while maintaining constant prices. The comparative static nature of the SAM multiplier analysis, as such, precludes capturing and estimating dynamic effects. For example, whereas investment demand (i.e., the intermediate inputs, labor, and capital required in the construction phase of a project) is explicitly incorporated in the SAM, the future effects of investment on productivity are ruled out by the fact that a SAM is only a one-year snapshot of the economy. Furthermore, when an economy is affected by an exogenous shock or a policy change, a new set of prices obtains, which, in turn, determine production, consumption, employment and incomes.

The SAM provides the underlying taxonomy of the CGE. Each account and subaccount of a given SAM appears as a corresponding endogenous or exogenous variable in the CGE based on that SAM. Not only does a CGE take as its initial conditions the values appearing in the base year SAM but, in addition, the parameters and coefficients of the various equations of the CGE are calibrated on the base year SAM. In this sense, it can be said that a SAM provides the "navigation table" for a CGE. All the mechanisms and transformations inherent in the SAM and described in detail in Section 2.1 are an intrinsic part of the CGE's architecture, as well. The SAM structure predetermines the channels (i.e., the various transformations) through which influence is transmitted throughout the socioeconomic system and the CGE formalizes the relationships underlying these channels through a set of behavioral and technical equations and equilibrium conditions.

The specification of a CGE should not only reflect the prevailing socioeconomic structure of the economy (i.e., the classification scheme in the base year SAM should be consistent with that structure) but also the behavior of the actors and the constraints they face. Hence a typical CGE starts with a set of neoclassical rules and modifies them to reflect the idiosyncratic environment specific to the setting that is described.

Computable general equilibrium models have traditionally been used to simulate the impact of exogenous shocks (such as changes in international terms of trade, and a recession in importing countries) and changes in policies on the socioeconomic system and, in particular, the income distribution. Good examples of such models are those that were built in connection with the OECD research program to explore the impact of structural adjustment on equity (see e.g., Thorbecke, 1991 for Indonesia; de Janvry et al. 1991 for Ecuador; Morrisson 1991 for Morroco). Since CGE models are fully calibrated on the basis of an initial year SAM that provides a set of consistent initial conditions, and the SAM, as such, does not contain information on intra socioeconomic household group income distribution it follows that conventional CGEs can only simulate the impact of a shock on the representative household in each group. This amounts to the implicit assumption that the variance of income within a group is zero. To the extent that poverty is pervasive and is likely to affect many socioeconomic groups (albeit to different degrees) it appears essential in any analysis of the impact of a shock on poverty to start with information on intragroup income distribution. Increasingly as more income and expenditure surveys become available, it is possible to generate the within-group income distributions prevailing in the same base year as that of the SAM used to calibrate the general equilibrium model.

Recently, Decaluwe, Patry, Savard, and Thorbecke (1999) built a CGE model of an archetype African economy incorporating the poverty dimension. The major additional features of this model compared to a conventional CGE model are as follows. The first is by proposing a more flexible income distribution function. Second, the intragroup distributions are specified so as to conform to the different socioeconomic characteristics of the groups. Thus, for example, as will be seen subsequently the characteristics displayed by rural landless households contrast markedly with those of large landowner households and yield significantly different distributions. Thirdly, a unique and constant basket of basic needs commodities is postulated. Since commodity prices are endogenously determined within the model the monetary value of the poverty line is also endogenously determined. These three innovations help shed more light on the black box pertaining to the behavior of poverty following a shock.

Table 3 presents an illustrative example of a SAM for an archetype African developing economy that provided the foundation of the above model. Although it was calibrated to reflect approximately the socioeconomic structure of Côte d'Ivoire, it should be considered as a demonstration SAM reflecting many of the characteristics of a prototype African economy. The SAM is disaggregated in terms of four factors, namely: unskilled labor, skilled labor, capital, and agricultural capital (i.e., land); six categories of households, i.e., rural (landless) workers, rural land owners (small), rural land owners (large), urban low education (and hence relatively low income), urban high education (high income), and capitalists; and enterprises. Six production activities are identified i.e., domestic agriculture, export agriculture, mining, industries, services, and public services. Finally, five different commodities are specified i.e., domestic agriculture, export agriculture, mining, industries, and services.

The import competing sectors are industry and traditional agriculture. The export sectors are represented by mining and export crops. Land, agricultural capital, capital, unskilled labor and skilled labor are the five primary factors of production employed by the activities. Households are aggregated into six groups (rural households, small landowner households, large landowner households, urban low-education households, urban high-education households, and capitalist households). The geographical location of a household and the origin of their income or occupation and other socioeconomic characteristics define the groups. For example, a rural household has the characteristics of living in rural areas and being endowed exclusively with unskilled labour (and thus being landless).

Except for the incorporation of a poverty module, which is described in detail next, the specification of the CGE model is standard, reflecting the structure of a small open economy that has no influence on international markets. The model consists of different blocs: production, employment incomes and savings demand and foreign trade, in addition to the poverty module. (The full model is given in the Appendix to Decaluwe et al. 1999.)

The way in which income distribution and poverty analysis is incorporated in this model is described next as its methodology is applicable and transferable to other countries.

Table 3. **Social Accounting Matrix for Archetype African Developing Country**

			Factors				Households							Activities						Commodities								
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Factors	Unskilled labour	1												365.5	81.0	38.5	474.2	293.2	267.8									*1 520.2*
	Skilled labour	2												4.5	10.0	144.6	107.8	97.7	202.2									*566.8*
	Capital	3												72.0	30.0	292.4	955.3	567.1	11.9									*1 928.7*
	Land	4												361.6	85.0	0.0	0.0	0.0	0.0									*446.6*
H'holds	Rural workers	5	228.0	0.0	0.0	0.0																			20.0			*248.0*
	Rural land-owners (small)	6	790.5	0.0	255.9	156.3																			0.0			*1 202.7*
	Rural land-owners (large)	7	76.0	141.7	511.8	290.3																			0.0			*1 019.8*
	Urban low education	8	425.7	0.0	85.3	0.0																			20.0			*531.0*
	Urban high education	9	0.0	226.7	341.2	0.0																			0.0			*567.9*
	Capitalists	10	0.0	198.4	511.8	0.0																			0.0			*710.2*
	Entreprise	11			222.7																							
Activities	Agriculture	12																		1 038.3		0.0	0.0	0.0			181.2	*1 219.5*
	Export Africulture	13																			50.0						231.0	*281.0*
	Mining	14																		0.0		507.4	0.0	0.0			535.0	*1 042.4*
	Industries	15																		0.0		0.0	2 135.1	0.0			195.0	*2 330.1*
	Services	16																		0.0		0.0	0.0	1 325.0			110.0	*1 435.0*
	Public Services	17																		0.0		0.0	0.0	594.0			0.0	*594.0*
Comm.	Agriculture	18					95.0	412.7	271.9	171.6	97.1	32.4		204.8		0.0	323.3	0.0	0.0						0.0	274.9		*1 883.7*
	Exp. Agr.	19					0.0	0.0	0.0	0.0	0.0	0.0			40.0											10.0		*50.0*
	Mining	20					0.0	0.0	0.0	0.0	0.0	0.0		0.0		19.3	43.1	0.0	0.0						0.0	445.0		*507.4*
	Industries	21					83.1	402.8	384.2	191.7	242.4	153.1		186.1	30.0	337.5	301.7	143.3	0.0						0.0	50.0		*2 505.9*
	Services	22					57.5	291.0	271.9	141.2	146.1	98.6		0.0		173.6	43.1	247.6	76.5						471.9	0.0		*2 019.0*
	Government	23					12.4	60.1	51.0	26.5	28.4	71.0		25.0	5.0	36.5	81.6	86.1	35.6	85.6		0.0	74.2	0.0				*679.0*
	Accumulation	24					0.0	36.1	40.8	0.0	53.9	355.1	222.7												167.1		-95.8	*779.9*
	ROW	25																		759.8		0.0	296.6	100.0				*1 156.4*
	Total		*1 520.2*	*566.8*	*1 928.7*	*446.6*	*248.0*	*1 202.7*	*1 019.8*	*531.0*	*567.9*	*710.2*	*222.7*	*1 219.5*	*281.0*	*1 042.4*	*2 330.1*	*1 435.0*	*594.0*	*1 883.7*	*50.0*	*507.4*	*2 505.9*	*2 019.0*	*679.0*	*779.9*	*1 156.4*	

Source: Decaluwe et al (1999).

In this illustrative case and consistent with the SAM (given in Table 3), the households are aggregated into the above six groups representative of those living in an archetype African country. To each of these groups income and demographic characteristics typical of an African economy are attributed. These descriptive data are presented in Table 4. As can be observed, the mean income varies from 13.57 for the rural households to 117.72 for the capitalist households. As for the population shares, the small landowner is the largest group with 36.1 percent of the total population. In this example the rural households have the highest initial headcount ratio with 93.3 percent of its population below the poverty line, followed by the urban low-income category with 57.7 percent of its population below the poverty line. It should be noted that in the great majority of developing countries detailed income and expenditure survey data exist from which the actual intragroup income distributions can be derived.

Table 4: **Income and Demographic Characteristics**

	Rural households	**Small landowner households**	**Large landowner households**	**Urban low-education households**	**Urban high-education households**	**Capitalist households**
Mean income	13.57	27.75	29.91	23.27	41.49	117.72
Maximum income	40.0	50.0	55.0	40.0	60.0	140.0
Minimum income	5.0	10.0	15.0	15.0	20.0	25.0
Population share	0.13	0.31	0.25	0.17	0.10	0.04
% below the poverty line	93.3%	36.1%	19.4%	57.7%	0.5%	0%

In order to analyze and derive poverty by household group, an income distribution formulation corresponding to the characteristics of each household group is postulated. This distribution will depend on the minimum and maximum incomes and on the skewness of the income distribution.[12] To represent these characteristics into our income distributions, we use the Beta distribution function (equation 16). Parameters *mx* and *mn* are, respectively, the maximum and minimum incomes within

12. A left skewed distribution (skewness < 0, long tail in the negative direction) is defined by mode > median > mean and the right one (skewness < 0, long tail in the positive direction) is defined by mode < median < mean. A right skewed distribution is when the mode is superior to the median.

a group. As for the parameters *p* and *q*, they influence the shape and the skewness of the distribution.

$$I(y;p,q)=\frac{1}{B(p,q)}\frac{(y-mn)^{p-1}(mx-y)^{q-1}}{(mx-mn)^{p+q-1}}$$

where, $B(p,q)=\int_{mn}^{mx}\frac{(y-mn)^{p-1}(mx-y)^{q-1}}{(mx-mn)^{p+q-1}}\mathrm{d}y$ (16)

Unlike the lognormal, the Beta function is much more flexible when it comes to the asymmetric forms it can adopt (for more details, see Decaluwe et al. 1999). The parameters assigned to each household category are selected so that the income distribution concords with the characteristics of the households groups described in Table 4.

These distributions are used to evaluate the poverty incidence within each group in a general equilibrium framework. Following an external shock on the economy, it is assumed—albeit arbitrarily—that the intragroup distributions shift with the change in the mean income without changing the shape or the variance of each distribution (see Figures 3a-f). Although there are recorded cases of significant changes in intragroup distributions following a shock, as in the case of Indonesia’s adjustment process between 1984 and 1987 (see Huppie and Ravallion 1991), more recent work by Ravallion and Chen (1997) finds that inequality increases as often as it falls during spells of growth in developing countries and that neutrality is actually a defensible first-order approximation. However, it is unlikely that distribution neutrality can be assumed to prevail following shocks leading to negative growth (such as the Asian financial crisis) and it is unclear even in spells of growth, whether distribution neutrality would be a good first-order approximation in estimating poverty as opposed to inequality. As stressed by Dervis, De Melo, and Robinson (1982), the complete endogenization of intragroup income distributions following shocks still remains the biggest challenge in studying income distribution in a general equilibrium context. We return to this question subsequently.

The procedure described above allows us to compare the poverty levels obtaining in the post-simulation case with those prevailing in the pre-simulation case using the F-G-T P_a measures. The FGT P_α class of additively decomposable poverty measures allows us to measure the proportion of poor in the population (the headcount ratio) but also the depth and severity of poverty. The P_α measure expressed in terms of the Beta distribution given in equation (16) becomes:

$$P_a = \int_{mn}^{z} \left(\frac{z-y}{z}\right)^{a} I(y;p,q)\mathrm{d} \tag{17}$$

where α is a poverty-aversion parameter, *z* is the poverty line and *mn* the minimum (intragroup) income and *p* and *q* parameters of the Beta function as defined earlier.

The poverty line itself (*z* in equation 17) is determined endogenously within the CGE model. It is postulated that the poverty line is determined by a basket of quantities of commodities reflecting basic needs (BN) consistent with Ravallion's (1994) approach to estimating absolute poverty. We denote this basket as v_{com}^{p} . This basket remains invariant from one simulation to another and applies to all households regardless of group membership. In turn the monetary poverty line is obtained by multiplying the BN commodity basket by their respective prices (Pq_{com}) and aggregating across commodities:

Monetary Poverty Line: $\sum_{com} v_{com}^{p} Pq_{com}$

Since commodity prices are endogenously determined within the model, so is the nominal value of this basket, i.e., the poverty line. If commodity prices rise following an external shock, the poverty line will increase (shift to the right) and poverty will rise ceteris paribus.

The demand system specified in the model is based on the Linear Expenditure System (LES):

$$C_{h,com} = \frac{Pq_{com} v_{h,com} + b_{h,com}^{c}\left(CH_h - \sum_{com} v_{com} Pq_{com}\right)}{Pq_{com}} \tag{18}$$

where $C_{h,com}$ is the demand for commodity com by household group h;

$v_{h,com}$ is the basket of committed (minimal) consumption in volume terms for the commodities specific to household group h;

C_h is disposable income of household group h;

Pq_{com} is the price of com; and

$\sum_{com} v_{h,com} Pq_{com}$ is the monetary value of the committed (minimum) consumption specific to household group h.

This demand system implies that each socioeconomic group has its own perception of the minimal commodity basket that it needs to satisfy, consistent with the socioeconomic characteristics and the overall standard of living of the group. Clearly, this minimum basket is bound to be different for the high income capitalist group than the low income rural households. Hence the first term on the right-hand side in the numerator of equation (18) represents the amount needed to satisfy this household-specific minimum consumption requirements of commodity com. In turn, the second term in the numerator represents the proportions or marginal expenditure propensities $\left(b_{h,com}\right)$ of discretionary income $\left(CH_h - \sum_{com} v_{h,com} Pq_{com}\right)$ to be spent on each respective commodity. It can be seen that if this last term is zero (i.e., there is no discretionary income) each household group consumes a quantity of each commodity corresponding exactly to its household-specific postulated minimum.

It is essential to grasp clearly the distinction between the poverty BN basket that applies to all households—regardless of group membership—and is defined at the level of the society; and the LES demand system that specifies a group-specific consumption level for each commodity that is intractable downward. Each group is assumed to behave lexicographically in such a way that it first satisfies its minimum consumption of the respective commodities.

Two simulations were performed on the model's base year equilibrium. The first is a reduction in the world price of the agricultural export crop on the international market and the second is an import tariff reform. The effects of these simulations on the whole socioeconomic system and how they ultimately affect the household income distribution and poverty based on the P_a measures are derived. The results of the first simulation are shown graphically in Figures 3a-3f.

The decline in each household category's nominal mean income is presented by a horizontal shift to the left of the income distribution, as shown in Figures 3a-3f.

Figure 3: **Effect of a 30% Reduction in World Export Price of Export Agriculture Crop on Income Distribution**

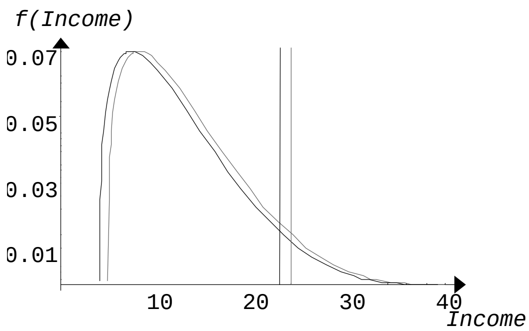


Figure 3a.
Income distribution rural households

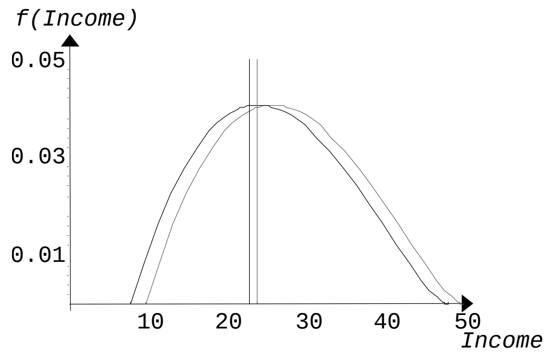


Figure 3b.
Income distribution small landowner households

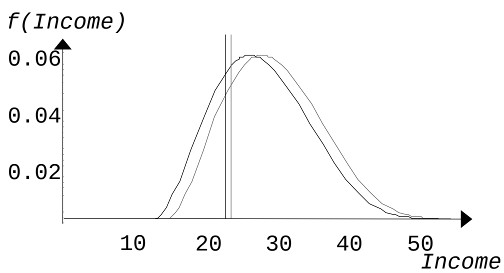


Figure 3c.
Income distribution large landowner households

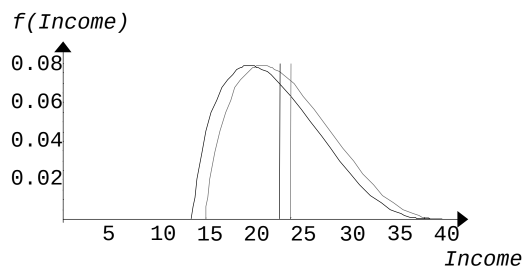


Figure 3d.
Income distribution urban low income households

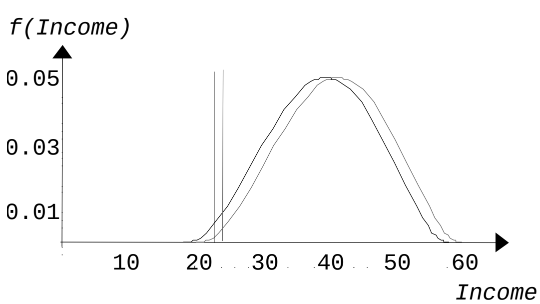


Figure 3e.
Income distribution urban high income households

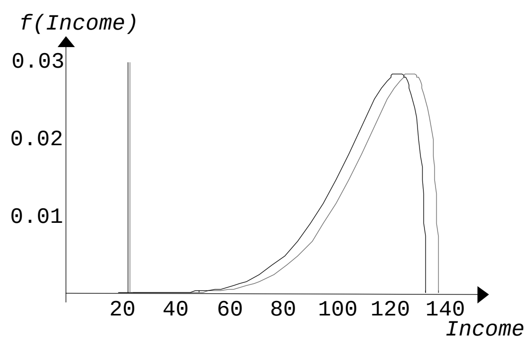


Figure 3f.
Income distribution capitalist households

Since the prices of the commodities are endogenously determined so is the new monetary poverty line, i.e.,

$$\sum_{com} v_{com}^{P} Pq_{com}$$

Hence in Figures 3a-3f the new post simulation poverty line is drawn next to the pre-simulation line. For the first simulation the poverty line decreases by 4.4 percent. This reduction is the consequence of a fall in the consumption prices of the basket of basic needs, which determines the poverty line. With the post-simulation distribution and a new poverty line, we can use the P_a class to estimate the effects on poverty.

The headcount ratio (P_0) increases for all household groups—except the rural households. Rural households display, by far, the highest headcount ratio with 92.9 percent of the population below the poverty line. Compared with the base year, this represents a 0.4 percent improvement in the headcount ratio. Rural households constitute the only group enjoying a reduction in poverty. This is explained by the poverty line reduction that dominates the reduction in nominal income of this specific household group. We find the highest relative increase in P_0 among the urban high-education households; this ratio increasing from 0.5 to 0.8 percent following the fall in the price of the export crop.

In an ongoing project Azis and Thorbecke (2001) have built a CGE model of the Indonesian economy to simulate the effects of the Asian Financial Crisis on the Indonesian economy. The model contains a detailed financial sector and a poverty module similar to the one described above in the CGE of an archetype African economy. In addition, the model attempts to endogenize the urban to rural migration that occurred between the onset of the crisis in 1997 and 1999.

As part of this project the post-crisis (1999) actual intragroup income distributions of eight socioeconomic household groups are obtained from the large scale SUSENAS survey (covering more than 200,000 households) and compared to the pre-crisis (1996) intragroup distributions. An attempt will be made at identifying and replicating the exogenous events and endogenous mechanisms yielding the post-crisis observed income distributions and poverty estimates.

The above project under the auspices of the World Bank also attempts to link a micro-simulation model of the Indonesian economy (under the leadership of Francois Bourguignon and Anne-Sophie Robillard) with the Azis–Thorbecke financial CGE. It is hoped that this project will throw more light on the process of endogenizing the intragroup income distributions obtaining consequent to an exogenous shock or policy change.

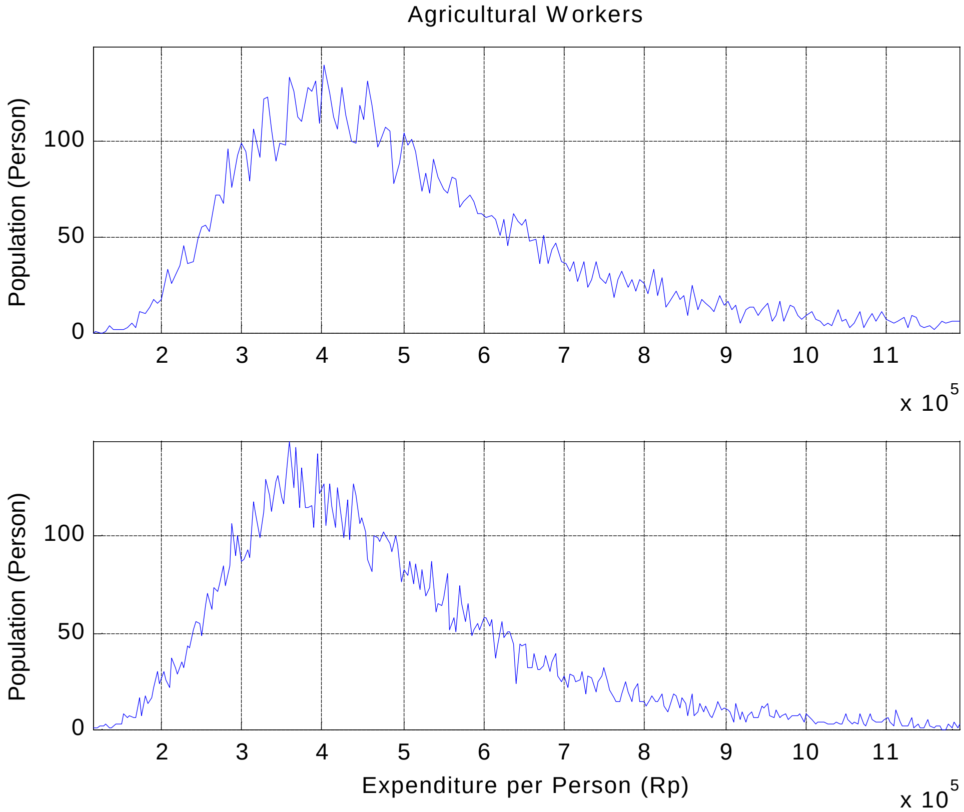
It is interesting to note that the intragroup income distributions for seven Indonesian socioeconomic household categories were extremely similar after the crisis (1999) compared to before the crisis (1996). Figure 4 presents the pre and post-crisis distributions for each of those groups. These distributions are the actual distributions derived from the large scale SUSENAS survey (with a total sample of about 205,000 households).

The fact that the shape and variable of each group distribution remained relatively similar in 1999 compared to 1996 provides a rationalization for the arbitrary assumption that the intragroup distributions remained constant and shifted horizontally to the left, or to the right depending on group mean income, made in the model described above.

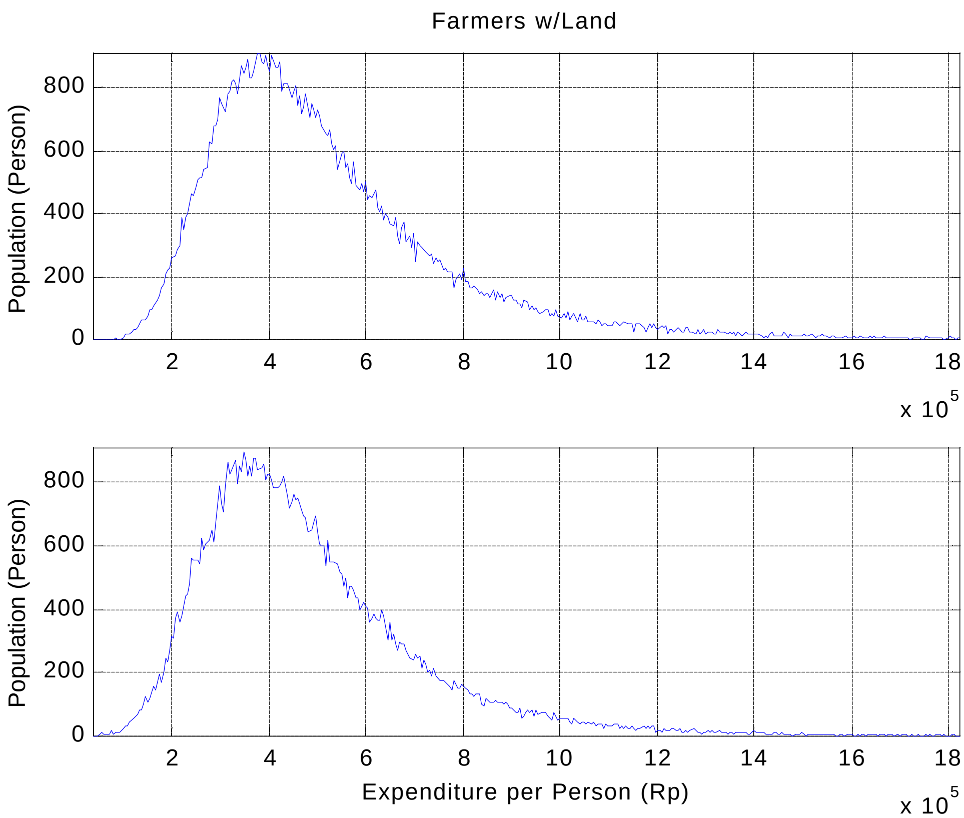
It is hoped that the combination of a financial CGE model and a microsimulation approach may prove fruitful in understanding better the mechanisms and channels through which the financial crisis affected poverty in Indonesia.

Figure 4. **Nonparametric Income Distribution for Indonesian Household Groups, 1996 vs. 1999 (at constant 1996 prices based on GDP Deflator)**

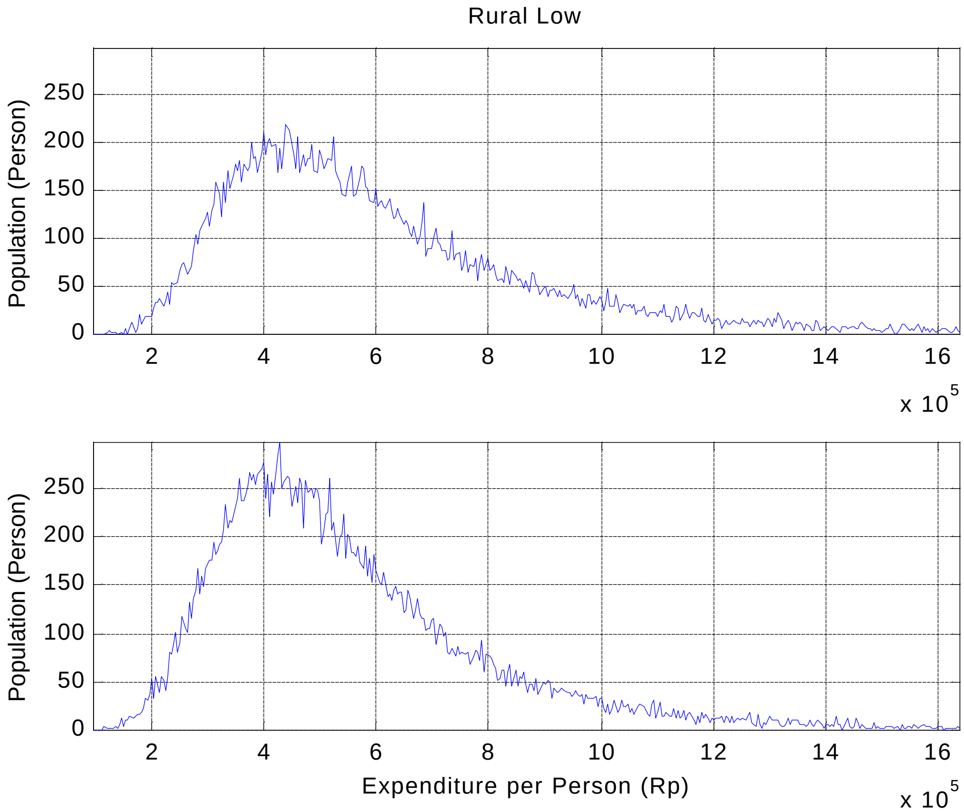
Note: Top figure (1996), Bottom figure (1999)

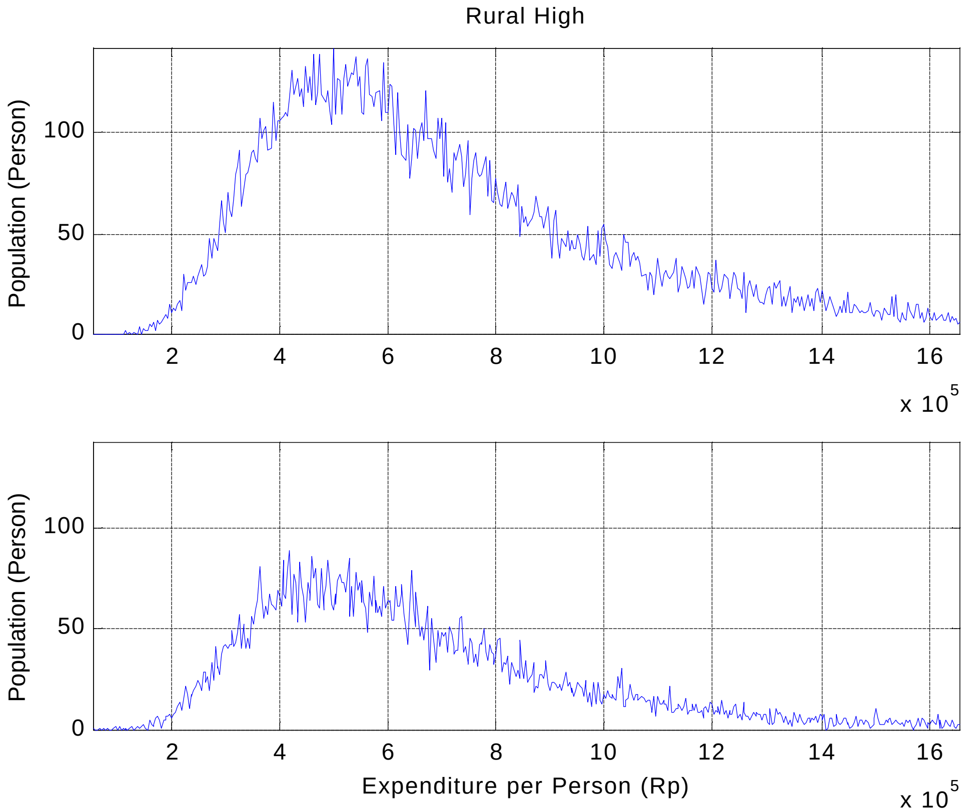


Source: Central Statistical Bureau: SUSENAS Survey (1996 and 1999).

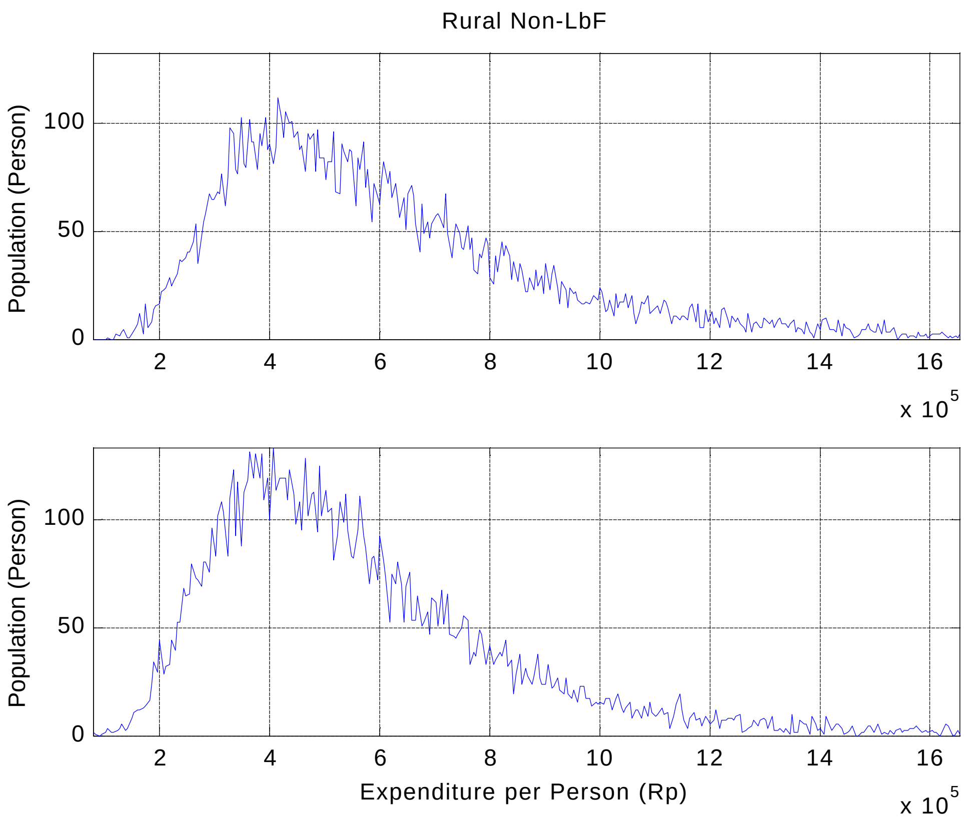

Farmers w/Land
Population (Person)
0
200
400
600
800
2
4
6
8
10
12
14
16
18
x 10^5
Population (Person)
0
200
400
600
800
2
4
6
8
10
12
14
16
18
Expenditure per Person (Rp)
x 10^5

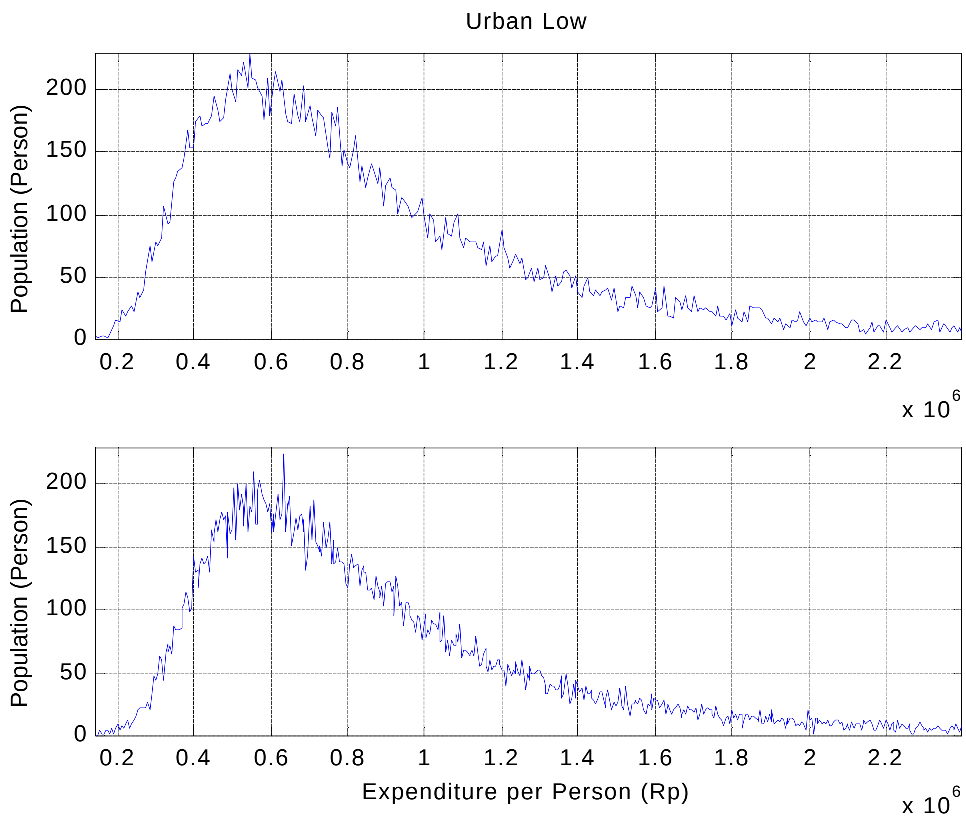
.


Rural Low
Population (Person)
0
50
100
150
200
250
2
4
6
8
10
12
14
16
x 10^5
Population (Person)
0
50
100
150
200
250
2
4
6
8
10
12
14
16
Expenditure per Person (Rp)
x 10^5

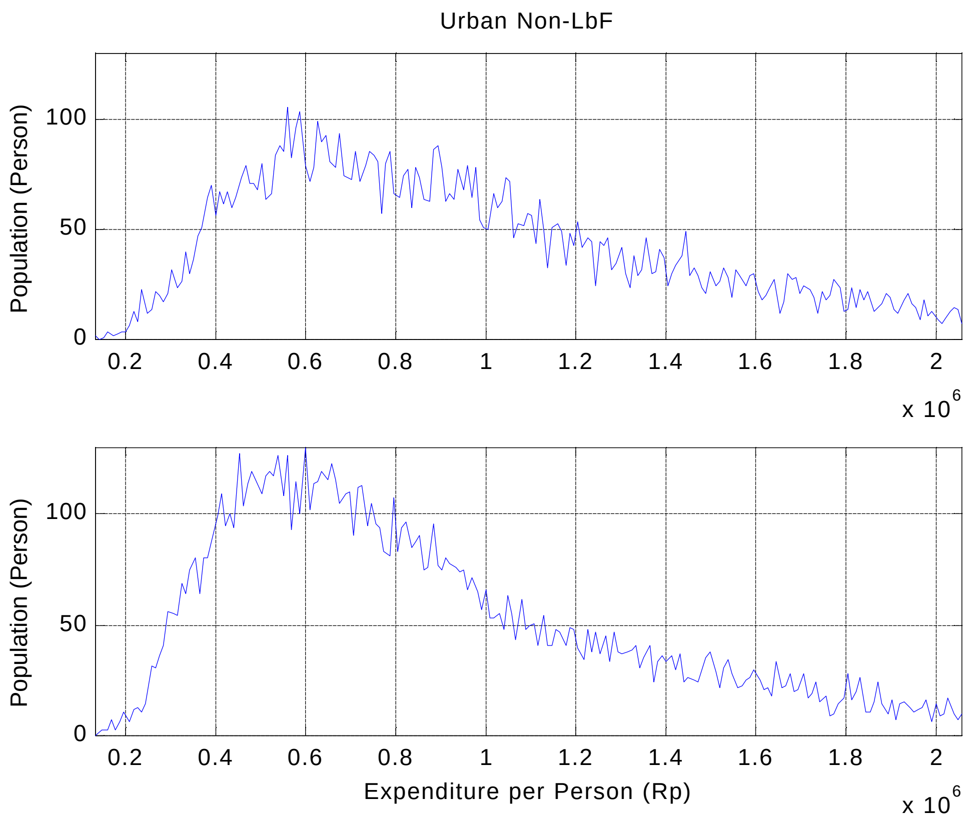


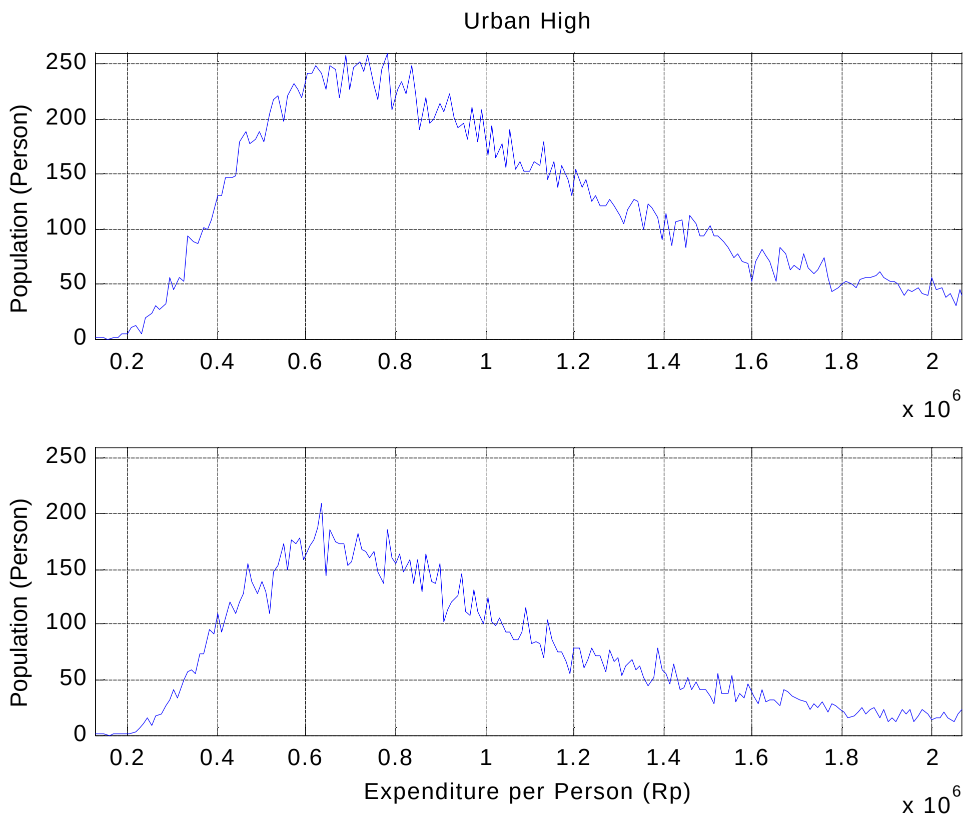
GDP Deflator with different horizontal scale


Rural Non-LbF
Population (Person)
0
50
100
2
4
6
8
10
12
14
16
x 10^5
Population (Person)
0
50
100
2
4
6
8
10
12
14
16
Expenditure per Person (Rp)
x 10^5



Urban Low
Population (Person)
0
50
100
150
200
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
x 10^6
Population (Person)
Expenditure per Person (Rp)
x 10^6


Urban Non-LbF
Population (Person)
100
50
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
x 10^6
Population (Person)
100
50
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Expenditure per Person (Rp)
x 10^6


Urban High
Population (Person)
250
200
150
100
50
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
x 10^6
Population (Person)
250
200
150
100
50
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Expenditure per Person (Rp)
x 10^6

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