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A multiplier decomposition method to analyze poverty alleviation

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Abstract

The objective of this paper is to present a multiplier decomposition method focusing on poverty alleviation. The decomposition captures the various mechanisms and linkages through which a production sector's output contributes to poverty alleviation within a socioeconomic system represented by a Social Accounting Matrix (SAM). It is shown that a multiplier can be broken down into two multiplicative effects, the distributional and interdependency effects. The decomposition method is applied to the case of Indonesia. A key policy implication is that the human capital of the poor needs to be enhanced if they are not to be sealed off from the industrialization process.

Keywords: Poverty analysis; Social accounting matrix; Multiplier decomposition; Human capital

1. Introduction

The sectoral pattern of growth is often identified as an important determinant of the impact of growth on poverty. Lipton and Ravallion (1993) in their survey paper on 'Poverty and Policy' put considerable emphasis on the sectoral composition of output growth as an important determinant of poverty alleviation. The impact of a sector's output on poverty alleviation can be direct through the increase in incomes accruing to the poor households who contributed through their

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labor or land to the sector's growth of output. 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. The poverty literature has tended to ignore the latter effects.

The objective of this paper is to derive and present a multiplier decomposition procedure focusing on poverty alleviation and incorporating both direct and indirect effects of sectoral output growth. In order to derive the total poverty alleviation effects, a poverty measure has to be selected. In this paper we adopt the Foster, Greer and Thorbecke (1984) (F-G-T) P_α class of additively decomposable poverty measures that includes the head count ratio (for $\alpha = 0$), the poverty gap ($\alpha = 1$) and a distributionally-sensitive measure ($\alpha = 2$).

The overall contribution of a change in the demand for, and output of a given sectoral production activity (say textiles) on poverty alleviation depends upon the impact on the incomes accruing to the various socioeconomic household groups and how sensitive the selected aggregate poverty measure is to the above income changes.

The income change of a given household group (say the households headed by an urban unskilled worker) caused by the demand for or output of a given production activity (say textiles) can be measured by the magnitude of the corresponding multiplier derived from an underlying SAM. But to understand the various mechanisms and linkages through which a change in a sector's output contributes to poverty alleviation within a socioeconomic system represented by a SAM requires an appropriate multiplier decomposition technique.

Two SAM multiplier decomposition methods have been developed until now. The first one was initiated by Pyatt and Round (1979) and Stone (1978). Three SAM accounts were taken as endogenously determined: factors, institutions (household groups and companies) and production activities. All other accounts (government, capital and rest of the world) were taken as exogenous. In its Stone (1978) version, the matrix of multipliers is decomposed into four additive components: (1) the initial injection; (2) the net contribution of transfer multiplier effects resulting from direct transfers within endogenous accounts; (3) the net contribution of open-loop effects capturing the interactions among and between the three endogenous accounts; and, (4) the net contribution of circular closed-loop effects insuring that the circular flow of income is completed among endogenous accounts.

Another more general method was developed by Defourny and Thorbecke (1984). Their structural path analysis (SPA) provides the complete network through which influence travels in a socioeconomic system – as reflected by a SAM – from any given pole of origin (say textiles) to any given pole of destination (say the urban unskilled workers). In this sense any other decomposition procedure is a special case of the more general SPA.

The purpose of this paper is to introduce a different decomposition technique focusing more specifically on the extent to which different production activities affect household groups' income and ultimately poverty alleviation and the structural mechanisms and linkages through which an initial rise in a given sector's output contributes ultimately, directly and indirectly, to poverty alleviation. In what follows it will be shown that the poverty alleviation effects can be decomposed into the product of (i) the changes in average incomes received by the various groups resulting, directly or indirectly, from the growth of a sector's output; and (ii) what we call the poverty-sensitivity effects which, in turn, depend on the respective household groups' poverty elasticities with respect to groups' mean-incomes and the intragroup income distributions.

We proceed to derive, first, the above mean-income effects before moving on to the poverty-sensitivity effects in Section 4. The mean-income effects can be represented by a multiplier which can be broken down into two multiplicative effects, the distributional effects and the interdependency effects. The distributional effects can be further decomposed into three components: (i) the income received by a given household group directly from the factors (such as unskilled labor and land) provided by that group and used as primary inputs in the production of the commodity under consideration; (ii) the indirect factor incomes received by the same group from the intermediate inputs required in the production of the initial commodity; and (iii) the incomes accruing to that group from transfers and remittances from other household groups. [1]

In turn, the interdependency effects (sometimes called closed-loop effects) capture the indirect spending and respending effects of the household group under consideration and other groups that benefited, income-wise, from the initial increase in output. The interdependency effects reflect the extent of integration within an economy, on both the consumption and production sides. The more consumers spend on domestic goods and services, the more diversified their consumption patterns, the greater the intersectoral linkages on the production side, the higher the interdependency effects.

It will be shown that poverty alleviation depends on the strength of the poverty-sensitivity effect and, more specifically, on the magnitude of the poverty elasticities with respect to mean-incomes in the various household groups and the prevailing mean income levels.

The paper consists of five sections. Section 2 reviews the SAM framework as a basis for multiplier analysis. Section 3 presents the multiplier decomposition procedure to estimate the impact of changes in demand for, and output of different production activities on the mean incomes of the household groups. Section 4 extends the multiplier decomposition procedure to incorporate explicitly the poverty-sensitivity effects. Section 5 applies the decomposition procedure to the

[1] For an early and pathbreaking discussion of these effects within the context of Sri Lanka, see Pyatt and Roe and associates (1977).

case of Indonesia and draws some policy implications. Finally, Section 6 is devoted to a summary and conclusions.

2. The social accounting matrix and multiplier analysis

We assume that there exists excess capacity which would allow prices to remain constant and that expenditure propensities of endogenous accounts remain constant. 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 1 and the corresponding endogenous flows in Fig. 1. Note that the exogenous accounts have been combined together in Table 1 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 1. T_{13} is the matrix which allocates the value added generated by the various production activities into income accruing to the various factors of production and 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 different household groups on the commodities (equivalent to production activities) which they consume. T_{21} reflects the mapping of the factorial income

[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.

Table 1
Simplified schematic social accounting matrix

		Expenditures				
		Endogenous accounts			Exog.	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	

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 inter-institutional transfers such as transfers among different types of households or between companies and households.

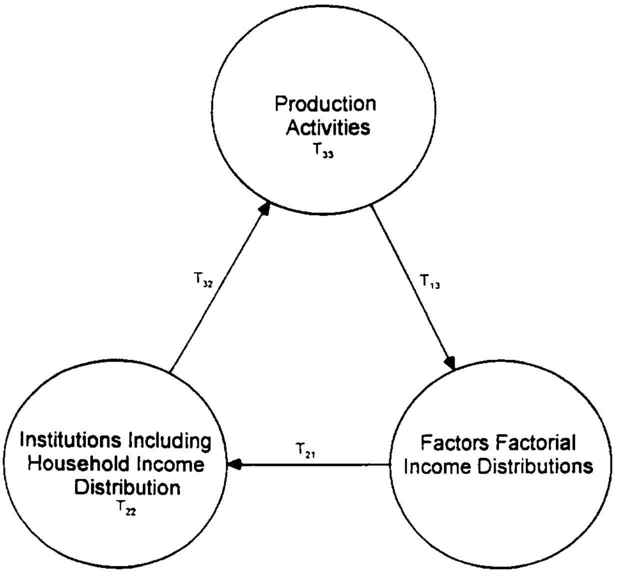

Fig. 1. Simplified interrelationship among principal SAM accounts (production activities, factors and institutions)

The logic underlying the scheme in Table 1 and Fig. 1, as will be seen shortly, is that exogenous changes (the x's) in Table 1 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).

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 1 it can be seen that A_n is partitioned as follows

$$A_n = \begin{bmatrix} 0 & 0 & A_{13} \\ A_{21} & A_{22} & 0 \\ 0 & A_{32} & A_{33} \end{bmatrix}. \tag{1}$$

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

$$y_n = A_n y_n + x \tag{2}$$

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.

Eq. (2) can be rewritten as

$$\begin{aligned} y_n &= (I - A_n)^{-1} x \\ &= M_a x. \end{aligned} \tag{3}$$

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 1) 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 Eq. (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

[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 which leak out as expenditure into any one 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.

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 $C_{32} \neq A_{32}$. Expressing the changes in incomes (dy_n) resulting from changes in injections (dx), one obtains

$$\begin{aligned} dy_n &= C_n dy_n + dx \\ &= (I - C_n)^{-1} dx = M_c dx. \end{aligned} \tag{4}$$

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

3. Multiplier decomposition to estimate impact of 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. 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 in Section 4 income growth, in turn, contributes to poverty alleviation depending on the sensitivity of the adopted poverty measure to income.

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[5] Since the expenditure (income) elasticity for household group h and commodity (product) i: εy_{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. $\varepsilon y_{hi} = MEP_{hi} / AEP_{hi}$; $MEP_{hi} = \varepsilon y_{hi} AEP_{hi}$.

[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.

Eq. (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 Eq. (4) can be written in explicit form as

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

which yields

$$\begin{aligned} dy_1 &= C_{13}dy_3 &+& dx_1, \\ dy_2 &= (I-C_{22})^{-1}C_{21}dy_1 &+& (I-C_{22})^{-1}dx_2, \\ dy_3 &= (I-C_{33})^{-1}C_{32}dy_2 &+& (I-C_{33})^{-1}dx_3. \end{aligned} \tag{4''}$$

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). Thus, we concentrate on that part of the fixed price multiplier matrix that links production activities to household groups (i.e. M_{c23}). [7] 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.

M_{c23} can be decomposed multiplicatively into two different matrices, which represent what we coin distributional (D) and interdependency (R) effects, respectively,

$$M_{c23} = R \cdot D \tag{6}$$

where dimensions of matrices M_{c23}, R and D are (household groups × production activities), (household groups × household groups) and (household groups × 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. To derive the interdependency effects, we used the following procedure. Note that dimensions of matrices M_{c23} and D are equivalent, while matrix R is a square matrix. We

[7] 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.

define as $r_{ij} = m_{ij}/d_{ij}$, where m_{ij} is an element of M_{c23} and d_{ij} is a corresponding element of D. Then, a number (scalar) r_{ij} represents the effect of matrix R on a specific d_{ij}, both of which multiplicatively determine a specific m_{ij}, (i.e. $m_{ij} = r_{ij}d_{ij}$). We refer to r_{ij} as the interdependency effects of production activity j on household group i.

The distributional effects (d_{ij}) 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 (r_{ij}) capture the direct and indirect effects of spending and respending by the particular household group, under consideration, and other groups that benefited, income-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, 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.

3.1. 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, that, 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 which is 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, [8] $D_3 = (I - C_{22})^{-1}$, $D_2 = C_{21}C_{13}$, and $D_1 = (I - C_{33})^{-1}$, i.e.

$$D = D_3 D_2 D_1, \tag{7'}$$

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

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.

To compare the respective impacts of different production activities on poverty groups, we need to identify these effects for each pair of production activity and household group. Dimensions of matrices D and D_2 are equivalent, i.e. (household groups × production activities), and the direct distributional effects for each pair of production activity and household group can be obtained from the matrix D_2. To derive the distributional transfer effects, we use the property that the matrices D $(= D_3 D_2 D_1)$ and $D_2 D_1$ have equivalent dimensions. We define as $d_{3ij} = d_{ij}/d_{21ij}$, where d_{ij} is an element of D, and d_{21ij} is an element of $D_2 D_1$. Then, a number (scalar) d_{3ij} represents the effect of matrix D_3. Similarly, we can obtain the distributional effects resulting from intersectoral production linkages from each production activity to each household group. That is, we get the intersectoral production linkage (d_{1ij}) by $d_{1ij} = d_{21ij}/d_{2ij}$, where d_{21ij} is an element of $D_2 D_1$, and d_{2ij} is an element of D_2. Hence we obtain,

$$d_{ij} = d_{3ij} d_{2ij} d_{1ij}. \tag{7''}$$

3.2. 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, in the present context, are equivalent to the closed

[8] An additive decomposition is impossible in this case since the dimensions of the matrices differ.

loop effects that have been identified by Pyatt and Round (1979) in their alternative multiplier decomposition method. They showed that

$$R=\left[I-(I-C_{22})^{-1}C_{21}C_{13}(I-C_{33})^{-1}C_{32}\right]^{-1}. \tag{8}$$

It can also be noted that if the marginal expenditure matrix (C_{32}) is denoted by E $(E=C_{32})$, we obtain the following expression for R given the definition of D in (7):

$$R=(I-DE)^{-1}. \tag{8'}$$

In other words, the interdependency effects can be fully expressed as function of the distributional effects (D) and the marginal expenditure propensities matrix (E). The larger the elements of D or E, the larger the interdependency effects.

Thus, the matrix of fixed price multipliers linking production activities to household groups M_{c23} can now be expressed as follows by substituting R in (8′) into (6):

$$M_{c23}=RD=(I-DE)^{-1}D. \tag{9}$$

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

$$m_{ij}=r_{ij}d_{ij} \tag{10}$$

where d_{ij} is an element of D, and $r_{ij}=m_{ij}/d_{ij}$. 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 (7″)).

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

$$m_{ij}=r_{ij}d_{ij}=r_{ij}d_{3ij}d_{2ij}d_{1ij}. \tag{11}$$

In Eq. (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,

$$dy_{2i}=m_{ij}dx_{3j}=r_{ij}d_{ij}dx_{3j}=r_{ij}d_{3ij}d_{2ij}d_{1ij}dx_{3j}. \tag{12}$$

4. 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 and Thorbecke (1984) (F-G-T) P_a measure which we adopt here. For different values of α the F-G-T P_a measure becomes, respectively, the head count ratio ($\alpha = 0$); the poverty gap ($\alpha = 1$); and the F-G-T distributionally-sensitive measure ($\alpha = 2$). 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,

$$dP_{\alpha ij} = \frac{\partial P_{\alpha ij}}{\partial \bar{y}_i} d\bar{y}_i + \sum_{k=1}^{l} \frac{\partial P_{\alpha ij}}{\partial \theta_{ijk}} d\theta_{ijk} \tag{13}$$

where $P_{\alpha ij}$ is the F-G-T P_α measure linking sector j to household group i, $\bar{y}_i$ is the mean per-capita income of household group i, and θ_{ijk} reflects the income distribution parameters. Let us assume that the change in the output of production activity j is distributionally neutral so that [9]

$$\frac{dP_{\alpha ij}}{P_{\alpha ij}} = \eta_{\alpha i}\left(\frac{d\bar{y}_i}{\bar{y}_i}\right) \tag{14}$$

where $\eta_{\alpha i}$ is the elasticity of $P_{\alpha ij}$ with respect to the mean per-capita income of each household group i resulting from an increase in the output of sector j. [10]

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 Eq. (4) it follows that

$$d\bar{y}_i = m_{ij} dx_j \tag{15}$$

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

$$\frac{dP_{\alpha ij}}{P_{\alpha ij}} = \eta_{\alpha i} m_{ij}\left(\frac{dx_j}{\bar{y}_i}\right). \tag{16}$$

Poverty tends to be pervasive in developing countries and to be spread among

[9] 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).

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

the different household groups. In order to obtain the aggregate poverty alleviation effects, these effects have to be summed across the various household groups.

Utilizing the additive decomposability of P_α the aggregate poverty measure $P_{\alpha j}$ can be written as

$$P_{\alpha j} = \sum_{i=1}^{m} P_{\alpha i j}\left(\frac{n_i}{n}\right) \tag{17}$$

where n_i is the population in the ith group and total population $n = \sum_{i=1}^{m} n_i$. It becomes in differential form,

$$\frac{dP_{\alpha j}}{P_{\alpha j}} = \sum_{i=1}^{m}\left(\frac{dP_{\alpha i j}}{P_{\alpha i j}}\right)\left(\frac{n_i}{n}\right) = \sum_{i=1}^{m}\left(\frac{dP_{\alpha i j}}{P_{\alpha i j}}\right)\left(\frac{P_{\alpha i j} n_i}{P_{\alpha j} n}\right). \tag{18}$$

Using the definition of the P_α class of poverty measures, we obtain

$$\frac{dP_{\alpha j}}{P_{\alpha j}} = \sum_{i=1}^{m}\left(\frac{dP_{\alpha i j}}{P_{\alpha i j}}\right)\left(\frac{\sum_{k=1}^{q_i}((z-y_k)/z)^\alpha}{\sum_{l=1}^{q_i}((z-y_l)/z)^\alpha}\right) \tag{19}$$

where q_i is the number of poor in the ith group and the total number of poor $q = \sum_{i=1}^{m} q_i$. Let us denote the poverty share of household group i out of total poverty as $s_{\alpha i}$ (and $\sum_{i=1}^{m} s_{\alpha i} = 1$), where [11]

$$s_{\alpha i} = \sum_{k=l}^{q_i}\left(\frac{z-y_k}{z}\right)^\alpha \Bigg/ \sum_{l=1}^{q}\left(\frac{z-y_l}{z}\right)^a.$$

Then,

$$\frac{dP_{\alpha j}}{P_{\alpha j}} = \sum_{i=1}^{m}\left(\frac{dP_{\alpha i j}}{P_{\alpha i j}}\right) s_{\alpha i}. \tag{20}$$

Combining Eqs. (16) and (20),

$$\frac{dP_{\alpha j}}{P_{\alpha j}} = \sum_{i=1}^{m} s_{\alpha i}\, \eta_{\alpha i} m_{ij}\left(\frac{dx_j}{\bar{y}_i}\right). \tag{21}$$

Now let us define as $m'_{\alpha ij} = s_{\alpha i} m_{ij}$ and $q_{\alpha ij} = \eta_{\alpha i}(dx_j/\bar{y}_i)$. The modified multiplier $m'_{\alpha ij}$ is the part of multiplier m_{ij} which contributes to the income increase of the poor in a household group i. The term $q_{\alpha ij} = \eta_{\alpha i}(dx_j/\bar{y}_i)$ represents the sensitivity of P_α to the change in income, which we call the 'poverty sensitivity

[11] In the simplest case of $\alpha = 0$, $s_{01} = q_i / q$.

effect'. Since $m_{ij} = r_{ij} d_{ij}$ (Eq. (10)), defining $m'_{\alpha ij} = s_{\alpha i} m_{ij}$, and $d'_{\alpha ij} = s_{\alpha i} d_{ij}$, we get

$$\frac{dP_{\alpha j}}{P_{\alpha j}} = \sum_{i=1}^{m} m'_{\alpha ij} q_{\alpha ij} = \sum_{i=1}^{m} (r_{\alpha ij})(d'_{\alpha ij})(q_{\alpha ij}) = \sum_{i=1}^{m} (r_{\alpha ij})(s_{\alpha ij} d_{ij})(q_{\alpha ij}). \tag{22}$$

At this stage it should be recalled that m_{ij} represents the change in income accruing to a household group i (say, the urban unskilled) caused by a change in the demand for (and output of) production activity j (say, textiles). The term $s_{\alpha i} d_{ij}$ represents the part of the total distributional effects received by the poor in the household group i, and the term $r_{\alpha ij}$ represents the related interdependency effects. The poverty sensitivity effects are positively related to poverty elasticity (h_{aij}) and negatively related to the mean per-capita income $\bar{y}_i$. We define the modified direct distributional effects ($d'_{2\alpha ij}$) as $d'_{2\alpha ij} = s_{\alpha i} d_{2ij}$ and we obtain $d'_{\alpha ij} = s_{\alpha i} d_{ij} = d_{3\alpha ij}(s_{\alpha i} d_{2ij}) d_{1\alpha ij} = d_{3\alpha ij} d'_{2\alpha ij} d_{1\alpha ij}$. Then Eq. (22) becomes [12]

$$\frac{dP_{\alpha j}}{P_{\alpha j}} = \sum_{i=1}^{m} r_{\alpha ij} d_{3\alpha ij} d'_{2\alpha ij} d_{1\alpha ij} q_{\alpha ij}. \tag{23}$$

The overall income change accruing to the poor across all household groups due to the output change in sector $j(m_{\alpha j})$ can be computed as $m_{\alpha j} = \sum_{i=1}^{m} m'_{\alpha ij} = \sum_{i=1}^{m} s_{\alpha i} m_{ij}$. The overall distributional effect ($d_{\alpha j}$) can be computed as $d_{\alpha j} = \sum_{i=1}^{m} s_{\alpha i} d_{\alpha ij}$. To derive the overall interdependency effect, we define $r_{\alpha j} = m_{\alpha j}/d_{\alpha j}$, which yields $m_{\alpha j} = r_{\alpha j} d_{\alpha j}$. Finally we define the overall poverty effect ($q_{\alpha j}$) as $q_{\alpha j} = -(dP_{\alpha j}/P_{\alpha j})/m_{\alpha j}$. In other words, the total poverty alleviation effects of an increase in the output of sector j $(-dP_{\alpha j}/P_{\alpha j})$ consists of the product of two components: (i) the mean-income change of the poor across all household groups ($m_{\alpha j}$); and (ii) the sensitivity of the selected poverty measure to the latter ($q_{\alpha j}$).

5. The multiplier poverty alleviation decomposition method applied to Indonesia

The poverty decomposition procedure described in the preceding section was applied to a highly disaggregated Indonesian SAM consisting of 75 sectors including 23 different categories of sectors; 9 institutions (8 household groups and 'companies') and 24 different production activities). [13]

[12] It can be seen in Table 3 that values of d_{3aij}, d_{1aij} and r_{aij} corresponding to a given sector j differ only marginally across different values of α ($\alpha = 0, 1, 2$).

[13] The OECD SAM of Indonesia, given in Thorbecke (1992), was built by E. Thorbecke and S. Keuning based on the 1980 SAM built by the Indonesian Central Bureau of Statistics (CBS). The matrix of marginal expenditure propensities (C_n) is also given in Thorbecke (1992).

Table 2
Indonesia: Estimates on poverty profiles of socioeconomic groups, 1980

	Mean income (in rupiah)	Population share	Elasticity of poverty measure to mean incomes			Group poverty share out of total poverty		
			Head count index	Poverty gap index	Distribution sensitive index	Head count index	Poverty gap index	Distribution sensitive index
	$(\bar{y})$ [a]	(n_i/n)	(η_{0i}) [b]	(η_{1i})	(η_{2i})	(s_{0i}) [c]	(s_{1i})	(s_{2i})
Agr. employees	101	0.106	−0.384	−0.733	−0.859	0.167	0.173	0.178
Small farmers	103	0.277	−0.431	−0.770	−0.893	0.433	0.448	0.459
Medium farmers	219	0.076	−3.169	−2.916	−2.825	0.056	0.058	0.059
Large farmers	320	0.095	−5.553	−4.785	−4.507	0.038	0.040	0.041
Rural nonagr. low	189	0.190	−2.461	−2.361	−2.325	0.183	0.172	0.165
Rural nonagr. high	240	0.055	−3.665	−3.305	−3.175	0.012	0.012	0.011
Urban low	307	0.136	−1.712	−5.815	−5.561	0.099	0.086	0.078
Urban high	469	0.065	−6.533	−8.812	−8.259	0.012	0.010	0.010

[a] From Thorbecke (1992, p. 202).

[b] Elasticities for rural and urban areas and poverty measures for different sectoral employment groups are obtained from Ravallion and Huppi (1991, p. 74). These estimates were used in deriving corresponding elasticities for our eight household groups taking into account the differential elasticities of poverty measures to mean incomes.

[c] The $P_{\alpha j}$'s for each production sector are obtained from Huppi and Ravallion (1991, p. 1660–1661). These were converted, in turn, into each household group using the SAM coefficient matrix $A_{21}A_{13}$, which represents the composition of each household group income by production sectors.

Table 2 gives the estimates of elasticities of P_α with respect to mean-incomes ($\eta_{\alpha i}$) and the shares of group poverty to total aggregate poverty ($s_{\alpha ji}$). The above elasticities represent how P_α responds to a relative change in household group incomes. The household group poverty elasticities and group poverty shares used here were derived indirectly from the detailed information contained in Ravallion and Huppi (1991) and Huppi and Ravallion (1991) for eight sectors of employment in Indonesia between 1984 and 1987 broken down according to employee/self-employed status and distinguishing between rural and urban location. [14]

The poverty shares among three categories of households, i.e. the agricultural employees (the landless and near landless), the small farmers (owning less than half a hectare of land) and the rural non-agricultural low income group were significantly larger, on average, than in the other groups for all values of α. The average income of the urban low income group was three times that of the agricultural employees and small farmers in 1980.

Table 3 gives the decomposition of the impact of sectoral output changes on the aggregate poverty measure ($dP_{\alpha j}/P_{\alpha j}$) in the context of Indonesia. As was seen previously the poverty alleviation effects for group i can be decomposed into the modified fixed price multiplier ($m'_{\alpha ij}$), which represents the mean-income increase of the poor who are included in this household group, and the poverty sensitivity effect ($q_{\alpha ij}$), which represents the sensitivity of the poverty measure to the mean-income increase of group i. In order to obtain the total poverty alleviation effects, the group specific effects have to be aggregated across the different household groups.

The poverty alleviation estimates in Table 3 are computed for the case of $dx_j = 100$ rupiah per capita in the respective groups. [15] Multipliers ($m'_{\alpha j}$ in row 3) represent income increase and are decomposed into distributional effects (in row 1) and interdependency effects (in row 2); and the distributional effects (row 1) are further decomposed into three components: direct linkages (in row 1b), intersectoral production linkages (in row 1c) and inter household group (transfer) linkages (in row 1a). First, it can be verified in Table 3 that any given poverty alleviation effects can be obtained by multiplying the fixed price multiplier ($m'_{\alpha j}$) and the poverty sensitivity effect ($q_{\alpha j}$) and that the fixed price multiplier is equal to the product of the corresponding distributional and interdependency effects. For example, in the case of the head-count index, the poverty alleviation effects from textiles amount to 0.065, which is the product of the modified fixed price multiplier (0.075) and the poverty sensitivity effects (0.861). In turn, the modified fixed price multiplier (0.075), is the product of modified distributional effects

[14] The footnotes to Table 2 explain the procedure used in deriving the present estimates (in Table 2) out of the somewhat different classification used by Huppi and Ravallion (1991).

[15] Per capita GNP in 1980 was 2968 rupiah. So the increase of 100 rupiah per capita in sectoral output is approximately 3.4% of GNP.

(0.069) and interdependency effects (1.084). Similarly, it can also be verified that modified distributional effects are equal to the product of the corresponding intersectoral activity linkages, modified direct distributional linkages and inter household transfer linkages.

Next, it can be observed that the poverty sensitivity effects and the interdependency effects reveal much smaller variances across production activities than the distributional effects. Among distributional effects for all three poverty measures, the transfer linkages (row 1a) reveal very small variances across production activities, which implies that the pattern of transfers among household groups is almost invariant to the income-generating production activity. Therefore we can conclude that the differential impact of production sectors on poverty alleviation is largely explained by distributional effects, and especially direct linkages and inter production activity linkages.

The following additional observations are suggested by Table 3. In general, although the impact of a given sector's output on poverty alleviation varies depending on which poverty measure is used, the ranking of sectors based on their total poverty alleviation effects tends to be almost constant across poverty measures. Therefore, the differential sectoral effects on poverty alleviation can be illustrated, next, using the head count ratio as representative of the other two poverty measures in Table 3.

Total poverty alleviation effects originating from agricultural production activities are highest ranging from 0.078 to 0.121 followed by services and informal activities (0.039–0.081), and manufacturing(0.026–0.086). Among manufactures, food processing and textiles, which have closer inter production activity linkages with agriculture, or are more labor intensive (especially of unskilled labor), made relatively large contributions to poverty alleviation (0.086 and 0.065 respectively). On the other hand, other manufacturing sectors such as 'paper and metallic products' and 'chemicals and minerals' display relatively low total poverty alleviation effects of 0.026 and 0.028 respectively.

The major reason for these low values in comparison with processed food, textiles and agricultural sectors appears to be the small magnitude of distributional effects, i.e. 0.027–0.029 for the 'paper and metallic products' and 'chemical and mineral products'. Table 3 shows that these last two sectors – compared to other industrial sectors – have similar magnitudes of transfer linkages, larger intersectoral production linkages, and much smaller direct distributional linkages. Therefore we can infer that low distributional effects of both 'paper and metal products' and 'chemical and mineral products' are mostly due to their low direct distributional linkages, which implies that socioeconomic groups with a high incidence of poor are only marginally employed in these production activities. One policy implication of this finding is that, in order to benefit from industrialization more directly, relatively poor socioeconomic groups need to be more engaged in the process of industrialization. To the extent that industrial sectors rely largely on skilled rather than unskilled labor, it is essential that the human capital of the poor

Table 3
Indonesia, multiplier decomposition and poverty alleviation

	Food crop	NF crop	Livest.	Forest.	Fish	Mining	Fd proc.	Textile
1. Head-count measure $(-dP_{0j}/P_{0j})$								
1. Distributional effects $(d_{0j}=d_{30j}d'_{20j}d_{10j})$	0.18	0.105	0.121	0.087	0.115	0.012	0.109	0.069
1a. Distributional transfer effects (d_{30j})	1.017	1.016	1.016	1.015	1.016	1.014	1.016	1.015
1b. Direct distributional effects $(d'_{20j}=s_{0i}d_{20j})$	0.14	0.068	0.07	0.05	0.074	0.006	0.017	0.023
1c. Distributional effects from production linkages (d_{10j})	1.258	1.507	1.705	1.705	1.529	2.011	6.493	2.979
2. Interdependency effects (r_{0j})	1.103	1.099	1.097	1.091	1.097	1.081	1.097	1.084
3. Fixed price multipliers $(m'_{0j}=r_{0j}\cdot d'_{0j})$	0.198	0.115	0.133	0.094	0.126	0.013	0.12	0.075
4. Poverty sensitivity effects (q_{0j})	0.612	0.72	0.753	0.829	0.724	0.915	0.715	0.861
5. Poverty alleviation effects $(-dP_{0j}/P_{0j}=m'_{0j}q_{0j})$	0.121	0.083	0.1	0.078	0.091	0.012	0.086	0.065
2. Poverty gap measure $(-dP_{1j}/P_{1j})$								
1. Distributional effects $(d_{1j}=d_{31j}d'_{21j}d_{11j})$	0.184	0.106	0.123	0.085	0.116	0.011	0.11	0.066
1a. Distributional transfer effects (d_{31j})	1.017	1.016	1.016	1.015	1.016	1.014	1.016	1.015
1b. Direct distributional effects $(d'_{21j}=s_{1j}d_{21j})$	0.145	0.07	0.072	0.05	0.076	0.005	0.016	0.022
1c. Distributional effects from production linkages (d_{11j})	1.251	1.482	1.683	1.672	1.493	2.022	6.816	3.025
2. Interdependency effects (r_{1j})	1.104	1.099	1.098	1.092	1.098	1.081	1.098	1.085
3. Fixed price multipliers $(m'_{1j}=r_{1j}\cdot d'_{1j})$	0.203	0.116	0.135	0.093	0.127	0.012	0.12	0.072
4. Poverty sensitivity effects (q_{1j})	0.888	0.987	0.993	1.112	1.009	1.313	0.999	1.253
5. Poverty alleviation effects $(-dP_{1j}/P_{1j}=m'_{1j}q_{1j})$	0.181	0.115	0.134	0.103	0.128	0.016	0.12	0.09
3. Distribution-sensitive measure $(-dP_{2j}/P_{2j})$								
1. Distributional effects $(d_{2j}=d_{32j}d'_{22j}d_{12j})$	0.187	0.106	0.124	0.084	0.116	0.011	0.11	0.064
1a. Distributional transfer effects (d_{32j})	1.017	1.016	1.016	1.015	1.016	1.014	1.016	1.015
1b. Direct distributional effects $(d'_{22j}=s_{2i}d_{22j})$	0.148	0.071	0.073	0.05	0.078	0.005	0.015	0.021
1c. Distributional effects from production linkages (d_{12j})	1.246	1.466	1.669	1.649	1.47	2.03	7.051	3.06
2. Interdependency effects (r_{2j})	1.104	1.1	1.098	1.092	1.098	1.082	1.098	1.086
3. Fixed price multipliers $(m'_{2j}=r_{2j}\cdot d'_{2j})$	0.207	0.117	0.136	0.092	0.128	0.011	0.121	0.07
4. Poverty sensitivity effects (q_{2j})	0.968	1.04	1.044	1.133	1.056	1.293	1.049	1.245
5. Poverty alleviation effects $(-dP_{2j}/P_{2j}=m'_{2j}q_{2j})$	0.2	0.122	0.142	0.104	0.135	0.015	0.127	0.087

	Pap.-met.	Chemic.	Utilit.	Constr.	PW.-Ag.	PW.-Tran.	PW.-Util.	PW.-Oth.
1. Head-count measure $(-dP_{0j}/P_{0j})$								
1. Distributional effects $(d_{0j}=d_{30j}d'_{20j}d_{10j})$	0.027	0.029	0.036	0.061	0.069	0.048	0.046	0.056
1a. Distributional transfer effects (d_{30j})	1.015	1.015	1.015	1.015	1.015	1.014	1.014	1.015
1b. Direct distributional effects $(d'_{20j}=s_{0i}d_{20j})$	0.006	0.005	0.016	0.03	0.051	0.029	0.026	0.035
1c. Distributional effects from production linkages (d_{10j})	4.206	5.26	2.29	2.001	1.342	1.608	1.745	1.597
2. Interdependency effects (r_{0j})	1.081	1.082	1.08	1.085	1.104	1.082	1.082	1.082
3. Fixed price multipliers $(m'_{0j}=r_{0j}\cdot d'_{0j})$	0.03	0.031	0.039	0.066	0.076	0.052	0.05	0.061
4. Poverty sensitivity effects (q_{0j})	0.873	0.882	0.86	0.904	0.651	0.9	0.897	0.897
5. Poverty alleviation effects $(-dP_{0j}/P_{0j}=m'_{0j}q_{0j})$	0.026	0.028	0.033	0.06	0.049	0.047	0.045	0.054
2. Poverty gap measure $(-dP_{1j}/P_{1j})$								
1. Distributional effects $(d_{1j}=d_{31j}d'_{21j}d_{11j})$	0.026	0.027	0.034	0.059	0.069	0.045	0.043	0.053
1a. Distributional transfer effects (d_{31j})	1.015	1.015	1.015	1.015	1.015	1.014	1.015	1.015
1b. Direct distributional effects $(d'_{21j}=s_{1i}d_{21j})$	0.006	0.005	0.014	0.029	0.052	0.028	0.024	0.032
1c. Distributional effects from production linkages (d_{11j})	4.25	5.292	2.316	2.021	1.319	1.618	1.756	1.61
2. Interdependency effects (r_{ij})	1.082	1.083	1.08	1.086	1.105	1.082	1.082	1.083
3. Fixed price multipliers $(m'_{1j}=r_{1j}\cdot d'_{1j})$	0.028	0.03	0.036	0.064	0.076	0.049	0.047	0.057
4. Poverty sensitivity effects (q_{1j})	1.323	1.292	1.363	1.219	0.947	1.307	1.312	1.296
5. Poverty alleviation effects $(-dP_{1j}/P_{1j}=m'_{1j}q_{1j})$	0.037	0.038	0.05	0.077	0.072	0.064	0.061	0.074
3. Distribution-sensitive measure $(-dP_{2j}/P_{2j})$								
1. Distributional effects $(d_{2j}=d_{32j}d'_{22j}d_{12j})$	0.025	0.026	0.032	0.057	0.069	0.043	0.041	0.051
1a. Distributional transfer effects (d_{32j})	1.015	1.015	1.015	1.015	1.015	1.015	1.015	1.015
1b. Direct distributional effects $(d'_{2ij}=s_{22j}d_{22j})$	0.006	0.005	0.014	0.027	0.052	0.026	0.023	0.031
1c. Distributional effects from production linkages (d_{12j})	4.284	5.316	2.337	2.036	1.304	1.626	1.765	1.62
2. Interdependency effects (r_{2j})	1.082	1.083	1.08	1.086	1.106	1.083	1.082	1.083
3. Fixed price multipliers $(m'_{2j}=r_{2j}\cdot d'_{2j})$	0.027	0.029	0.035	0.062	0.077	0.047	0.045	0.055
4. Poverty sensitivity effects (q_{2j})	1.302	1.276	1.335	1.216	1.01	1.288	1.292	1.279
5. Poverty alleviation effects $(-dP_{2j}/P_{2j}=m'_{2j}q_{2j})$	0.035	0.037	0.046	0.075	0.077	0.06	0.058	0.07

Table 3 (continued)

	Trade	Restau.	Ld tran.	Oth. tran.	Finan.	Edu.-hea.	Pers. se.
1. Head-count measure $(-dP_{0j}/P_{0j})$							
1. Distributional effects $(d_{0j}=d_{30j}d'_{20j}d_{10j})$	0.084	0.09	0.086	0.042	0.058	0.052	0.07
1a. Distributional transfer effects (d_{30j})	1.015	1.015	1.015	1.015	1.015	1.015	1.015
1b. Direct distributional effects $(d'_{20j}=s_{0i}d_{20j})$	0.077	0.035	0.062	0.017	0.048	0.036	0.054
1c. Distributional effects from production linkages (d_{10j})	1.072	2.56	1.355	2.386	1.193	1.419	1.284
2. Interdependency effects (r_{0j})	1.082	1.089	1.081	1.08	1.085	1.084	1.082
3. Fixed price multipliers $(m'_{0j}=r_{0j}\cdot d'_{0j})$	0.091	0.098	0.093	0.045	0.063	0.056	0.076
4. Poverty sensitivity effects (q_{0j})	0.88	0.773	0.877	0.855	0.762	0.876	0.881
5. Poverty alleviation effects $(-dP_{0j}/P_{0j}=m'_{0j}q_{0j})$	0.08	0.076	0.081	0.039	0.048	0.049	0.067
2. Poverty gap measure $(-dP_{1j}/P_{1j})$							
1. Distributional effects $(d_{1j}=d_{31j}d'_{21j}d_{11j})$	0.079	0.088	0.081	0.039	0.056	0.049	0.066
1a. Distributional transfer effects (d_{31j})	1.015	1.016	1.015	1.015	1.015	1.015	1.015
1b. Direct distributional effects $(d'_{21j}=s_{1i}d_{21j})$	0.073	0.032	0.059	0.016	0.046	0.034	0.051
1c. Distributional effects from production linkages (d_{11j})	1.072	2.679	1.358	2.421	1.193	1.433	1.285
2. Interdependency effects (r_{1j})	1.083	1.09	1.081	1.081	1.085	1.084	1.083
3. Fixed price multipliers $(m'_{1j}=r_{1j}\cdot d'_{1j})$	0.086	0.096	0.087	0.043	0.06	0.054	0.071
4. Poverty sensitivity effects (q_{1j})	1.296	1.155	1.327	1.342	1.267	1.25	1.288
5. Poverty alleviation effects $(-dP_{1j}/P_{1j}=m'_{1j}q_{1j})$	0.111	0.111	0.116	0.057	0.076	0.067	0.092
3. Distribution-sensitive measure $(-dP_{2j}/P_{2j})$							
1. Distributional effects $(d_{2j}=d_{32j}d'_{22j}d_{12j})$	0.076	0.087	0.077	0.038	0.054	0.048	0.063
1a. Distributional transfer effects (d_{32j})	1.015	1.016	1.015	1.015	1.015	1.015	1.015
1b. Direct distributional effects $(d'_{22j}=s_{2i}d_{22j})$	0.07	0.031	0.056	0.015	0.044	0.033	0.049
1c. Distributional effects from production linkages (d_{12j})	1.073	2.77	1.36	2.449	1.193	1.442	1.286
2. Interdependency effects (r_{2j})	1.083	1.091	1.082	1.081	1.086	1.085	1.083
3. Fixed price multipliers $(m'_{2j}=r_{2j}\cdot d'_{2j})$	0.083	0.095	0.084	0.041	0.058	0.052	0.069
4. Poverty sensitivity effects (q_{2j})	1.28	1.168	1.305	1.318	1.258	1.242	1.273
5. Poverty alleviation effects $(-dP_{2j}/P_{2j}=m'_{2j}q_{2j})$	0.106	0.11	0.109	0.054	0.074	0.065	0.087

be enhanced through education and vocational training so that they are not sealed off from modern production activities.

6. Summary and conclusion

This paper developed a new SAM multiplier decomposition method to analyze and measure the impact of different production activities (sectors) on poverty alleviation. The total impact of a change in the demand for (output of) a given production activity, j, on poverty alleviation depends upon the resulting income gains accruing to the various household groups and the sensitivity of the selected poverty measures to these income gains. The income change of household group i is given by the corresponding magnitude of the modified fixed price multiplier which is a weighted average of household groups' fixed price multipliers using the share of group-specific poverty to total poverty as weights. This multiplier is, first, decomposed into modified distributional effects and interdependency effects. In turn, modified distributional effects are further broken down into three multiplicative components: i.e. intersectoral linkages, modified direct distributional linkages, and interhousehold transfer linkages. The sensitivity of the poverty measure to income depends on the poverty elasticity to income and the average income level of each household group. The group-specific poverty alleviation effects generated by output growth of sector j have to be aggregated across the different groups to obtain the total poverty alleviation effects.

The poverty decomposition technique developed in this paper can provide useful information for policymakers relating to the pattern of sectoral growth most conducive to poverty alleviation. It can also be helpful in identifying the structural determinants of, and mechanisms through which sectoral output affects poverty alleviation.

The case study of Indonesia revealed that agricultural and service sectors contribute 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.

As countries develop and undergo a process of industrialization, it becomes increasingly important to strengthen the distributional and interdependency effects. In this context, our decomposition analysis 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 displaced by modern capital intensive technologies.

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