Encyclopedia of World Poverty

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DECOMPOSABLE POVERTY MEASURES

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A poverty measure is said to be *decomposable* if the poverty measure of a group is a weighted average of the poverty measures of the individuals in the group. An important property of decomposable poverty measures is that a *ceteris paribus* reduction in the poverty measure of a subgroup always decreases poverty of the population as a whole. Decomposable poverty measures are particularly useful in poverty studies where a population is break down into subgroups defined along ethnic, geographical or other lines. We can use these measures to obtain the contribution of each subgroup to total poverty and to estimate the effect of a change in subgroup poverty on total poverty.

Standard poverty indicators like the *headcount ratio* and the *average poverty gap ratio* are decomposable. However, these poverty measures violate some basic properties or axioms proposed by Sen (1976), like the monotonicity axiom and the transfer axiom. On the other hand, Sen poverty index and all its variants that rely on rank-order weighting are not decomposable. In particular, the indicators in that class fail to satisfy the property that an increase in subgroup poverty must increase total poverty. In this context, an important contribution by Foster, Greer and Thorbecke (1984) was to define a class of decomposable poverty measures that satisfy the basic axioms proposed by Sen. We describe here this class of decomposable indicators.

Let $y = (y_1, y_2, \ldots, y_n)$ be the income vector of a population of n individuals with incomes sorted in increasing order of magnitude. Let z be the poverty line and let q be the number of poor individuals. The Foster-Greer-Thorbecke index is defined as:

$$FGT = \sum_{i=1}^{q} \frac{1}{n} \left(\frac{z - y_i}{z} \right) \left(\frac{z - y_i}{z} \right)$$

This index is a weighted sum of the poverty gap ratios $(z - y_i)/z$ of the poor. In contrast with Sen index, the weights do not depend on the "ordering rank" of the poor but on the poverty gap ratios themselves. In other words, the contribution of an individual to the poverty measure depends only on the distance between his income and the poverty line and not on the number of individuals that lie between him and the poverty line.

The Foster-Greer-Thorbecke index satisfies the *monotonicity axiom* (i.e., a reduction in a poor person's income, holding other incomes constant, increases the poverty index), and the *transfer axiom* (i.e., the index increases whenever a pure transfer is made from a poor person to someone with more income). Suppose that the population of n individuals is divided into m subgroups that we index by $g \in \{1, 2, \ldots, m\}$. Let n_g be the size of group g . The Foster-Greer-Thorbecke index can be decomposed additively as:

$$FGT = \sum_{g=1}^{m} \frac{n_g}{n} FGT_g$$

where FGT_g is the Foster-Greer-Thorbecke index for group g. The contribution of subgroup g to overall poverty is (n_g/n) FGT_g. This decomposition shows that, in contrast with Sen-type indexes, this index satisfies the *subgroup monotonicity axiom:* if we change the incomes in subgroup g such that we reduce poverty in this subgroup leaving the other subgroups the same, then total poverty in the population should decrease.

Foster, Greer and Thorbecke propose a generalization of this index. Let α be a parameter that represents the *degree of aversion to inequality*. Then, the family of decomposable poverty measures is:

$$P(\alpha) = \sum_{i=1}^{q} \frac{1}{n} \left(\frac{z - y_i}{z}\right)^{\alpha-1} \left(\frac{z - y_i}{z}\right)$$

This family of poverty indexes contains as particular cases the Foster-Greer-Thorbecke index (when $\alpha = 2$), the headcount ratio (when $\alpha = 0$), the average gap ratio of the poor (when $\alpha = 1$), and the "Rawlsian" measure (as α goes to infinity). This index is decomposable for any value of α. In particular,

$$P(\alpha) = \sum_{g=1}^{m} \frac{n_g}{n} P_g(\alpha)$$

Furthermore, this poverty measure satisfies the monotonicity axiom for any $\alpha > 0$, and the transfer axiom for any $\alpha > 1$.

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