Poverty and Inequality: Definitions, Measures and Mechanism

Inequality

The understanding of inequality has evolved from the traditional outcome-oriented view, whereby income is used as a proxy for well-being. The opportunity-oriented perspective acknowledges that circumstances of birth are essential to life outcomes and that equality of opportunity requires a fair starting point for all. In Simple Words, inequality refers to the **phenomenon of unequal and unjust distribution of resources and opportunities among members of a given society**.

Economic inequality refers to disparities among individuals' incomes and wealth in a society. The essence of economic equality is how much money the least well off make compared to the most well off—and how wealth is distributed in a society. Development theory has largely been concerned with inequalities in standards of living, such as inequalities in income/wealth, education, health, and nutrition.

Inequality Axioms

Every inequality measurement or index has its own desirable properties called axioms. Axioms are the properties that define the way the inequality index should behave. According to Giovanni & Liberati (2006), there are 5 axioms of inequality to be considered in the process of selecting which index should be used that suit the objectives.

1. Principle of Transfer

2. Scale invariance

3. Translation invariance

4. The principle of population

5. Decomposability

To illustrate the axioms of inequality, let us define a generic inequality index **I** and assume an income distribution as:

$$\boldsymbol{Y} = (y_{1,}\, y_{2\,,}\, \dots,\, y_i \quad, \dots\, .\, .\, y_k\, , \dots \dots y_n)$$

1. Principle of Transfer (PT): Principle of Transfer also known as the Pigou-Dalton Principle requires that the inequality measure to change when income transfers occur among individuals in the income distribution.

The inequality index falls when the income is transferred from richer to poorer individuals and such transfer is called progressive transfer. On the other hand, the inequality index should rise when the income is transferred from poorer to richer individuals and such transfer is called regressive transfer.

Let us now assume that a *progressive transfer* δ occurs from income y_k to y_i, where $y_k > y_i$. A new income distribution yields the following result:

$$\boldsymbol{Y}^* = (y_1, y_2, \ldots, y_i + \delta, \ldots y_k - \delta, \ldots \ldots y_n)$$

With $y_k - \delta > y_i + \delta$, i.e. the transfer does not reverse the relative position of the two individuals. Now, an inequality index satisfies *PT* if $\mathbf{I}(\mathbf{y}^*) < \mathbf{I}(\mathbf{y})$, i.e. if it gives a lower value for $\mathbf{y}^*$ than for the initial $\mathbf{y}$.

2. Scale invariance: Scale invariance requires the inequality index to be invariant to equi-proportional changes of the original incomes. In other words, Scale Invariance requires the inequality index to be unchanged when every individual in the society receives income increment in the same scale or proportion.

For example, starting from **y**, we could obtain a new distribution multiplying all incomes by λ. The new distribution, in this case, would be:

$$\boldsymbol{Y}^* = (\lambda y_1, \lambda y_2, \ldots, \lambda y_i, \ldots \lambda y_k, \ldots \ldots \lambda y_n)$$

An inequality index is scale invariant if $\mathbf{I}(\mathbf{y}) = \mathbf{I}(\mathbf{y}^*)$, i.e. if the index does not change when all income are scaled by the same factor. Scale invariance means that income changes are distributionally neutral only if they occur in the **same proportion** for all individuals in the income distribution.

The whole illustration can be substantiated with a numerical example as: If one receives 10% additional in his/her income, the rest of individuals should receive the same 10% additional income as well so that the index will remain unchanged.

3. Translation invariance: Translation invariance means that income changes are distributionally neutral only if they occur in the same absolute amounts for all individuals in the income distribution. In other words, translation Invariance requires the inequality index should remain unchanged if all the individuals receive the same absolute amount of addition or subtraction in the income distribution.

For example, starting again from **y**, we could obtain a new income distribution adding θ to all incomes. The new distribution, in this case, would be:

$$\boldsymbol{Y}^{*} = (y_1 + \theta, y_2 + \theta, \ldots., y_i + \theta, \ldots.. y_k + \theta, \ldots\ldots y_n + \theta)$$

Therefore, an inequality index is translation invariant if $\mathbf{I(y) = I(y^*)}$.

Hence, translation invariance requires the inequality index to be invariant to uniform additions or subtractions to original incomes. For example, if one received an absolute amount of Rs.1000 as an additional income, the rest of individuals should receive the same Rs.1000 additional income as well so that the index will remain unchanged.

4. The principle of population: The principle of population requires an inequality index to remain unchanged if all the incomes are replicated at once in the same income distribution. If the size of population grows and the individuals are replicated by the exact same amount of income for everyone, the index will stay unchanged.

The principle of population axiom requires the inequality index to be invariant to replications of the original population. Given an initial income distribution **y**, replicating the population would give:

$$\boldsymbol{Y}^{*} = (y_1, y_1, y_2, y_2, \ldots., y_i, y_i, \ldots.. y_k, y_k, \ldots\ldots y_n, y_n)$$

where all incomes are replicated once. An inequality index satisfies the population principle if $\mathrm{I}(\mathbf{y}) = \mathrm{I}(\mathbf{y^*})$.

5. Decomposability: The decomposability axiom requires a consistent relation between overall inequality and its parts. Hence, the inequality index that satisfies this axiom can be decomposed into several groups such as races, location (urban and rural), gender, education levels and so forth. An overall inequality index (or total inequality) is formed when all the inequality indexes of every group are summed up.

If the original income distribution **y** is composed by, say, n groups, and has an overall inequality $I(\mathbf{y})$ it must be that:

$$I(\boldsymbol{Y}) = I(y)_1 + \boldsymbol{I(y)_2} + \ldots\ldots \boldsymbol{I((y)_n}$$

i.e., total inequality must be equal to the sum of the various group inequalities.