Inequality of Income

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Size Distribution

- In a broader sense, we measure inequality of Size Distributions. Positive or non-negative valued distributions are considered as size distributions. But not all positive valued distributions are size distributions. It should make sense if we redistribute size distributions. Examples of size distributions are as follows.
  - 1. Distribution of wages
  - 2. Distribution of Land holdings
  - 3. Distribution of wealth, etc.
- Heights of persons can not be considered as size distribution, because we can not redistribute it.
- Income of a person may be accrued from wages or from wealth (accumulated earnings).

What do we Mean by Income Inequality?

- **Income inequality** means the concentration of income in the hands of a small percentage of a population. As such, the inequality attains the highest value when one person in the community has all the money and the rest of the people in the community gets no money at all. Thus, it has been described as the gap between the richest and the rest.
- Inequality is nothing but relative deprivation. If the first person has income 100 and the second person has income 200, we say that the first person is deprived in comparison with the second person. A measure of inequality is an average of all such deprivations - average of distances or ratios. Sometimes we may take a particular value and measure average of distances from that value.
- It is not always true that we always take average of distances as an inequality measure. For example, the following statement can show the severity of inequality very clearly.

> *The richest 1% of the U.S. population possessed 38.6% of the nation's wealth in 2016, according to a 2017 Federal Reserve report.*

Why Do We Bother Inequality?

- Some people are of the opinion that we should not bother inequality, so long as everybody can fulfill the basic needs. They also put forward other reasons in favour of inequality.

- Well. It is a question of ethics (moral principle). Inequality is not morally good for the society. Everybody should be treated equally. We are members in the society. Why should one member relatively suffer while the other member is privileged in many respect? There should be a sense of वसुधैव कुटुम्बकम् , "the world is one family". The ultimate aim of globalization is to reach the concept of वसुधैव कुटुम्बकम् .

Data

- **The purpose** is to measure the degree of inequality of incomes in a community.
- The primary data should relate to total income of households. – Not reliable.
- **Data on consumer expenditure** are often utilized for the measurement of inequality, treating consumer expenditure as a proxy for income.
- The inequality of consumer expenditure would be somewhat smaller than the inequality of income.
- Let $y_1, y_2, \ldots, y_n$ be the **per capita or per adult equivalent incomes/expenditures** of the n persons forming a community.

Usefulness/Purpose

- A measure of inequality should indicate the extent to which these incomes/expenditures vary among themselves. Such measures are useful for comparisons of income inequality, say, across countries or regions or across socioeconomic groups within a country or region. They are also needed for studying changes in the degree of inequality in the same country/region over time.

Desirable Properties of a Measure of Inequality

– Scale Independence Property:

$$I(cy_1, cy_2, \ldots, cy_n) = I(y_1, y_2, \ldots, y_n)$$

for all $I(y_1, y_2, \ldots, y_n)$, and c > 0.

– The Pigou-Dalton Principle of Transfers

This says that any index of inequality should decrease if a small amount of income is transferred from a higher income person to a person with a lower income without altering their relative positions.

– The Principle of Diminishing Transfers

The change in the degree of inequality due to a transfer of a small amount of income from a person with income y to a person with income y-d should decrease as y increases.

Measures of Inequality

- All measures of inequality can be classified into two categories:

1. **Positive Measures of inequality**

These measures are proposed from semi-intuitive statistical or mathematical angle. There is no explicit reference to consideration of social welfare,

and 2. **Normative measures of inequality**

Normative measures take into account of welfare lost or gained due to more unequal or equal distribution of income.

Positive Measures of Inequality

- **1. Measures of Relative Dispersion**

(i) Relative Mean Deviation: RMD is

$$\frac{\frac{1}{n}\sum_{i=1}^{n}|y_i - \bar{y}|}{\bar{y}},$$

where $\bar{y}$ is the arithmetic mean (AM) of $y_1, y_2, \ldots, y_n$.

(ii) Coefficient of Variation: The formula for coefficient of variation, assuming that the observations are $y_1, y_2, \ldots, y_n$, is

$$\text{CV} = \frac{SD}{AM},$$

$$\text{where SD = standard deviation} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \bar{y})^2}\,.$$

Positive Measures of Inequality

- **1. Measures of Relative Dispersion**

(iii) Gini Concentration Coefficient or Lorenz Ratio:

LR is defined as

$$LR = 1 - \frac{1}{n^2\bar{y}}\sum_{i=1}^{n}\{2(n-i)+1\}y_i$$

$$= \frac{1}{2n^2\bar{y}}\sum_{i=1}^{n}\sum_{j=1}^{n}\left|y_i - y_j\right|,$$

- where y_i values are arranged in increasing order.

Positive Measures of Inequality

- **2. Shares of Selected Ordinal Groups (or fractile groups):**
- Suppose one ranks the incomes in increasing order of size: $y_1 < y_2 < \ldots < y_n$, and finds the share of bottom (i.e., poorest) 50% of the people in the aggregate income of the community. This can be computed as:

$$\text{Share of bottom } 50\% = \frac{\left(y_1 + y_2 + \ldots + y_{\frac{n}{2}}\right)}{\left(y_1 + y_2 + \ldots + y_n\right)} \times 100$$

- In the same way, one can compute shares of different ordinal groups – e.g., decile groups or percentile groups – like the bottom 20% or the top 10%. These shares are in fact selected ordinates of the Lorenz Curve. The ratios of two such shares are sometimes used, like the following:

$$\frac{(\text{The share of top } 10\%)}{(\text{The share of bottom } 10\%)}$$

Why Shares of Selected Ordinal Groups Are Important?

- To understand why share of selected ordinal groups are important towards measurement of inequality of income, let us assume that the community has 100 individuals with incomes $(x_1, x_2, \dots, x_{100})$. Without loss of generality, we may assume that $x_1 < x_2 < \cdots < x_{100}$.
- Let us divide the population into 10 equal groups in increasing order of their incomes as

$$(x_1, x_2, \dots, x_{10}), (x_{11}, x_{12}, \dots, x_{20}), \dots, (x_{91}, x_{92}, \dots, x_{100})$$

- their respective shares of incomes are

$$S_1 = \frac{\sum_{i=1}^{10} x_i}{\sum_{i=1}^{100} x_i}, \qquad S_2 = \frac{\sum_{i=11}^{20} x_i}{\sum_{i=1}^{100} x_i}, \qquad \dots, \qquad S_{10} = \frac{\sum_{i=91}^{100} x_i}{\sum_{i=1}^{100} x_i}.$$

- Observe that $S_1 \leq S_2 \leq \cdots \leq S_{10}$. This implies that $S_1 \leq 0.1$ and $S_{10} \geq 0.1$.

Why Shares …? (Continued)

- What is the implication of the value of $S_1 = 0.1$?
- Surprisingly, $S_1 = 0.1$ implies that income of everyone is same not only for this group but also for the whole population. Income distribution is perfectly equal. So, is the value of $S_{10} = 0.1$. But we cannot arrive at the same conclusion when $S_5 = 0.1$, say. Such are the importance of the extreme groups!
- Usually, $S_1 < 0.1$. Less is the value of S_1 more is the bottom 10% deprived of income compared to the rest of the society. Thus, the difference 0.1 - S_1 can be regarded as a measure of inequality of income. To make the measure lie in between 0 and 1 we can divide it by 0.1 and take $\frac{(0.1-S_1)}{0.1}$ as a measure of inequality.
- We can completely infer about the distribution of the whole population only when S_1 = 0.1. When $S_1 < 0.1$, the above measures ignores the distribution of incomes of members in other groups to some extent. We should be able to find a better measure by incorporating the shares of incomes of all ordinal groups.

Why Shares …? (Continued)

- Now let us take groups like bottom 10%. bottom 20%, bottom 30% and so on. These groups are not mutually exclusive. But each of these groups are extreme groups. Let us denote the shares of incomes as $Q_1, Q_2, \dots, Q_{10}$. Naturally, $Q_1 \leq 0.1, Q_2 \leq 0.2, \dots, Q_{10} \leq 1$. The overall measure can be found by combining $0.1 - Q_1, 0.2 - Q_2, \dots, 1 - Q_{10}$ with suitable weights.
- If the distribution is perfectly equal, then the values of $Q_1, Q_2, \dots, Q_{10}$ will be 0.1. 0.2, 0.3, …, 1.0. If we plot these values against the corresponding proportions of persons, i.e., 0.1. 0.2, 0.3, …, 1.0 and join these values by straight lines, then we shall get only one straight line. Thus, this line is called the line of equality.
- If we plot the values $Q_1, Q_2, \dots, Q_{10}$ and join these values by straight lines or smooth curves then we shall get what is known as Lorenz Curve (LC).
- The area between the line and the LC is a measure of inequality. Maximum of this value is 0.5. Thus, we multiply it by 2 to make it lie in between 0 and 1. This is known as the Lorenz Ratio. So, it is the overall measure of inequality.

Lorenz Ratio

- In actual practice, we take individuals instead of groups of individuals.
- Thus, the Lorenz curve reveals **the percentage of income owned by x per cent of the population**. It is usually shown in relation to a 45-degree line that represents perfect equality where each x percentile of the population receives the same x percentile of income.
- Now we see that there are two definitions of LR. But the two definitions are equivalent. It can be shown that Gini Concentration Coefficient or Lorenz Ratio as defined here is also

$$\mathrm{LR} = 1 - \frac{1}{n^2\bar{y}}\sum_{i=1}^{n}\{2(n-i)+1\}y_i = \frac{1}{2n^2\bar{y}}\sum_{i=1}^{n}\sum_{j=1}^{n}\left|y_i - y_j\right|,$$

- where y_i values are arranged in increasing order.
- **Home Task:** Prove the equivalence of the three definitions.
- The graph of Line of Equality, LC are usually put in a Lorenz Box in which the four sides are covered by straight lines.

Positive Measures of Inequality

3. The SD of logarithms

- The SD of ln y values is an important measure of inequality. SDL or $SD(Ln(y))$ is defined as

$$SD(Ln(y)) = \sqrt{\frac{1}{n}\sum Ln^2\left(\frac{y_i}{G}\right)}$$

- where $\overline{Ln(y)} = \frac{1}{n}\sum_{i=1}^{n} Ln(y_i)$ and G is the geometric mean of y_i's.

Positive Measures of Inequality

4. Theil's Entropy measure

- Theil's Entropy measure is based on the notion of entropy in information theory and is defined as

$$T = \sum_{i=1}^{n} x_i Ln(nx_i) \, ,$$

- where x_i is the income share of the ith person defined as $\frac{y_i}{n\bar{y}}$ so that $\sum x_i = 1$.
- The measure takes a minimum value '0' when all incomes are equal and the maximum value $Ln(n)$ when only one person has the total income of the community while all others have zero income.

Positive Measures of Inequality

4A. **Generalized Entropy measures**

- It is a generalization to Theil's index.

$$GE(\alpha) = \frac{1}{\alpha(\alpha-1)}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right], \alpha \geq 0.$$

- It can be proved that $0 < \mathrm{GE} < \infty$.
- For low value of α, the measure is very sensitive to low values of y.
- For α = 1, it reduces to Theil's index.

Positive Measures of Inequality

5. Elteto-Frigyes (EF) Measures:

EF measures are defined as

$$u = \frac{m}{m_1}, v = \frac{m_2}{m_1}, w = \frac{m_2}{m},$$

where m is the overall mean, m_1 is the mean of incomes < m, and m_2 is the mean of incomes > m. Obviously, v = uw.

Normative Measures of Inequality

Social Welfare Function (SWF):

This approach was first developed by Atkinson in 1970. He derived the measure of inequality of income through Social Welfare Function (SWF). For simplicity let us assume the SWF of incomes $\mathrm{y}_1, \mathrm{y}_2, \ldots, \mathrm{y}_\mathrm{n}$ of n individuals in a society is the sum of individual utility functions which are assumed to be same for everyone, i.e.,

$$W(\mathrm{y}_1, \mathrm{y}_2, \ldots, \mathrm{y}_\mathrm{n}) = \sum U(y_i)\,,$$

where W is the welfare function and $U(y_i)$ is the utility of y_i for the ith individual. The utility function is assumed to be increasing and concave

Normative Measures of Inequality

- **The Equally Distributed Equivalent income:**
- The Equally Distributed Equivalent (ede) income is defined as that income which, if given to each individual, gives the same value of the SWF as that of the existing one. I.e.,

$$W(y_{ede}, y_{ede}, \ldots, y_{ede}) = W(y_1, y_2, \ldots, y_n).$$

- Since the utility function is assumed to be increasing and concave, it can be proved that $y_{ede} < m$, where m is the arithmetic mean of y values. The difference $m - y_{ede}$ goes on increasing as the utility function becomes more and more concave. Thus, maximum welfare is attained when $y_{ede} = m$, i.e., when the total income is distributed equally to each person – the case of perfect equality.

Normative Measures of Inequality

- **Dalton's Measure Vs. Atkinson's Measure:**
- Dalton has proposed the following measure of inequality:

$$I_D = 1 - \frac{\sum U(y_i)}{nU(m)}.$$

- This is nothing but

$$I_D = 1 - \frac{U(y_{ede})}{U(m)}.$$

- As a refinement to the Dalton's measure Atkinson has proposed the following measure.

$$I_A = 1 - \frac{y_{ede}}{m}.$$

- This measure is invariant under any positive linear transformation of the utility function. Calculation of both the Dalton's and Atkinson's measures needs knowledge of the utility function.

Normative Measures of Inequality

- The class of utility functions can further be narrowed down if we assume that the inequality measure is invariant under the change of unit of measurement. In this case the utility function boils down to

$$U(y) = A + By^{1-\varepsilon}, for\ \varepsilon > 0\ and\ \varepsilon \neq 1, and$$

$$= C + DLn(y), for\ \varepsilon = 1.$$

- The constants A, B, C and D are unimportant in our analysis since, under the above specifications, I_A becomes

$$I_A = 1 - \left[\frac{1}{n}\sum\left(\frac{y_i}{\bar{y}}\right)^{(1-\varepsilon)}\right]^{\frac{1}{(1-\varepsilon)}}, for\ \varepsilon > 0\ and\ \varepsilon \neq 1, and$$

$$= 1 - \frac{AM}{GM}, for\ \varepsilon = 1.$$

- where ε > 0 and represents the degree of inequality aversion. The Equally Distributed Equivalent Income y_{ede} now becomes

$$y_{ede} = \left[\frac{1}{n}\sum(y_i)^{(1-\varepsilon)}\right]^{\frac{1}{(1-\varepsilon)}}.$$

Normative Measures of Inequality

Significance of Lorenz Curve Comparisons

Atkinson's theorem: Consider two communities each with the same number of persons and the same mean of income. If the LC of one community is inside the LC of the other community, then the social welfare measured by the sum of utilities of all the individuals is greater for the first community than for the second, whatever the unknown utility function U(.) is. But if the two LCs intersect and cross each other, then such an unambiguous ranking is not possible – two different utility functions may lead to different orderings of the two communities by social welfare.

This theorem has been considerably generalized. The number of persons need not be equal for the two communities. The social welfare function can be much more general. The interpretation of LC comparisons can still be made as suggested by Atkinson's theorem.

Kuznets hypothesis

- **Kuznets hypothesis**
- Simon Kuznets put forward the hypothesis that relationship between per capita national income and the degree of inequality in income distribution may be of the form of inverted-U. Due to limitations of data he used an inequality measure of the ratio of income share of the richest 20 per cent of the population to the bottom 60 per cent of the population known as Kuznets' ratio.
- **Kuznets' Inverted U-hypothesis:**

  As per capita national income of a country increases, in the initial stages of growth, inequality in income distribution rises and after reaching the highest degree in the intermediate level the income inequality falls.

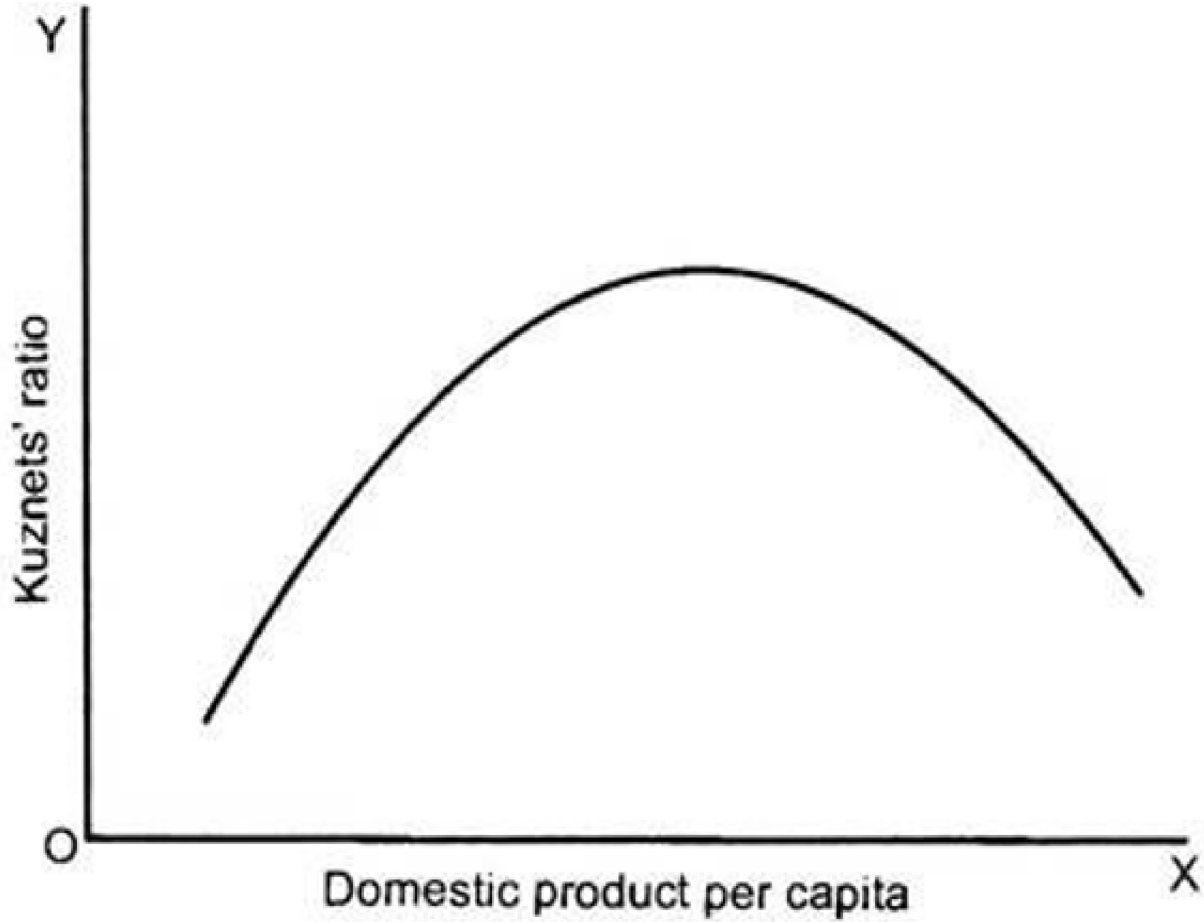

Diagram 1: Kuznets' Inverted-U Curve

Paukert's Analysis of Cross Section Data

- **Paukert's Analysis of Cross Section Data**
- There were many analysis with time series data to prove or disprove Kuznets hypothesis. But analysis with cross section data is rare. One such cross-section study with data of forty-six countries classified into different income categories according to the per capita GDP in 1965 in US dollars was made by Paukert using Gini Coefficient as a measure of inequality. Paukert's analysis of cross-section of countries also confirmed the inverted U-hypothesis of Kuznets and his findings are given in the following Table.

Income Category (1965 US $)	Average Gini Coefficient in Various Income Categories of Countries
Less than $100	0.419
$101 to $200	0.468
$201 to $300	0.499
$301 to $500	0.494
$501 to $1000	0.438
$1001 to $2000	0.401
$2001 and higher	0.365

Causes of Inequality

1. Unemployment:

Since sufficient employment could not be created through the process of planned economic development, it was not possible to increase the income levels of most people in India.

2. Inflation:

Wages, especially in private and unorganized sectors, do not rise at the same proportion to inflation. Real income of wage earners goes down. Since price increases disproportionately, few profit earners gain.

3. Tax Evasion:

High tax rate encourages tax evasion. Undue concentration of incomes in a few hands are caused by large-scale tax evasion.

Causes of Inequality

4. Regressive Tax:

The indirect taxes give maximum revenue to the government. But they are regressive in nature.

(When tax increases proportionately more as income rises then it is called progressive taxation, e.g., income rises by 10%, but tax rises by 12%.)

Indirect taxes like sales tax, excise duty, customs duty, etc., are levied on all products/services without any differentiation, i.e., without considering the consumer group's income status which consumes the product/service. So the poor or rich are equally impacted by this and hence considered regressive.

Causes of Inequality

5. New Agricultural Strategy:

India’s new agricultural strategy led to the Green Revolution and raised agricultural productivity. But the benefits of higher productivity are enjoyed mainly by the rich farmers and landowners.

Measures Taken to Eliminate Income Inequalities in India

1. Land Reforms and Redistribution of Ceiling Surplus Land:

The Zamindari system prevailed in our country for a long time. Income inequalities are mostly resulted from the concentration of agricultural land in the hands of a few big landlords.

After independence, various legislative measures were introduced for abolishing the system of absentee landlords and other intermediaries and imposing ceiling on land holdings.

Ceiling on landholdings has been imposed in the rural areas. Each household is allowed to hold a certain amount of land. Any surplus above this is taken over by the Government and is redistributed among the landless workers and marginal farmers. Moreover, in 1976 a ceiling on urban property has also been imposed.

Measures Taken to Eliminate Income Inequalities in India

2. Control over Monopolies and Restrictive Trade Practices:

The **Monopolies and Restrictive Trade Practices Act (MRTPA)** was passed in 1969 which made necessary provision for the control of monopolies and for prohibiting restrictive trade practices. The MRTP act is no longer active in India as it has been replaced by the **Competition Act** which came into effect on September 1st, 2009, by the Competition Commission of India. Accordingly, a Commission was formed to make necessary judgment on the erring enterprises.

Moreover, under the present regime of liberalization of the industrial sector, the monopoly trends are likely to be strengthened further and thereby economic disparities may aggravate further.

> *Restrictive trade practice, means a trade practice which tends to bring about manipulation of price or its conditions of delivery or to affect flow of supplies in the market relating to goods or services.*

Measures Taken to Eliminate Income Inequalities in India

3. Social Security Measures:

Social Security Measures include Workmen's Compensation Act for providing compensation in case of any injury to industrial workers, Maternity Benefit Act for Women Workers and Employees Provident Fund Act for providing the benefit of provident fund to the workers etc.

Again, the most comprehensive social security measure in the country is the Employees State Insurance Act which provides the insured workers' various facilities like medical benefits, disability benefits, sickness benefit, maternity benefits and also benefit to the dependents.

All these measures are playing important role in poverty alleviation especially in urban areas. But the rural areas and the unorganized sectors remain mostly untouched. Even the unemployment allowance and the old age pension, which are considered as vital measures for removing poverty, are almost absent in India.

Measures Taken to Eliminate Income Inequalities in India

4. Employment Programme and Wage Policies:

From time to time many programmes have been taken by the Government of India to tackle the problem of growing unemployment and persistent poverty. These programmes include Food for Work Programme, Integrated Rural Development Programme (IRDP), National Rural Employment Programme (NREP), Rural Landless Employment Guarantee Programme (RLEGP) etc. Later NREP and RLEGP were merged into a new programme, namely, Jawahar Rojgar Yojana (JRY). The latest is the MGNREGS scheme.

All these programmes were short lived and ad-hoc in nature. All these programmes were mostly guided by the objective of poverty alleviation in rural areas through generation of gainful employment opportunities.

Measures Taken to Eliminate Income Inequalities in India

5. Payment of Bonus and Imposition of Progressive Taxation on Direct Income

The payment of bonus has been made compulsory in every industry. Progressive taxation on direct income failed to reduce inequality due to large scale tax evasion.

6. Transfer Payments:

Finally, various types of transfer payments (such as unemployment, compensation, soft loans, pensions to freedom fighters, concessions to senior citizens, etc.) have been made for improving the welfare of certain weaker sections of the society.

But all these measures failed to achieve the desired level of success.

Thank you