⊙ Income poverty measurement :

A poverty measure is an index $P(Y, z)$ that gives the level of poverty of distribution Y according to the poverty line z.

The most common poverty index is the headcount ratio, which reports the percentage of the population. However, the headcount ratio is a flawed measure. The most common way to improve the headcount ratio ~~is~~ draws on what are called the Foster – Greer – Thorbecke (FGT) indices. This is a family of indices, which includes the headcount ratio as one of its members, but it has the advantage that other members of this family provide better incentives for policy makers to address the very poorest of the poor. All members of the FGT family can be decomposed by district, ethinicity, rural – urban or any other categories of the population.

Two are widely used —

1.) Poverty Gap : reflects the depth of poverty as well as the headcount ratio.

2.) Squared Poverty Gap : reflects the headcount ratio, the depth of poverty and the inequality among the poor. This measure prioritizes the poorest of the poor.

⊙ Properties of poverty measure : (Axioms)

As for inequality, many authors have identified the set of properties that a poverty measure should satisfy. They are —

(i) **Symmetry and replication invariance** are required for a poverty measure, such that the poverty level doesnot depend on who is poor or on the total size of the considered population.

(ii) **Scale invariance** is also required as it demand the poverty measure not to change when all incomes and the poverty line changes in the same proportion.

(iii) **Focus axiom** requires the poverty measure to be concerned exclusively with those who are poor. That is, an increase in the income of a non poor shouldnot change the poverty level.

(iv) **Monotonicity** requires the poverty measure to increase whenever a poor person's income decreases.

v) **Transfer property** from inequality measurement is also required in poverty measurement, but restricted to the set of the poor, so that if there is a progressive transfer between two poor people, poverty should decrease.

(vi) Subgroup consistency demands that whenever poverty decreases in a given subgroup of the popu-lation, and the poverty level of all other groups remain unchanged, overall poverty should decrease.

(vii) Additive decomposability goes even requires the overall poverty level to equal the weighted sum of subgroup-poverty levels, where the weights are the population shares of each subgroup.

⊙ The Foster – Greer – Thorbecke (FGT) poverty measures:

This ~~section~~ presents the class of poverty measures that has been most widely used in empirical applications, which is the Foster, Greer and Thorbecke (1984) class of poverty indices. The headcount ratio is a special case of the FGT indices and this is a very easy class of measures to understand and compute.

Given an income distribution $y = (y_1, y_2 \dots y_n)$ and a poverty line z, start by calculating the normalized gap for each individual in the distribution. For incomes that are below the poverty line, the normalized gap is the distance between the poverty line and the income value, measured in poverty line units.

For incomes that are above the poverty

line, their income is replaced by z, the income at the poverty line, so their normalized gap is simply zero. The normalized gap are given by:

$$g_i = \frac{z - y_i}{z} \quad \text{if } y_i < z$$

or

$$g_i = 0 \quad \text{if } y \geq z$$

Now, construct a vector: $g^a = (g_1, g_2 \ldots g_n)$ where each element is the normalized gap raised to the power a, with $a \geq 0$. The FGT class of measures are just the mean of that vector:

$$P_a(y; z) = \mu(g^a) \qquad a \geq 0$$

- **The Headcount Ratio (P_0):**

Let's consider first the case of $a = 0$.

Each gap raised to the 0 power just gives us a value of 1, if the person is poor and 0 if the non-poor, so we can call the g^a vector the deprivation vector. On this example: $g^a = (0, 1, 1, 0)$ indicating that the second and third persons in this distribution are poor. This measure is known as the headcount ratio. However as noted by Watts, it gives neither information of the depth of poverty nor on its distribution among the poor.

If this was the official poverty measure in a country, a govt. interested in maximising the impact of resources on poverty reduction would have all incentives to allocate them among the least poor, those that are closer to the poverty line, leaving the lives of the poorest poor unchanged.

⊙ The Poverty Gap (P_1):

Consider now the case of $\alpha = 1$. The g_1 vector which maybe called the normalized gap vector. As opposed to the headcount ratio (P_0), the P_1 the measure is sensitive to the depth of poverty. It satisfies monotonicity.

All measures with $\alpha > 0$ satisfy monotonicity. However, a transfer from an extremely destitute person to a less poor person would not change P_1, since the decrease in one gap would be exactly compensated by the increase in the other.

Therefore, by being sensitive to the depth of poverty, the P_1 measure does make policy-makers want to decrease the depth of poverty. But because of its insensitivity to the distribution among the poor, the P_1 measure doesnot provide extra incentives to help the poorest poor.

⊙ The Squared Poverty Gap (P_2) [Best measure]

Finally, consider the case of $a = 2$. The g^2 vector, which may be called the square gap vector. The aggregate poverty measure P_2, is the mean of normalized gap vector. The P_2 measure is sensitive to the depth of poverty. By squaring the normalized gaps, the biggest gaps recieve a higher weight, which has the effect of emphasizing the poorest poor and providing incentives for policy makers to address their situation urgently. All measures with $a > 1$ satisfy the transfer property.

It is worth repeating that all measures of the FGT family are decomposable in subgroups of population, allowing the identification of each group's contribution to overall poverty.

Q. Consider four people whose incomes are: $Y = (2, 7, 4, 8)$ and the poverty line, $z = 5$. Find the FGT class of measures.

Soln:

	H_1	H_2	H_3	H_4
Y :	2	7	4	8
G_i :	$\frac{3}{5}$	0	$\frac{1}{5}$	0
G_i^0 :	1	0	1	0

$P_0 : \frac{\Sigma G_i^0}{n} = \frac{2}{4} = 0.50$ (HCR)

Poverty Gap :

	H_1	H_2	H_3	H_4
Y	2	7	4	8
G_i :	$\frac{3}{5}$	0	$\frac{1}{5}$	0
G_i' :	$\frac{3}{5}$	0	$\frac{1}{5}$	0

$P_1 : \frac{\Sigma G_i'}{4} = \frac{\frac{3}{5} + \frac{1}{5}}{4} = 0.20$

Sq. Poverty Gap :

	H_1	H_2	H_3	H_4
Y :	2	7	4	8
G_i :	$\frac{3}{5}$	0	$\frac{1}{5}$	0
G_i^2 :	$\frac{9}{25}$	0	$\frac{1}{25}$	0

$\therefore P_2 = \frac{\Sigma G_i^2}{n} = \frac{\frac{9}{25} + \frac{1}{25}}{4} = 0.10$

Checking for Monotonicity : (HCR)

	H_1	H_2	H_3	H_4
Y :	2	7	3	8
G_i :	3/5	0	2/5	0
G_i^0 :	1	0	1	0

$$P_0 : \frac{\Sigma G_i^0}{n} = \frac{2}{4} = 0.50$$

As with the fall in the income of H_3, the value of HCR donot change. Thus, it doesnot fulfill the monotonicity principle.

⊙ Poverty Gap :

	H_1	H_2	H_3	H_4
Y :	2	7	3	8
G_i :	3/5	0	2/5	0
G_i^1 :	3/5	0	2/5	0

$$\therefore P_{0_1} : \frac{\Sigma G_i^1}{n} = \frac{3/5 + 2/5}{4} = \frac{1}{4} = 0.25$$

As the income of H_3 household decreases, the value of poverty index increases i.e, $(0.25 > 0.2)$. Therefore, it fulfilled the monotonicity principle.

⊙ Sq. Poverty Gap :

	H_1	H_2	H_3	H_4
Y :	2	7	3	8
G_i :	3/5	0	2/5	0
G_i^2 :	9/25	0	4/25	0

$\therefore P_2 : \frac{\Sigma G_i^2}{n} = \frac{9/25 + 4/25}{4} = \frac{0.52}{4} = 0.13.$

The value of poverty index increases from 0.1 to 0.13, therefore it fulfilled the monotonicity principle.

※ Checking for Transfer Principle :

HCR : Transfering 1 unit of income from H_3 to H_1.

	H_1	H_2	H_3	H_4
Y :	3	7	3	8
G_i :	2/5	0	2/5	0
G_i^0 :	1	0	1	0

$\therefore P_0 = \frac{\Sigma G_i^0}{n} = \frac{2}{4} = 0.5.$

Due to the transfering of 1 unit of income from H_3 to H_1, the value of HCR donot change. Thus, it doesnot fulfilled the principle.

① Poverty Gap :

	H_1	H_2	H_3	H_4
Y :	3	7	3	8
$\hat{G}_i$:	2/5	0	2/5	0
G_i^1 :	2/5	0	2/5	0

$$\therefore P_1 = \frac{\Sigma G_i^1}{n} = \frac{2/5 + 2/5}{4} = \frac{0.8}{4} = 0.20$$

The value of poverty gap doesnot change, therefore it doesnot fulfilled this principle.

② Sq. Poverty Gap :

	H_1	H_2	H_3	H_4
Y :	3	7	3	8
G_i :	2/5	0	2/5	0
G_i^2 :	4/25	0	4/25	0

$$P_2 = \frac{\Sigma G_i^2}{n} = \frac{4/25 + 4/25}{4} = \frac{0.64}{4} = 0.08$$

The value of sq. poverty gap decreases from 0.1 to 0.08, this it implies that it fulfills the transfer principle.

** Unit - 3 continue

* Measurement of Poverty :

The various measures of poverty are —

(i) **Absolute Poverty** – It is referred to the no. of people who are unable to command sufficient resources to satisfy their basic needs. They are counted as the total no. of people living below a poverty.

(ii) **Head count** : It refers to the fraction of total population that lives below the poverty line. The HC Index is interpreted as $\frac{H}{N}$, where H = Head count & N = Total population.

(iii) **Poverty Gap** : It measures the total amount of income necessary to raise the people who are below the poverty line to the poverty line.

(iv) **Total Poverty Gap (TPG)** : It measures the total amount of income necessary to raise the poor section of the population above the poverty line. If Y_i refers to the income of the poor person and Y_p be the poverty line then,

$$TPG = \sum_{i=1}^{H} (Y_p - Y_i).$$

(v) **Average Poverty Gap (APG)** : On the per capita basis, APG is worked out by dividing TPG by total population (N).

Thus, $APG = \frac{TPG}{N}$

(vi) **Normalized Poverty Gap (NPG)** : It is defined as the ratio of APG and Poverty line.

$$NPG = \frac{APG}{Y_p}$$

This measures lies between 0 and

1 and it can be used to when we want a unitless measure of the gap for easier comparison.

(vii) Average income shortfall (AIS): It is defined as the ratio of total poverty gap by HCR i.e,

$$AIS = \frac{TPG}{HCR}$$

It tells us the average amount by which income of poor persons fall below the poverty line.

(viii) Normalised income shortfall: It is defined as the ratio between AIS and Y_p.

$$NIS = \frac{AIS}{Y_p}$$

✱ Human Poverty Index (HPI):

This ~~means~~ measures was introduced by United Nations ~~Development~~ Programme (UNDP) in 1947 HDR. The UNDP ~~has~~ argued that human poverty ~~index~~ should be measured in terms of 3 keys variable:

(i) Percentage of population not expected to survive to the age of 40 (P_1)

(ii) The adult illiteracy Rate (P_2)

(iii) A ~~deprecation~~ deprivation index (P_3) based on the average of two variables i.e, percentage of population without access to safe drinking water (P_{31}) and the percentage of underweighted children under 5 years of age (P_{32}).

Thus, $$HPI = \left[\frac{1}{3}\left(P_1^3 + P_2^3 + P_3^3\right) - 3\right]^{1/3}$$

where,

$$P_3 = \frac{P_{31} + P_{32}}{2}$$

For India, the HPI stands to 34.4% which indicates that $\frac{1}{3}^{rd}$ of indian population lives in poverty.

* Poverty Trap :

It is a reincurring mechanism where poor people remains poor. It is a state where poor people can't get out of the cyclical pattern of poverty. Thus, poverty trap is a self-perpetuating condition where an economy is caught in a vicious circle of poverty and also suffers from persistent underdevelopment.

Proff. Rognar Nurkse defined the vicious circle of poverty for the first time in 1953. According to him, the poverty trap in a circular constellation of forces tending to act and react to one another in such a way so as to keep a poor country in a state of poverty.

⊙ Causes of Poverty trap :

(i) Poor work opportunities : In population dense area, it is difficult for people to find jobs which intum creates an economy with huge mass of low earning and unemployed masses.

(ii) The inability to pay for education owing to low income keeps the poor masses from attaining different skills thereby promoting unemployment and poverty in the society.

(iii) Poverty also fuels violence in the society which inhibits education, industry and an individual's ability to excels.

(iv) Inflation is another root cause of generating poverty traps.

Inflation not only increases the price of goods and services but also reduces the real income of the individuals making the poors poorer.

(v) Poor sanitation or tainted resources can lead to diseases and effect the human capitals levels of a underdeveloped country. This country devoid of proper health infrastructure are vulnerable to such epidemics and thus fall prey to vicious circle of poverty.

(vi) The poor underdeveloped countries are characterized by lack of industrial growth, corruption and absence of skilled labour which deters the business and industrial growth of the region.