

## 4) The Solow Neoclassical Growth Model

- The Solow growth model is a model of L.R economic growth set within the framework of Neo-classical economics.
- It was developed by the Robert Solow in 1956 and superseded the Keynesian Harrod-Domar Model.
- The Solow growth model is the extension of Harrod-Domar model.
- Standard Solow model predicts that in the Long-Run economies converges to the steady-state equilibrium.
- The key component of Economic growth is saving and investment. An increase in saving and investment raises the capital stock and thus raises the full employment, national income and

Simply that the rate of growth of GDP ( $\frac{\Delta Y}{Y}$ ) is determined jointly by the net national saving ratio,  $s$ , and the national capital - output ratio,  $R$ .

More specifically, it states that growth rate of national income is directly related to national saving and inversely related to national capital - output ratio.

The equation (V) is also often expressed in terms of Gross saving.

$$\frac{\Delta Y}{Y} = \frac{S^G}{C} - \delta$$

Where  $\delta$  is the rate of capital depreciation!

→ Growth in the Harrod domar model

Increasing the saving rate, increasing the marginal product of capital, or decreasing the depreciation rate will increase

or finally

$$\Delta K = R \Delta Y \rightarrow (ii)$$

As we know that net national saving "S" is / must equal net investment "I" so.

$$S = I \rightarrow (iv)$$

From equation (i) and (iv), we know that ..

$$S = SY = I = \Delta K = R \Delta Y$$

or

Simply as:

$$SY = C \Delta Y$$

no change  
in  
level

$$C = R$$

$$\boxed{\frac{\Delta Y}{Y} = \frac{S}{C}} \rightarrow (v)$$

$\frac{\Delta Y}{Y}$ , represents the rate of change or rate of Growth of GDP.

The equation (v) is simplified version of the famous equation in the Harrod-Domar theory of economic Growth, states

small elite ruling class in the developing countries are responsible for the perpetuation of the underdevelopment in the developing countries.

### (ii) The False - Paradigm Model

The proposition that developing countries have failed to develop because their development strategies (usually given to them by western economist) have been based on incorrect model of development.

⇒ If we want to describe the model in one sentence

Western economists that guides falsely intentionally or unintentionally.

the growth rate of output, these are the means to achieve growth in the Harrod-Domar model.

→ Limitations of the Harrod-Domar model &

i) → It only uses capital and saving as determinants. It ignores the other factors such as labor productivity (labor force growth) and technological advances.

ii) → Difficult to increase the saving rate in developing countries

iii) → They say that there is a constant marginal return on capital but there is always that capital has a decreasing marginal rate of return.

iv) → Lack of labor skills.

→ Obstacles and Constraints &

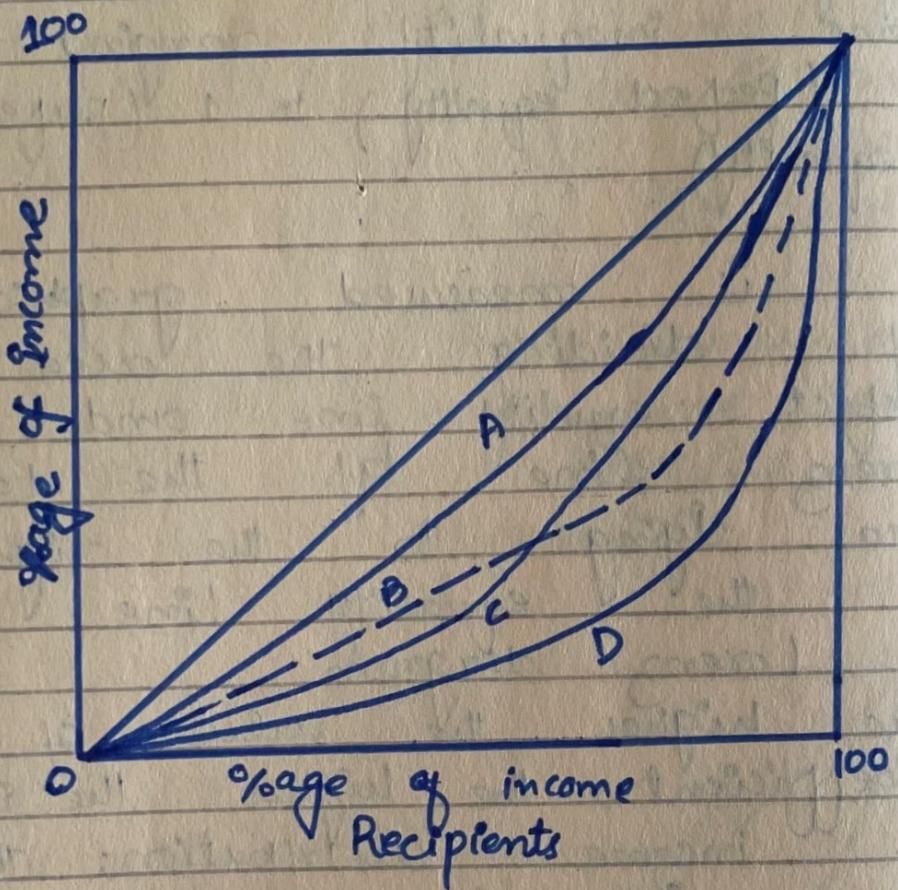
In the harrod-Domar model

product.

## → Assumptions of the Model

- i) Saving is equal to Investment.  
 $S = I$ .
- 2) Labour and Capital are substitutable for each other.
- 3) Capital depreciates at a Constant rate
- 4) There is a diminishing return to an individual output.
- 5) Full Employment of Labour.
- 6) Constant return to scale.  
(Same proportional increase in Input & output)
- 7) No technological progress.  
(~~labor~~)
- 8) Population grows at a Constant rate.

Four possible Lorenz curves such as might be found in international data are drawn in Figure.



\* Whenever one Lorenz curve lies above another Lorenz curve, the economy corresponding to the upper Lorenz curve is more equal than that of the lower curve.

Thus economy A may unambiguously be said to

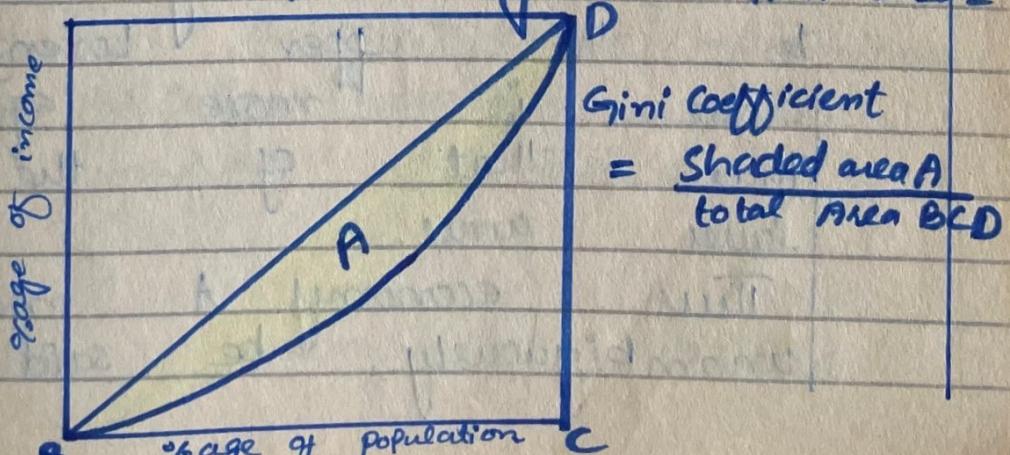
## → Gini Coefficients and Aggregate Measures of Inequality 8

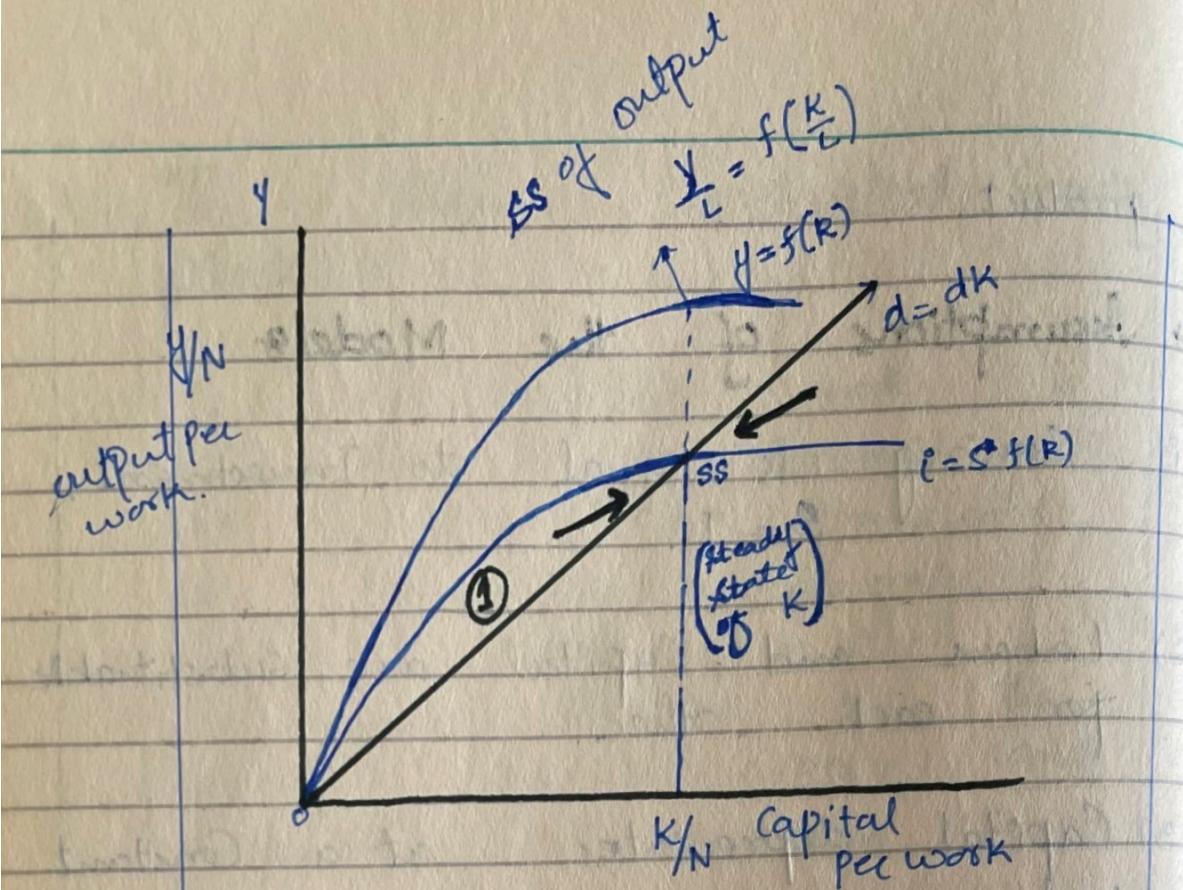
A Gini Coefficient is an aggregate numerical measure of income inequality ranging from 0 (Perfect equality) to 1 (Perfect inequality)

It is measured graphically by dividing the area between perfect equality line and the Lorenz line by the total area lying to the right of the equality line in a Lorenz diagram.

The higher the value of the Coefficient, the higher the inequality of income distribution; the lower it is, the more equal the distribution of income.

Estimating the Gini Coe-





i) The straight line is a depreciation curve which is proportional to the amount of capital.  
 { with increase in capital "k"  
 Depreciation "d" also increases.

ii) Output per worker increase at a diminishing rate as  $K$  increases due to low of Diminishing returns  
 (with increase in  $(K/N)$  we get increase in  $(Y/N)$ )

iii) Investment we multiply by saving. What we save

of Growth, we come to know that if a country wants to increase its economic growth so they should save more and the economic growth is inversely related to the Capital-output ratio.

→ for example, if we assume that national capital output ratio in some less developed country is 3 and net saving ratio is 6% of GDP then this country can grow at a rate of 2% per year because.

$$\frac{\Delta Y}{Y} = \frac{S}{C} = \frac{6\%}{3} = 2\%$$

And know if a country increase its saving rate from 6% - 15% then GDP Growth can be increased from 2% - 5%.

$$\frac{\Delta Y}{Y} = \frac{15\%}{3} = 5\%$$

So, in fact Rostow defined the takeoff stage in precisely this way. Countries that are able

the growth of the developing economy in terms of labor transition between two sectors.

i) Capitalist (Industrial Sector)  
ii) Subsistence (Agriculture Sector).

⇒ Assumptions

→ Capitalist / Industrial Sector

- i) Capital intensive manufacturing process.
- ii) Higher average wages.
- iii) Higher marginal + Average productivity.
- iv) Higher demand for labor.

→ Agriculture Sector

- i) Labor intensive production process.
- ii) Low average wages.
- iii) Low marginal + Average ~~wages~~ productivity.
- iv) Low dependency of labor on capital.

⇒ Assumptions

→ In this model Lewis argued that in the developing economies the agriculture sector has a surplus amount of unproductive labors.

→ Lewis assumed that the

### 3) → The International - Dependence Revolution &

i) Neocolonial dependence model.

ii) The False Paradigm.

### 1) → Neocolonial dependence models

↳ The theory indirectly tells us that difference between the rich and poor countries is due to highly unequal international capitalist system. In this system poor countries are exploited by rich countries. The international system is dominated by unequal relationship between the center of periphery. This makes it difficult for poor nations to develop.

↳ According to the model of neocolonial dependence rich countries hurt the developing countries through their intentionally exploitative or unintentionally neglectful policies. The rich countries and a

over time to permit new industries to replace traditional agriculture as the engine of economic growth.

- When economy moves from one sector to another sector, resources also move from one to another sector so economy grows.

## ⇒ Structural changes &

$$Y = Y_A + Y_I + Y_S$$

This means that the economy depends on 3 sectors

- Agriculture sector.
- Industrial Sectors.
- Services Sectors.

The economy of the underdeveloped countries grow when they move from the traditional societies (agricultural sector) to a more modern Industrial and the Services sector).

domestic economic structures from a heavy emphasis on traditional subsistence agriculture to a more modern, more urbanized, and more industrially diverse manufacturing and service economy.

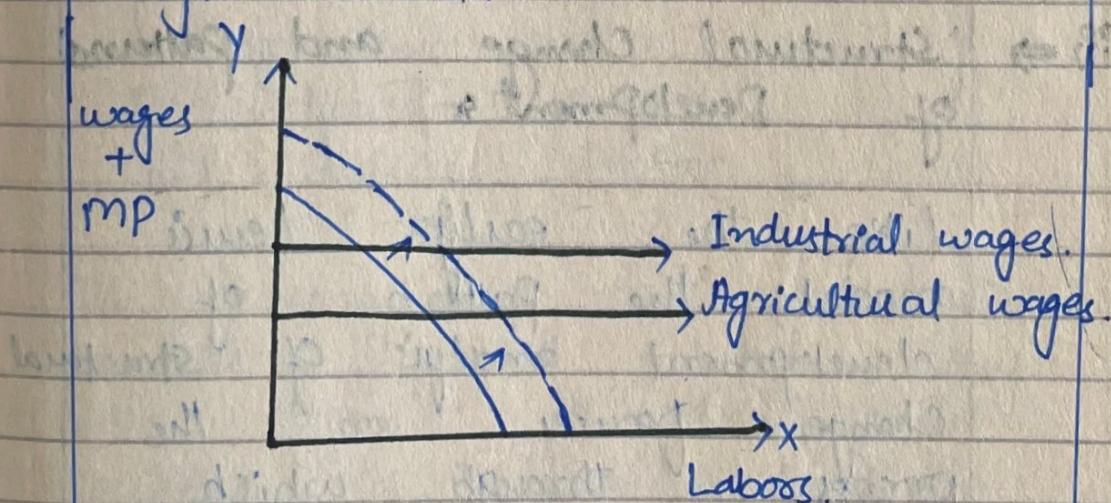
⇒ Two well-known representative examples of the structural-change approach are the "two-sector surplus labor" which is the theoretical model of W. Arthur Lewis and "Patterns of development" empirical analysis of Hollis B. Chenery and his coauthors.

### (i) → The Lewis Theory of Economic Development :-

- The model was given by W. Arthur Lewis in the year 1954
- This model is also known as the (two-sector model or unlimited supplies of labor model).
- This model usually explains

, put to work, the marginal productivity will be diminishing.

- ↳ The surplus labor were attracted by the higher wages in the industrial sector and they migrate to cities.
- ↳ Leading to higher urban profitization which are assumed to be reinvested.
- ↳ This reinvestment leads to growth within sectors, which ultimately cause PPF to shift outward.



### ⇒ Criticisms

- ↳ The model assumed that all the profits will be

to save 15 - 20% of GDP could grow (develop) at a much faster rate than those that saved less.

The mechanism of economic growth and development, therefore would be simply a matter of increasing national saving and investment.

i) → The main obstacle to or constraint on development, according to this theory, is the relatively low level of new capital formation in most poor countries.

ii) → The other constraint to this theory is that how the poor countries will manage to save more.

→ Characteristics of the Model

i) Warranted Growth rate

The warranted growth rate is the growth rate at which all saving is absorbed into investment.

growth in terms of the level of saving plus capital.

⇒ Every economy must save a certain proportion of its national income. However, in order to grow, new investment representing net additions to the capital stock is necessary. If we assume that there is some direct economic relationship between the size of the total capital stock,  $k$ , and the total GDP  $Y$  - for example, if \$3 of capital is always necessary to produce an annual \$1 stream of GDP - it follows that any net addition to the capital stock in the form of new investment will bring about corresponding increase in the flow of national output, GDP.

Suppose that this relationship, known in economics as the Capital-output ratio, is roughly 3 to 1. If we define the Capital-output ratio as

Let us assume further that the national net saving ratio,  $s$ , is a fixed proportion of national output (e.g. 6%) and that total new investment is determined by the level of total savings, we can construct the following simple model of economic growth.

B) Net saving ( $S$ ) is some proportion of national income ( $Y$ )

$$S = sY \rightarrow (i)$$

II) Net investment is defined as change in Capital stock  $K$ .

$$I = \Delta K \rightarrow (ii)$$

And total capital stock has a direct relationship to total national income or output  $Y$ , as expressed by the Capital output ratio,  $R$ .

$$R = \frac{K}{Y}$$

or  $R = \frac{\Delta K}{\Delta Y}$

If, for example, people save 10% of their income, and the economy's ratio of capital to output is 4, the economy's warranted growth rate is 2.5%.

$$\frac{\Delta Y}{Y} = \frac{S}{C} \Rightarrow \frac{10}{4} = 2.5\%$$

### ii) Natural Growth rates

Natural Growth is the Growth an economy requires to maintain full employment. For example. If a labor force grows at + 3% per year, then to maintain full employment, the economy's annual growth rate must be 3%.

$S(L)$  is not discussed in model 3

$\Rightarrow$  He assumes increased Growth by the amount of increase in labor).

### 2) Structural - Change Models

Structural - Change theory focuses on the mechanism by which underdeveloped economies transform their

re-invested in the business.

- ii) Model assumes that there are large number of unproductive labour. Transferring will lead to reduction in agricultural sector.
- iii) Mobility of Labor is not easy.
- iv) Saving is also done by the agriculture sector but Lewis has ignored the saving of agricultural sector.

ii)  $\Rightarrow$  Structural Change and patterns of Development &

Like the earlier Lewis model, the pattern of development analysis of structural change focuses on the process through which the economic, industrial, and institutional sectors structural of an underdeveloped economy is transformed

Workers are attracted to Industrial sector because of higher wages.

- He also said that wages in a Capitalist sectors are more or less fixed.
- And lastly he has said that the profits in the industrial sectors are reinvested in business in business in the form of fixed capital.

### Entire Working of the Model

i) Lewis said that the higher wages in the Industrial sector attracted the labours of the agricultural sector and that was the reason they moved towards the Industrial Sector.

ii) The labor productivity was so low so when they left agricultural sector there was no impact on the output of the agricultural sector.

## \* Rostow's Stages of Growth &

According to Walt W. Rostow, the transition from underdeveloped to developed can be described in terms of a series of steps or stages through which all countries must proceed.

→ Five stages.

### i) Traditional Society &

This type of society is simple and primitive society and its economy is based on agriculture and upto 80% of the people are working in Agriculture.

In such societies there is no technology and their is a tribal system installed.

- Class and Caste system.
- Strong family system.
- No political system.
- Power owned by landlords.
- Religious beliefs.

distant groups, or sizes. A common method is to divide the population into successive quintiles (fifths) or deciles (tenths) according to ascending income levels and then determine what proportion of the total national income is received by each income group.

(table 5.1 Page(205) 8)

Kuznets  $\rightarrow$  ratio, 8

The common measure of income inequality is the ratio of the incomes received by the top 20% and bottom 40% of the population. This ratio, sometimes called as a Kuznets ratio after Nobel laureate Simon Kuznets, has often been used as a measure of the degree of inequality between high- and low-income groups in a country.

In the book example, this ratio of inequality is equal to 51 divided by 14, or approximately 3.64.

the total incomes they receive. The way in which that income was received is not considered. Doesn't matter whether the income was derived solely from employment or came also from other sources such as interest, profits, rents, gifts, or inheritance. Moreover, the locational (urban or rural) and occupational sources of the income (e.g., Agriculture, manufacturing, commerce, services) are ignored.

If Mr. X and Mr. Y both receive the same personal income, they are classified together irrespective of the fact that Mr. X may work 15 hours a day as a doctor while Mr. Y doesn't work at all but simply collects interest on his inheritance

→ Economists and statisticians therefore like to arrange all individuals by ascending personal incomes and then divide the total population into

- Hunting and gathering societies.
- Birthrate high.
- Investment is below 5%.
- Production is limited.

### ii) Pre - Condition for take-off &

- Shifts from agriculture to industry.
- Saving + Investment increases.
- Roads, Railways and Infrastructure advances.
- Birthrate declines.
- Surplus reinvest.
- Elite class emerged.
- Investment is above 5%.
- Personal skills is important.

### iii) Take-off &

Also called Economic dynamic Growth.

- Technological innovation, means that introduction of technology.
- National income increase.
- Foreign trade start.
- To Give important to country product.

iii) So the people moved towards the urban and the people who were in villages enjoy some amount of food + less people.

iv) And those who left the villages to town get increased income, so in this way both of the people were happy/benefiting.

v) So the people who moved towards the town for a better job.

Higher income → high saving →

Investment → more Capital + increased productivity!

## → Summary 8

↳ Initially Labors were employed upon land.

↳ As we know that when more & more labor is

→ tax policy improve.  
→ In this stage economy  
is stable.

The advanced countries, it was argued, had all passed the stages of "take off into self-sustaining growth" and the underdeveloped countries that were still in either the traditional society or the "preconditions" stage had only to follow a certain set of rules of development to take off in their turn into self-sustaining economic growth.

### \* Harrod-Domar Growth model

A functional economic relationship in which the growth rates of gross domestic product depends directly on the national net saving rate ( $s$ ) and inversely on the national capital-output ratio ( $\frac{K}{Y}$ ).

This model explains economies

most likely be appropriated by them, and progress against poverty would be slow, and inequality would worsen. But if it were generated by the many, they would be principle beneficiaries, and the fruits of economic growth would be shared more evenly. Thus many developing countries that had experienced relatively high rates of economic growth by historical standards discovered that such growth often brought little in the way of significant benefits to their poor.

Because the elimination of widespread poverty and high and even growing income inequality are at the core of all development problems and in fact define for many people the principle objective of development policy.

→ Measuring Inequality and Poverty &

→ Measuring Poverty

ii) Headcount index

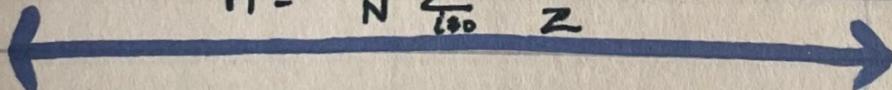
The proportion of population below the poverty line of a country is living below the poverty line.

$$P_0 = \frac{N_p}{N}$$

→ Total Poverty Gap (TPG)

The Total Poverty Gap is the ratio showing the average shortfall from the poverty line of total population.

$$P_1 = \frac{1}{N} \sum_{i=0}^z \frac{G_i}{z}$$



In this section, we define the dimensions of income distribution and poverty problems. But first we should be clear about what we are measuring when we speak about the distribution of income and absolute poverty.

## → Measuring Inequality 8

Economists usually distinguish between two principal measures of income distribution for both analytical and quantitative purposes: the personal or size distribution of income and the functional or distributive factor share distribution of income.

### i) Size Distributions 8

The personal or size distribution of income is the measure most commonly used by economists. It simply deals with individual persons or households and

- Political Revolution.
- Re-investment of profit.
- Investment is about 10%.

## v) Drive to Maturity &

In this stage economy is stable and mature.

- Economy mature
- Technology adopted.
- New economic policy introduced and profit can increase.
- Business expand.
- Agriculture production increase due to technological advance.
- Saving rate 10-20%.
- High standard of living.
- Banking system complex.
- 40-60 years after take-off

## v) Age of high Mass communications

- Luxurious life desired.  
(T.V, A.C, and Airplanes).
- National income increase.
- Per-Capita income increase.
- Investment 20% above.
- Employment.

## Chapter # 03

### ⇒ Classic theories of Economic Growth and Development &

Every nation strives after development. Economic progress is an essential component, but it's not the only component.

- In this chapter, we explore the historical and intellectual evolution in the scholarly thinking about how and why development does or does not take place. We do this by examining four major and often competing development theories.

#### → Classic theories of Economic Development :

##### Four approaches:

The classic literature on economic development has been dominated by four major and sometimes

the lower left corner (the origin) of the square to the upper left corner. At every point of that diagonal, the percentage of income received is exactly equal to the percentage of income recipients. For example, the point halfway along the length of the diagonal represents 50% of the income being distributed to exactly 50% of the population. At the three-quarters point on the diagonal, 75% of the income would be distributed to 75% of the population. In other words, the graph is representative of "perfect equality" in size distribution of income. Each percentage group of income recipients is receiving that same percentage of the total income; for example, the bottom 40% receives 40% of the income, while the top 5% receives only 5% of the total income.

means that our measure of inequality should not depend on ~~the size of economy~~ who has the higher income; for example, it should not depend on whether we believe the rich or the poor to be good or bad people.

→ The scale independence principle means that our measure of inequality should not depend on the size of economy or the way we measure its income i.e. Our inequality measure should not depend on whether we measure income in dollars or cents or in rupees because if we are interested in inequality, we want to measure dispersion of income, not its magnitude.

→ The population independence principle is somewhat similar; it states that

be more equal than the economy D

\* Whenever two Lorenz curves cross, such as curves B and C, the Lorenz criterion states that we "need more information" or additional assumptions before we can draw/ determine which of the economies is more equal.

⇒ One could also use an aggregate measure such as the Gini Coefficient to decide the matter. As it turns out, the Gini Coefficient is among a class of measures that satisfy four highly desirable properties.

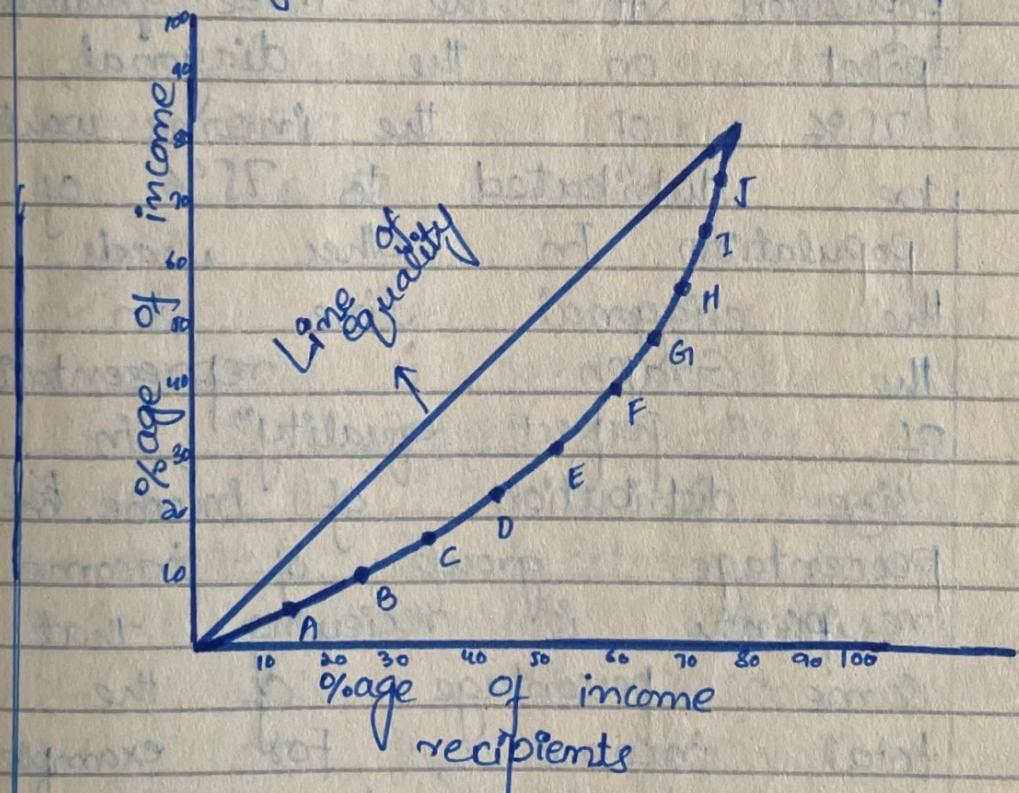
- i) The anonymity (ii) scale independence.
- iii) population independence and iv) transfer independence.

↳ The anonymity principle

## Lorenz Curves

Another common way to construct / analyze personal income statistics is to construct what is known as a Lorenz curve.

"A Lorenz curve is the graphical representation of income inequality. Such as,



The entire figure is enclosed in a square, and a diagonal line is drawn from

## competing strands of thoughts

- 1) The linear stages of Growth model.
- 2) Theories and patterns of structural Change.
- 3) The international dependence revolution.
- 4) The Neoclassical, free market counterrevolution.

1)  $\Rightarrow$  Development as Growth and the Linear stages theories.

Stages of Growth model  
of development. A Theory  
of economic development  
associated with the  
American economic historian  
Walt W. Rostow, according  
to which a country  
passes through sequential  
stages in achieving  
development.

## Poverty, Inequality and Development 8

No society can surely be flourishing and happy, of which by far the greater part of the numbers are poor and miserable

— Adam Smith, 1776

In this chapter, we set the stage with an in-depth examination of the problems of poverty and of highly unequal distribution of income.

That development requires a higher GNI, and hence sustained growth is clear.

The basic issue, however is not only to make GNI grow but also who would make it grow, the few or the many. If it were the rich, it would

the measure of inequality  
Should not be based on  
the number of income  
recipients.

4 Finally the transfer principle which states that, holding all other income constant, if we transfer some income from a richer person to a poorer person, the resulting new income distribution is more equal.

⇒ If we like these ~~for~~ criteria, we can measure the Gini Coefficient in each case and rank the one with the ~~on~~ larger Gini as more unequal.

## iii) Functional Distributions

The second common measure of income distribution used by economists, the functional or factor share distribution of income, attempts

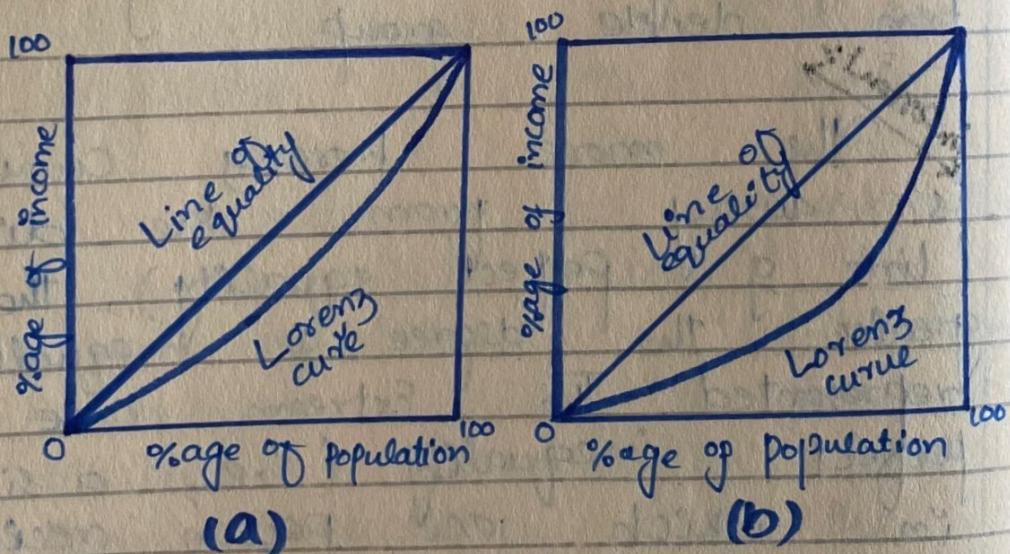
The Lorenz curve shows the actual quantitative relationship between the percentage of income recipients and the percentage of the total income they did in fact receive during, say, a given year.

Here in the graph we have plotted this Lorenz curve using the decile data. In other words we have divided both the horizontal and vertical axes into ten equal segments corresponding to each of the ten decile group.

→ <sup>Important</sup> The more Lorenz curve is away from the diagonal (line of perfect equality), the greater the degree of inequality represented. The extreme case of perfect inequality (i.e., a situation in which one person receives all of the national income while everybody else receives nothing) would be represented by the Lorenz curve with the

bottom horizontal and right hand vertical axes. Because no country exhibits either perfect equality or perfect inequality in its distribution of income, the Lorenz curves for different countries will lie somewhere to the right of the diagonal.

⇒ The Greater the curvature of the Lorenz Line, the Greater the Relative Degree of Inequality &



(a) → A relatively equal distribution

(b) A relatively unequal distribution

to explain the share of total national income that each of the factors of production (Land, Labor, and Capital) receives. Instead of looking at individuals as separate entities, the theory of functional income distribution inquires into the percentage that labor receives as a whole and compares this with the percentages of total income distributed in the form of rent, interest, and profit (i.e., the returns to Land and financial and Physical Capital). Although specific individuals may receive income from all these sources, that is not a matter of concern for the functional approach.

### → Poverty &

Poverty is about not having enough money to meet basic needs including food, clothing and shelter.

is spent on Investment.

⇒ Initially when.

i) Investment > Depreciation = Capital grows.

ii) Investment < Depreciation = Capital shrinks.

iii) At SS the investment = Depreciation  
At this point all investments  
is used to maintain depreciation.

So, basically the Economy  
will always end up at  
Steady state (SS)  
and the steady state is  
the key to understanding the  
Solow growth model.

The steady state means that  
economy keep growing stating  
on the point of equilibrium

Notes