

UNIT II

CLASSICAL GROWTH MODELS

Mrs JOHN ROBINSON'S GOLDEN AGE MODEL OF ECONOMIC GROWTH

It is simple model based on the capital rules of the game. According to her, if they have no profit entrepreneurs cannot accumulate, and if they do not accumulate, they have no profits. Thus, accumulation of profit is the pivot around Robinson theory of economic growth.

The model of economic growth is based upon two fundamental factors are:

- a. The capital formation is conditioned by the manner in which income is distributed in the economy.
- b. The rate at which labour is utilised is a function of the supply of capital and the supply of labour.

ASSUMPTIONS

- a. There is a laissez faire closed economy.
- b. Labour and capital are only productive factor in the economy.
- c. Capital and labour are employed in fixed proportion for a given output.
- d. Technological progress is static.
- e. Labour is in abundance and entrepreneurs can employ as much as labour as the wish.
- f. The entire income is distributed between two classes – the workers and entrepreneurs.
- g. Entrepreneurs constitute the only saving-investing class in the economy.
- h. There is no change in the price level.
- i. Entrepreneurs are only source of capital formation.
- j. The total national income is the sum of total wages-bill and total profits.
- k. Total wage-bill is the product of real wage rate and number of workers.
- l. Total profit is the product of profit rate and the amount of capital invested.

MATHEMATICAL INTERPRETATION

She begins with this formal statement that the national income includes the sum of total wage amount and total profits. The total wage amount is the real rate multiplied by the number of workers, and the total profits are equal to the rate of profit multiplied by the amount of capital. This can be stated as the following equation:

$$Y = wN + pK$$

Where, Y = the national income, w= the real wage rate, N= the total number of workers, p= the rate of profit, K the amount of capital.

From the above equation it easily calculate the value of p which stands for the rate of profit, and which is important for capital accumulation. It may expressed as:

$$P = \frac{Y - wN}{K}$$

Where p rate of profit, is the ratio of total income(Y) minus total wage bill (wN) to the amount of capital (K). Since the profit per labourer employed is the difference between the output per labourer and the real wage, the rate of profit would depend on labour productivity, the real wage rate and the amount of capital per labourer. The rate of profit would also rise if the ratio of capital to labour decreases.

INCOME SIDE

The rate of profit can be increased, provided the income accelerates, but the rate of wage remains constant or the wage rate decreases, if income remains constant and or the capital-labour ratio decreases. These are only the conditions when the producers will be able to maximise their profits.

EXPENDITURE SIDE

The national income (Y) should equal to the aggregate consumption (C) and aggregate investment (I). The equation may be:

$$Y=C+I$$

The saving must be equal to investment in order to fulfil the conditions of equilibrium and that may be termed in the form of equation:

$$S=I$$

Mrs. Robinson's model of growth assumes that workers by nature are extravagant. They save nothing and consume their entire wages, and secondly, the entrepreneurs consume nothing and invest their entire profits. Under these conditions, the saving-investment relationship may be represented as:

And $S=PK$
Since $I=\triangle K$ where $\triangle K$ represents the net growth in real capital.
or $S=I$
 $pK = \triangle K$
 $p = \frac{\triangle K}{K}$

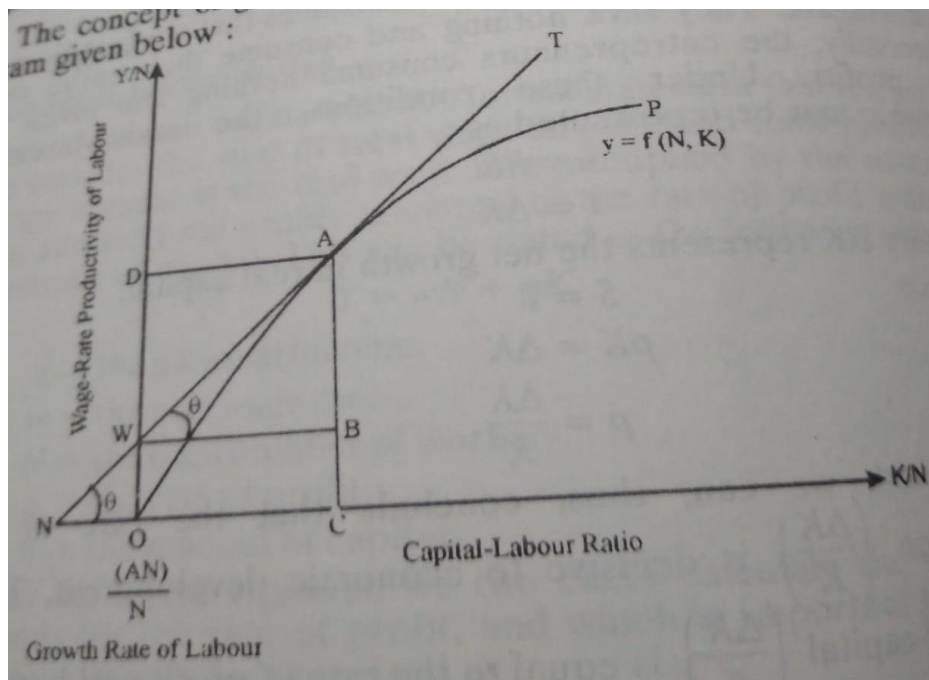
It concluded that the rate of capital accumulation $\triangle K / K$ is decisive to economic development. The rate of growth of capital $\triangle K / K$ is equal to the rate of profit and hence it can be said that both of them depend on each other.

GOLDEN AGE

If growth rate of population is equal to the growth rate of capital, there will full employment of both labour and capital in the economy. Mrs. Joan Robinson call this the golden age. The golden age corresponds to a situation where the natural, the warranted and actual rate of growth of national income are all equal. It represents a state of economic bliss, since consumption is in increasing at the maximum technically feasible rate which is compatible with maintaining the rate of increase.

It is the indicator of full employment of labour and full utilisation of capital in the economy.

DIAGRAM



OX axis represents capital labour ratio, OY axis represents wage rate of labour. OP is the production function curve. It implies the proportion in which labour and capital are combined to produce a particular level of output. At the point A capital ratio is OC, and the productivity of labour is OD and out of OW is the wage rate. The surplus WD is the rate of return to capital. It also said that at point at A, the growth rate of capital is equal to growth rate of labour.

STATE OF DISEQUILIBRIUM

If rate of growth of population exceeds the rate of growth of capital, a return to the golden age would be possible under certain conditions.

If the rate of growth of capital exceeds the rate of growth of population, there is a possibility of golden age equilibrium being restored through technological improvements leading to a higher capital-output ratio.

TYPES OF GOLDEN AGE

1. Limping Golden Age – Capital growth is not sufficient.
2. A Restrained Golden Age – Capital is lower than desired growth rate.
3. A Bastard Golden Age – capital stock does not grow.
4. Platinum Age --- development parameters are considered as rigid.

CRITICISMS

- A. Based on unrealistic assumption.
- B. Ignores the role of institutional factor.
- C. Closed economy.
- D. Ignores the role of human capital.
- E. Ignores State role.
- F. Limited significance to UDEs.
- G. Capital and labour are employed in a fixed ratio.
- H. Neutrality to policy implications.

NEO-CLASSICAL MODELS

MEADE'S NEO-CLASSICAL MODEL OF ECONOMIC GROWTH

Meade's model analyses the relationship between income, capital, labour and technology. This model also called as "Model of steady growth". He explain the relationship between population growth and income growth.

Basic three principles for the economy grows are:

- a. Capital accumulation.
- b. Growth of working population.
- c. Technical progress.

ASSUMPTIONS

- a. Closed economy.
- b. There is a laissez –faire economy.
- c. Perfect competition prevail in the economy.
- d. Only two commodities – consumption goods and capital goods are produced.
- e. Machines, land and labour are factors of production.
- f. Money prices of consumption are remains constant.
- g. All machines are alike.
- h. Perfect substitutability between consumption and capital goods.
- i. There is a depreciation of machines every year.
- j. No government intervention.

EXPLANATION OF THE MODEL

According to the model, net output produced in an economy depends on four things:

- a. Net stock of capital -- Machinery
- b. Labour force.
- c. Land and natural resources.
- d. Technological knowledge.

It expresses as $Y = F(K, L, N, t)$. Where Y is net output. K is existing stock of capital. L is existing labour force. N is natural resources and t stands for technical knowledge.

First K increases – saving- investment – change in investment- increase in marginal product of capital (V. K) ▲

Second L increases - increase employed labour L total ▲ output increase by W ▲ L (Marginal product of labour).

Third Land and natural resources are fixed. No change in N.

Fourth t technology cannot remain constant.

The net increase total output in any year is the sum total of the contribution of L, K and t. symbolically:

$$\text{▲} Y = V \text{▲} L + W \text{▲} L + \text{▲} Y.$$

The proportionate rate of growth of output is the ratio of increase to initial amount of capital, is therefore,

$$\text{▲} Y / Y = V K / K + W L / Y \cdot \text{▲} L / L + \text{▲} Y' / Y.$$

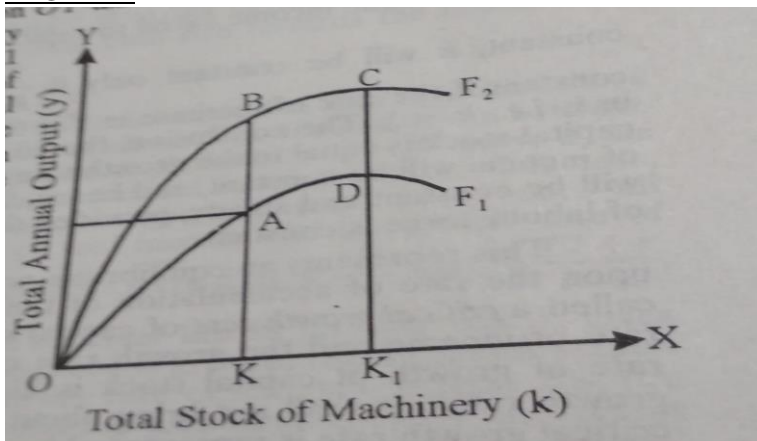
The proportional marginal product of capital represent by U, and Q stands the proportional product of labour. The basic relationship can,

$$Y = UK + QL + t.$$

Where Y is growth rate of output, K capital stock weighted by the proportional marginal product of capital (U) plus L labour force weighted by the proportional marginal product of labour (L) plus t growth rate of technical progress.

The growth of the economy is shown by rise in the per capita real income. (Y-1). It expressed as $Y-1=UK-(1-Q)^{1+r}$.

DIGRAM



OX axis total stock of machinery, OY axis total annual output. OF1 production function. OK is quantity of machinery. KA is amount of production. The point A indicates the MP of machinery which falls as we proceed towards the right along with the curve, because of LDMR also applies, like other factors on machinery. Thus the MP of machinery will be less at point C in comparison to point A.

In the 2 year the production function shifts to (OF2) for technical progress. Total production increases from KA to KB using the same stock of machinery OK. The total stock of machinery is raised to OK1, the production will increase from K1D to K1C in the corresponding years. Thus, the figure reveals that the technical progress is likely to increase the total annual output.

STATE OF STEADY ECONOMIC GROWTH

Meade examine this question under following assumptions:

- a. All elasticity's of substitution between the various factors are equal.
- b. Technical progress is neutral.
- c. The proportion of profits, wages and rents saved are all constant.

Accordingly, total savings are $S= SvU+S_wQ+S_gZ$. As assumed l and r constant, the proportional marginal product U and Q will be constant. So S_v , S_w , and S_g are also constant. Hence, the rate of growth of income(Y) will be constant only if rate of growth capital (k) constant. But the growth rate of capital (k) is the ratio of the proportion of the income saved to capital stock $K=SY/K$. since S is constant, k will be constant only if Y/k is constant. Now Y/K will be constant if the rate of increase in income as the rate of increase on k ($k=y$).

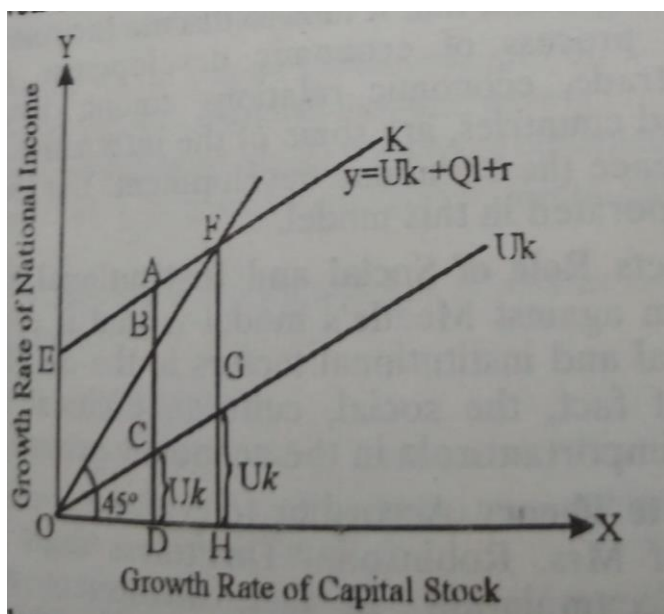
Therefore, the growth rate of capital stock is equal to growth rate of income, the growth rate income will be constant, and hence, the per capita growth of income will be constant and steady, provided the proportionate rate of growth of labour force is constant.

CRITICAL GROWTH RATE

If actual growth rate of growth of capital stock is higher or lower than the critical growth rate, it shall not bring about equality between Y and k . If critical growth rate is represented by α , the basic relationship will be indicated by the following equation:

$$\alpha= U\alpha+Ql+r \quad \text{Or } \alpha=Ql+r/l-U.$$

DIAGRAM



OY axis growth rate of capital stock, OY axis national income. $AD = AC + CD$.

$$AC = OE$$

$$OE = Ql + r$$

$$CD = Uk$$

$$\text{Hence } AD = Ql + r = Ur$$

Critical growth rate can also be derived from this diagram

$$HF = Uk + Ql + r$$

$$HF = GH + FH + GF \quad Ql + r = GF$$

$$HF - GH = FH = GF$$

$$FH(1 - GH) = GF \quad (\text{or})$$

$$FH = GF / (1 - GH) = Ql + r / (1 - u)$$

CRITICISMS

- a. Based on unrealistic assumption.
- b. Mathematic method.
- c. Neglects investment function.
- d. International forces not discussed.
- e. Neglect role of social and institutional factors.
- f. Obsolete theory.
- g. Lacks empirical evidence.
- h. No place for uncertainty.
- i. Based on closed laissez-faire economy.

HARROD-DOMAR GROWTH MODELS

Both of them are great prominent mathematical economists. These models stress the conditions which are very essential for achieving and maintaining steady growth.

ASSUMPTIONS

- a. Full employment equilibrium level of income.
- b. There is no state interference.
- c. It operates in a closed economy.
- d. No lags in adjustments between investment and creation of productive capacity.

- e. APS is equal to MPS.
- f. The MPS remains constant.
- g. The capital stock of income is assumed to be fixed.
- h. There is no depreciation of capital goods.
- i. Saving and income relate to the income of the same year.
- j. The general price level is constant.
- k. There is no change in interest rates.
- l. There is fixed proportion of capital and labour in the productive process.
- m. There is only one type of product.

EXPLANATION

The basic idea underlying this model is capital accumulation. It plays a crucial role in the process of economic development. It takes both sides of the investment process, namely, the supply side as well as the demand side. Classical economists considered only the supply side of capital accumulation (Saving side). On the other hand, Keynes considered the demand side of capital accumulation. The HO model lies in the fact that it considers both demand and supply of capital accumulation. In fact, it represents an integration of the classical and Keynesian analyses of economic growth.

The HO model starts from a position of full employment level in income. Investment and growth of income must go side by side. An increase in capital accumulation (investment) expands the productive capacity of the economy. This results in an adequate increase in income of the community to absorb the increased output. So, this model clearly points out that excessive accumulation of capital unaccompanied by an adequate increase of income would lead to overproduction, unemployment and depression in the economy.

HARROD'S MODEL OF ECONOMIC GROWTH

He propounded two models of economic growth:

HARROD'S FIRST MODEL OF ECONOMIC GROWTH

ASSUMPTIONS

- a. Constant returns scale holds.
- b. The capital and labour output ratio are assumed to be constant.
- c. The level of ex-ante aggregate saving is constant proportion of aggregate income.
- d. Technology remains constant.
- e. The entrepreneur desires to undertake investment depending on how quickly output is increasing.

EXPLANATION

There are three main issues on which he concentrates in his growth model.

- a. How can steady growth rate be achieved in the model?
- b. How can steady growth rate be maintained?
- c. How do natural factors put a ceiling on the growth rate of the economy?

Answering the above three questions, Harrod's model is based on the following three distinct rates of growth:

- a. Actual Growth Rate (G)
- b. Warranted Growth Rate (G_w)
- c. Natural Growth Rate (G_n).

THE ACTUAL GROWTH RATE (G)

It is determined by the saving ratio and capital output ratio. It indicates cyclical variations in the growth rate. Thus, growth rate is determined by the actual amount of saving and investment available in the economy.

(i) $GC = S$. Where G represents the growth rate of output. ($G = \frac{\Delta Y}{Y}$). C increase in capital ($C = I/\frac{\Delta Y}{Y}$). S stand for APS ($S = S/Y$). The equation (i) can be rewritten as $\frac{\Delta Y}{Y} \cdot I/\frac{\Delta Y}{Y} = S/Y$ or $I/Y = S/Y$ or $I = S$. He takes S and I in the ex-ante sense. To maintain full employment.

WARRANTED GROWTH RATE (Gw)

It refers to that growth rate of the economy, when it is working at the full capacity by making the full and optimum use of machine and manpower. It is known as “Full Capacity Growth Rate” or Full Employment Growth Rate or Potential Growth Rate”. Gw is interpreted as the rate of income growth required for the full utilisation of a growing stock of capital, so that entrepreneurs will be satisfied with the amount of investment actually made.

It (Gw) was determined by two factors – capital output ratio and saving-income ratio. It is expressed as (ii) $Gw Cr = S$. Where Gw = Warranted growth rate, Cr = capital required to maintain growth, S = saving income ratio.

The two equations now are

- (i) $GC = S$
- (ii) $GwCr = S$

Therefore $GC = GwCr$. If G exceeds Gw, C must be less than Cr. It means that actual quantity of capital goods would be less than the desired quantity of capital goods. Orders for new capital goods will increase. This would automatically increase G which, in turn, would require more of C, leading to the continuous expansion of the economy.

On the other hand if Gw exceeds G the actual growth rate falls short of warranted growth rate, then Cr would be less than C. It means desired capital equipment would be less than actual equipment. Orders for new capital equipment will be reduced. This reduces G which, in turn, further depresses C, leading to depression in the economy.

NATURAL GROWTH RATE (Gn)

It is the trend in production with full employment and no inflation. It is the rate of advance, which the increase of population and technological improvements allow. It depends on macro variables like population, technology, natural resources and capital equipment. It is expressed as (iii) $Gn Gr = \text{or } \neq S$.

When G exceeds Gw there is a cumulative boom of continuous expansion in the economy until Gn is reached. The economy cannot rise above Gn because of the limitations of natural resources and labour supply.

When G touches Gn Gw catches up with it. G cannot rise further, Gw tends to exceed G. There will be a continuous downtrend in the economy. During this period capital will be reduced, but fixed capital will not fall, because orders cannot be reduced below zero.

HARROD'S SECOND MODEL OF ECONOMIC GROWTH

This second model was intended to cover the UDC. He examines the role of interest rate in determining the supply and demand of saving. According to him, the natural rate of interest corresponds to the natural growth of income and is determined by the natural rate of growth of per capita output Pc and elasticity of the schedule of the diminishing utility of income.

e. A large value of e implies that the utility of income declines rapidly when income grows in size.

(iv) $rn = PcGn/e$. Where rn = natural rate of interest, Pc = natural rate of growth of per capita output, and e indicates the elasticity of schedule of the diminishing utility of income. With given values of Pc and Gn the natural rate of interest will be low if e happens to be large and vice versa.

In case S (saving) exceeds Sr (social requirement saving), the Gw would be above Gn . The entrepreneur would like to increase investment because of the availability of larger savings.

On the contrary Sr exceeds S investment will exceed savings, giving rise to the possibility of inflation. The possibility of inflation is real and not an imaginary possibility of UDCs.

DOMAR MODEL OF ECONOMIC GROWTH

According to him, investment on one hand and increase productive capacity on the other, at what rate investment should increase in order to make the increase in income equal to the increase in productive capacity.

ASSUMPTIONS

- a. There is initial full employment level of income.
- b. APS and MPS are equal.
- c. The propensity to save and capital coefficient are considered constant.
- d. Depreciation is measured to the cost of replacement of depreciated asset.
- e. There are no lags in adjustments.
- f. Absence of government intervention.
- g. Closed economy.

SYMBOLS USED IN DOMAR'S MODEL

Y_d = net national income Or effective demand at full employment (demand side).

Y_s = productive capacity or supply at full employment (supply side).

K = real capital

I = net investment

∞ = MPS, $1/\text{multiplier}$.

α = productivity of capital or net investment.

According to his model is simple, it consists of two important points. (i). it increases the productive capacity of the economy, and (ii) it generates additional income. The growth of the economy will be stable only if the additional income generated is adequate to absorb the increased productive capacity.

The change in investment multiplied by the multiplier gives the total increase in income in the economy. If full employment is maintained, then the demand for output shall be equal to the supply of output as the income grows consequent upon investment. In other words of Domar, maintenance of a continuous state of full employment requires that investment and income grow at a constant annual relative rate equal to the product of the propensity to save and the average productivity of investment.

SIMILARITIES BETWEEN HARRODS-DOMAR MODEL

- a. Both the model are based on similar assumptions.
- b. Both model employ the Keynesian saving-investment equality as the equilibrium condition.
- c. $Gw = \infty$ and α .
- d. Both model solve the problems of advances economies rather than backward and poor economies.
- e. Both models are designed in terms of experimental equilibrium path.
- f. Both models agree to the maintenance of full employment rise in income.
- g. Both model feel for the introduction of dynamic element for attaining steady growth in economy.

DIFFERENCES

- a. Harrod recognise business cycle as an important segment of the growth process. Domar does not agree on this point.
- b. Harrod give importance to income. Domar give importance to investment.
- c. $H = Gw$, Domar $\frac{I}{Y} = \frac{G}{\alpha}$
- d. Harrod used three growth rates G , Gw , Gn . Domar based on one growth rate $r = \infty$ and α .
- e. Harrod used marginal capita output ratio. Domar used reciprocal of marginal capita output ratio.
- f. Harrod considers behaviour pattern essential for entrepreneurs. Domar does not suggest the behaviour pattern.
- g. Harrod model is based on the principle of acceleration. Domar's model is based on the principle of multiplier.

CRITICISMS

- a. Unrealistic assumption.
- b. Model refer to aggregates only.
- c. Fail to consider the changes in the general price level.
- d. Not empirically true.
- e. Wrong to consider interest rate constant.
- f. Non-economic factors ignored.
- g. Variables expressed in real terms.
- h. Exaggeration of instability.
- i. Natural growth rate open to objections.
- j. Little application to UDCs.
- k. Ignore the effect of government programme on economic growth.
- l. Study of technical change ignored.

APPLICABILITY OF HARRODS-DOMAR MODELS IN UDCs.

This model offer little help in solving the problem of growth in the UDCs. It may not applicable to UDCs due to certain limitations are:

- a. These models also attempt to explain the problem of secular stagnation which arises only in the developed countries of the west, not the UDCs of Asia or Africa.
- b. The problem of unemployment.
- c. Secular stagnation or laissez –faire.
- d. Saving ratio.
- e. Disguised unemployment.
- f. Financial assistance and foreign trade.
- g. Price changes.
- h. Institutional changes.

MAHALANOBIS MODEL OF GROWTH

He is an eminent Indian economist. He was requested by the government of India to prepare the blue print of the development model for India's Second Five Year Plan so as to enable the country to achieve the object of five per cent increase per annum in national income throughout the plan period and create additional employment opportunities for the millions of unemployed youth also who are leading a miserable life. Unemployment is a basic problem of our country.

He developed three models of growth

First was developed in October, 1952, on the variables of national income and investment.

Second growth model was developed in 1953 in which economy was divided in two sectors i.e., investment goods sector and consumer goods sector.

Third growth model was developed in 1955. It is four sector model which is a famous model.

TWO-SECTOR MODEL (1953)

According to this model the entire net output of the economy is divided into two sectors – the investment goods sector and the consumer goods sector. These two sectors are assumed to be vertically integrated within themselves. It is great significance in the sense that it provides the basis for the formulation of the four-sector model (1955) for the second five year plan.

ASSUMPTIONS

- a. Two sectors are investment and consumer goods sectors.
- b. Closed economy.
- c. The supply of capital goods determined the investment.
- d. There is no intermediate sector.
- e. The economy maintain full capacity of production.
- f. There is absolutely non-transferability of capital equipment.
- g. There is stability of process during the plan.
- h. Marginal utility of consumption remains constant.
- i. The rotation period of capital is constant.
- j. There is increase in national income in one sector is not neutralised.

MAHALANOBIS EQUATION OF THE MODEL

He divides the economy into two major sectors – the investment goods sector (k) and consumer goods sector (c). In this model, β_k and β_c represents the output –capital ratio in the two sector k and c. Further λ_k presents the proportion of net investment going to capital – goods sector and λ_c to the consumption sector. Hence, $\lambda_k + \lambda_c = 1$. The net investment (I) at any point of time (t) may be divided into two sectors – $\lambda_k I_t$ to investment goods sector, and $\lambda_c I_t$ to the consumption goods sector, i.e.,

$$I_t = \lambda_k I_t + \lambda_c I_t$$

▲ I_t and ▲ C_t - show the growth in investment and consumption goods. It increase in any period (t), depend upon net investment in the preceding period marked by I_{t-1} .

FOUR SECTOR MODEL (1955)

This model is basis for preparing the draft of India's second five Year plan. Maximum funds available during the second five year plan and provide additional employment. To these 5 per cent per annum increase in the national income during the second plan period.

DIVISION OF THE ECONOMY

He divided the economy into the following four sectors:

- a. Investment goods sector (k).
- b. Factory produced consumer goods sector (C).
- c. The small household produced consumer goods sector (agricultural products and small and domestic industries) (C2)
- d. Service producing sector (health, education etc) (C3)

The chief objectives of this four sector model was to give a better understanding of the process of the growth income. The model was designed including two basic objectives: (a) the rate of growth in income (r) is achieved five per cent per annum, and (b) increase in employment (N).

CRITICISMS

- a. Arbitrary value of λk .
- b. Fails to solve any welfare function by model.
- c. Closed economy.
- d. Supply of labour force also not infinitely elastic.
- e. Supply of agricultural products not infinitely elastic.
- f. Silent over pattern of investment in missed economy.
- g. Production technique not constant.
- h. Failure to explain the problem of choice of technique.
- i. Failure to link up investment decisions with rates of savings required.
- j. Arbitrary values for structural parameters.
- k. Stability of prices.
- l. Ignores factor prices.

REFERENCES:

1. M.L. Jhingan, *Economic Development and Planning*, Chand and & Co. New Delhi.