Growth equilibrium

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ABSTRACT

The total differential is equal to the total change on production. a change in production is nothing but economic development or economic growth. The average growth rate from 2017 to 2025 is 5.96 and the S.D i5.94. As technology in short period is constant. The magnitude of growth will depend on the level of change in production and both are equal too. But there is a budget constrain. Within given constrain a producer should produce maximum output. It can be possible where isoquants tangents budget line. All equilibrium points will construct growth path.

Keywords: Growth, Economic development, Production, Marginal physical products, Force, market, National income.

1. Introduction:

Production is an indispensable element in economic development. It stimulates and dynamizes the economic forces in the market system. The amount of value added is a measure of economic progress of the country. It is therefore, marginal physical product of production factor can be considered as the economic progress in the economy. The economic progress in other wards economic development which is substituted by the term economic growth because we measure the economic development by the scale of increment in terms of real national income. Growth is the increment of total production in any unit period expressed as a fraction of total production (R. F Harrod, 1948). Economic growth therefore, is total derivative of production function. That is

$$P = f(v_1, v_2 \ldots\ldots, v_n) \quad \ldots\ldots.. 1.1$$

Differential P with respect to v_i, $v_i = (v_1, v_2 \ldots\ldots., v_n)$

$$\frac{\partial p}{\partial vi} = \frac{\partial p}{\partial vi}\, \partial v_i \quad \ldots\ldots\ldots\ldots 1.2$$

Or

$$\frac{\partial p}{\partial vi} = \frac{\partial p}{\partial v1} + \partial v_1 + \frac{\partial p}{\partial v2} + \partial v_{2+.} \ldots\ldots + \frac{\partial p}{\partial vn} + \partial v_n \quad \ldots\ldots\ldots. 1.3$$

∂v_i approaches to zero, therefore, mathematical formula for economic growth is

$$\lim_{\Delta vi\to 0}\frac{\partial p}{\partial vi} = \lim_{\Delta v1\to 0}\frac{\partial p}{\partial v1}\,.\,\lim_{\Delta v1\to 0}\Delta v1 + \lim_{\Delta v2\to 0}\frac{\partial p}{\partial v2}\,.\,\lim_{\Delta v1\to 0}\Delta v2 + \ldots + \lim_{\Delta vn\to 0}\frac{\partial p}{\partial vn}\,.\,\lim_{\Delta vn\to 0}\Delta vn$$

We can find the magnitude of economic growth with the help of Cobb – Douglas production function. That is

$$P = bL^kC^{k-1} \ldots\ldots 1.4$$

The production factors are increased by λ times then

$$P = b(\lambda L)^k(\lambda C)^{k-1}$$

$$= \lambda^{k+k-1}bL^kC^{k-1}$$

$$= \lambda\, bL^kC^{k-1}(k+k-1=1)$$

Therefore,

$$\lambda P = (P = bL^kC^{k-1}) \ldots\ldots. 1.5$$

The equation reveals that if the production factors increased by λ times the production is also increased by λ times. Mathematically that is

$$\partial v_i = \lambda \ \ldots\ldots\ldots 1.6$$

$$\partial P = \lambda \ \ldots\ldots.. 1.7$$

Therefore the economic growth $\left(\frac{\partial p}{\partial vi}\right)$ is

$$\left(\frac{\partial p}{\partial vi}\right) = \frac{\lambda}{\lambda} = 1 \ \ldots. 1.8$$

Capital, usually, not necessarily exclusively buildings, machines but raw material also come under capital but it is not a fixed capital, it is variable capital. Let us see what kind of relationship be between production and production a factor that is variable capital.

$$P = x(x) \ldots\ldots 1.9$$

Left side of the x indicates function and right side x represents variable capital. For finding the magnitude of marginality in production due to an augment in supply of variable capital, derivate partially the given production function. That is

$$\Delta p = x(\Delta x) \ldots\ldots 1.10$$

$$\Delta p = x(x+\Delta x) - x(x) \ldots. 1.11$$

$$\frac{\Delta p}{\Delta x} = \frac{x(x+\Delta x) - x(x)}{\Delta x} \quad .....1.12$$

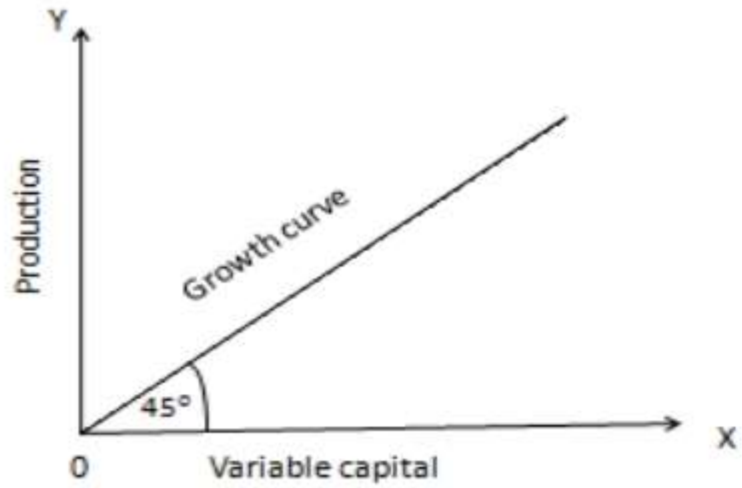
$$\lim_{\Delta x \to 0} \frac{\Delta p}{\Delta x} = \lim_{\Delta x \to 0} \frac{x(x+\Delta x) - x(x)}{\Delta x} \quad ......1.13$$

Δx approaches to zero production also approaches zero.

The conclusion of above discussion emphasizes R F Harrod's words which have been mentioned above. The conclusion of the discussion ascertains that is shown below graph.

Figure No.01

The functional relationship between variable and production



The figure shows economic growth based on Cobb – Douglas production function. The function in the figure determines that production is directly proportion to variable cost. The figure emphasizes that the volume of marginal physical product due to a small change in variable capital is equal to the magnitude of economic growth. Hence,

$$\lim_{\Delta x \to 0} \frac{\Delta p}{\Delta x} = \lim_{\Delta x \to 0} \frac{x(x+\Delta x) - x(x)}{\Delta x} = G_e \quad ....1.14$$

Or

$$G_e = \frac{\Delta p}{\Delta x} \quad .....1.15$$

Here, G_e indicates economic growth.

2. Data analysis:

The production particularly Cobb – Douglas production function determines that marginal physical product is proportion to the marginal volume of its production factors. So that incremental change in production is equal to incremental change in production factors as the elasticity of labour and capital k and k-1 respectively are equal to one together. The producer therefore receives constant returns. However, the production functionemphasis the essentiality of production factors in the economic process.

Table N0.02

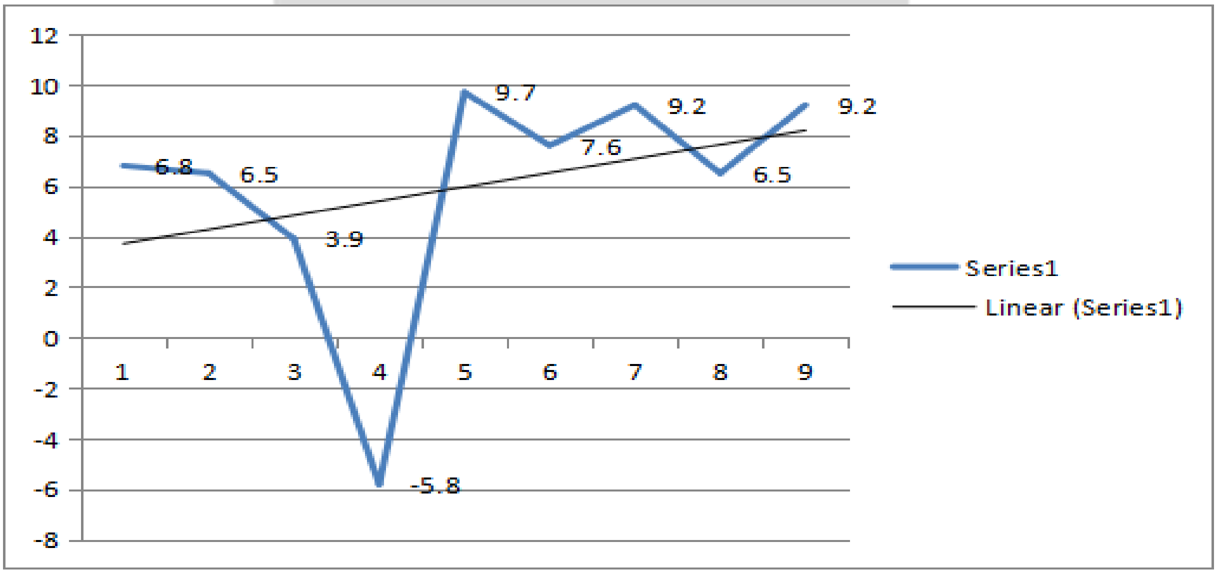
Growth rates in India from 2017 to 2025

(in per cent)

Sl.NO	year	Growth rate
1	2017	6.8
2	2018	6.5
3	2019	3.9
4	2020	-5.8
5	2021	9.7
6	2022	7.6
7	2023	9.2
8	2024	6.5
9	2025	9.2

Source: UNO

figureNo.02
Growth rates in India from 2017 to 2025



For comprehensive understanding we should study the graph as well as given data together.

Source: Table No.02

Though fluctuations in growth rates are there in the given data the overall trend is increasing that shown in below figure. The ups and downs in the data ascertain deviation that is in considerable level. The average growth rate is 5.96 and deviation is 5.94.In spite of the trend line in the figure indicates directly the tendency of growth in India based on the give period, indirectly it indicates an increasing way of consumption of the production factors. We know that

$$\Delta p = \Delta v_i = G_e \quad .....2.1$$

The equation seems to be perfectly equal but it is true, some short fall is there in the equation. Input is in fact is not equal to product only. Some kind wastage is also come out simultaneously along with product in a production process. the input equation can be rewritten that is

Input = change in output + change in wastage

It is in mathematical expression

$$V_i = P + V_W \ ......2.2$$

Or

$$P + V_W = f(V_i) \ ....2.3$$

$$\Delta V_i = \Delta P + \Delta V_W \ ....2.4$$

$$\frac{dvi}{dvi} = \frac{dp}{dvi} + \frac{dvw}{dvi} \ ...2.5$$

$$\lim_{\Delta vi \to 0} \frac{dvi}{dvi} = \lim_{\Delta vi \to 0} \frac{d}{dvi} \cdot p + \lim_{\Delta vi \to 0} \frac{d}{dvi} \cdot v_w ...2.6$$

V_i represents total input P represents product and V_W wastage or other than product which comes out in the production process along with product. The equation 2.6 V_i approaches to zero $P+ V_W$ also approaches to zero. It means a small change in V_i leads to small change in $P+ V_W$.

Now, let us derivate economic growth from production in order to bring it nearer to truism by mathematical expression.

$$Ge = \lim_{\Delta vi \to 0} \frac{d}{dvi} \cdot p + \lim_{\Delta vi \to 0} \frac{d}{dvi} \cdot v_w ...2.7$$

The equation 2.7 not only establishes the links between left and right sides. If we want to achieve economic growth we have to obtain positive change in production but also bear positive wastage or output other than product or real income.

An efficient entrepreneur maintains always balance between output and budget constrain (α) forsake of attaining maximum profits. The objective of an entrepreneur in mathematical expression is

$$P + v_w = \alpha \ ....2.8$$

If we want to increase production or get economic growth there is a need to enhance budget allocation than previous allocation. The equation 2.8 is rearranged to represent economic growth, that is

$$\frac{d}{d\alpha} . p + \frac{d}{d\alpha} . v_w \leq \Delta\alpha = \text{Ge} \ ....2.9$$

An entrepreneur should minimize the production cost to reach his objective that is maximum profits by maximizing the volume of production. The cost of other than goods exists in the total cost.

$$C = p_g . p + vw . p \ ....2.10$$

C indicates total cost, G represents production of goods, v_w is a sign of volume of other than products and p_g p_v represent price of goods and wastage or other than goods.

$$C = G . p_g + v_w . p_v \ ......2.11$$

Economic growth measures at constant prices so p_g and p_v are constant. Therefore C can change due to change in amount of remaining elements. It is shown mathematically as

$$\Delta C = \Delta G . p_g + \Delta v_w . p_v \ .....2.12$$

The equation 2.12 should satisfy the budge constrain so that

$$\Delta C \leq \Delta\alpha \ ......2.13$$

$$\Delta G . p_g + \Delta v_w . p_v \leq \Delta\alpha \ .....2.14$$

The level of v_w is indicated by k which is a ratio and constant as in short period there is no change in technology and production process. k expresses in percentile ($k = \frac{Vw}{100}$), the total wastage id equal to k times to total production factors V_i that is ($k . v_i$).

It is clear when read equation 2.9 with equation 2.14 that the maximum economic growth is

$$\Delta G . p_g + \Delta v_w . p_v \ .....2.15$$

$$\Delta G . p_g + \Delta v_w . p_v = 0 \ .....2.16$$

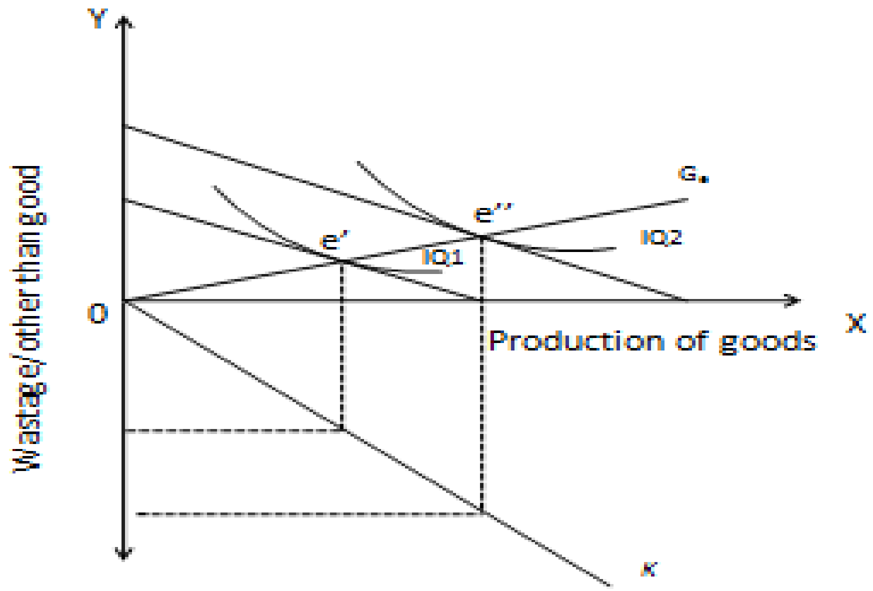
$$\Delta G . p_g = \Delta v_w . p_v \ .....2.17$$

$$\Delta v_w \div \Delta G = p_g \div p_v \ ......2.18$$

$\Delta v_w \div \Delta G$ indicated Isoquant and $p_g \div p_v$ represents budget line. The economy will be in equilibrium related to economic growth where isoquants tangents budget line. It is explained below with a figure.

Figure No.03

Growth equilibrium



The equation 2.18 is illustrated in above figure. The production or economic growth is maximized where isoquants ($\Delta v_w \div \Delta G$) are just tangent the budget line. It is happened at points e' and e'' in the figure. The line which is going through the points e' and e'' is representing growth path. k indicates constant.

Conclusion:

It is clear that the input ii equal to output. During the production process wastage or other than goods (v_w) are also produced along with goods. Some amount of v_w is inevitable that has to bear the producer. As technology is constant in short period v_w is constant. A change in production is taken in to consideration economic growth. The term growth is a substitute term for development because remaining factors are kept in constant (partial derivation). The economic growth will be maximized where the isoquant tangents the budget line. The equilibrium points will construct growth path.

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