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Economic Growth

Growth - change overtime [analyze dynamic aspect of a variable].

Economic Growth - change in GDP/ National Income overtime for a economy.

Define: $Y(t)$: GDP/ National Income of the economy [fn of time (t)].

Similarly, $K(t)$: Capital, $L(t)$: Labour.

∴ Aggregate production fn for the economy:

$$Y(t) = F\big(L(t), K(t)\big)$$

Measures of Economic Growth:-

To measure economic we will evaluate change in Y overtime.

(i) Absolute Growth measure: $g_A = \left(\frac{dY}{dt}\right) = \dot{Y}$ [Notation].

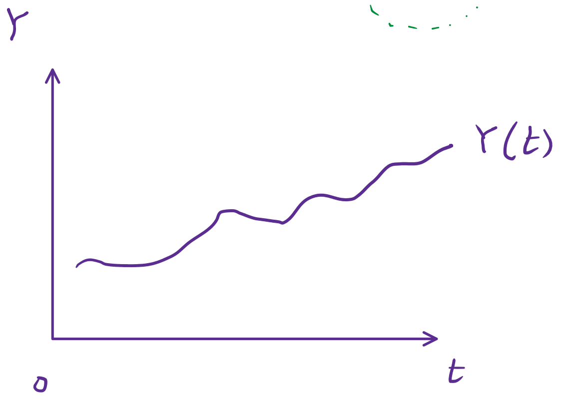
(ii) Relative Growth measure: $g_R = \frac{(dY/dt)}{Y} = \frac{\dot{Y}}{Y}$

∴ For our purpose, Economic growth will evaluated based on the Relative measure g_R.

Note: There are 2 time-setups under which Economic Growth can be evaluated.

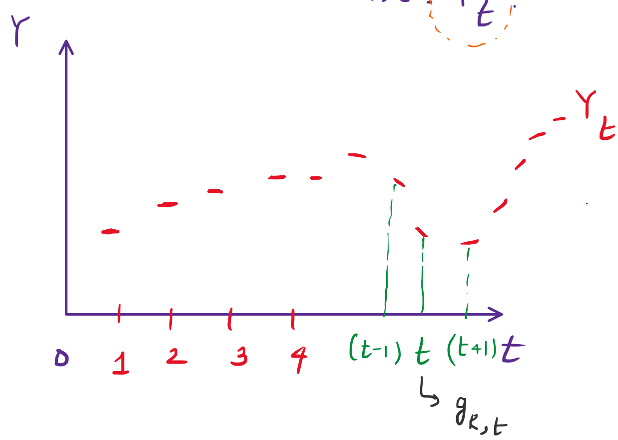
growth can be evaluated.

(i) Continuous time: $Y(t)$



$$g_R(t) = \frac{dY/dt}{Y} = \frac{\dot{Y}}{Y}.$$

(ii) Discrete time: Y_t



$$g_{R,t} = \frac{\Delta Y_t}{Y_{t-1}} = \frac{(Y_t - Y_{t-1})}{Y_{t-1}}$$

Solow Model of Economic Growth:

Consider a continuous time framework i.e $Y = Y(t)$ "without technological progress"

Assumptions of the Solow Model:

(i) Consider a perfectly competitive setup with the aggregate production fn exhibiting diminishing returns.

i.e $Y(t) = F(K(t), L(t))$;
$$\left.\begin{aligned} &F_K > 0, \quad F_{KK} < 0. \\ &F_L > 0, \quad F_{LL} < 0. \\ &F_{KL} = F_{LK} > 0. \end{aligned}\right\} \text{--- (i)}$$

$\frac{\partial}{\partial L}(F_K)$ $\quad \frac{\partial}{\partial K}(F_L)$

[Mixed partial derivatives are equal - Young's Theorem]

(ii) Aggregate production fn exhibits CRS in L, K.

$$\lambda \cdot Y = F(\lambda L, \lambda K) \; ; \quad \lambda > 0 \quad \text{---- (ii)}$$

(iii) Savings fn: $S(t) = s \cdot Y(t)$; $s > 0$ is the savings rate. --- (iii)

(iv). Labour in the economy grows @ n.

$\therefore$ Growth Rate of Labour $= n$.

$$\frac{\dot{L}}{L} = n. \quad \text{--- (iv)}$$

(v). Investment is addition to capital stock and the existing capital stock depreciates @ δ.

$$\dot{K} = (\text{Addition of } K) - (\text{Depreciated cap})$$

$$\dot{K}(t) = I(t) - \delta \cdot K(t) \quad \text{---- (v)}.$$

& Given a competitive setup $S(t) = I(t)$

Setup:

(i) $Y(t) = F(K(t), L(t))$.

(ii) $\lambda \cdot Y = F(\lambda K, \lambda L)$.

(iii) $S = s \cdot Y$.

(iv) $\dfrac{\dot{L}}{L} = n$

(v) $\dot{K} = I - \delta K$.

$\rightarrow$ Find. $\dfrac{\dot{Y}}{Y}$.

CRS: $\lambda \cdot Y = F(\lambda \cdot K, \lambda \cdot L)$, $\lambda > 0$.

If $\lambda = \frac{1}{L}$, $\left(\frac{Y}{L}\right) = F\left(\frac{K}{L}, 1\right)$.

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$\left(\frac{Y}{L}\right)$ ↙ output per unit of labour.

$\frac{K}{L}$ ↳ capital per unit of labour.

Define: $\frac{Y}{L} = y$, $\frac{K}{L} = k$.

$$\therefore \quad y = F(k, 1)$$

$$\boxed{y = f(k)}$$

$\Rightarrow$ Production fn in intrinsic form / per-unit terms.

$$\frac{\partial y}{\partial k} = \text{----}$$

$$\frac{\partial^2 y}{\partial k^2} = \text{---}$$

} Obtained using conditions in assumption 1.