

[Academic Script]

Understanding Economic Growth

Subject:

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Unit – 2 Growth Model

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Lecture – 1 Understanding Economic Growth

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1. Introduction

Growth for a nation is measured as the growth of GDP or per capita GDP (or by GNP and per capita GNP).

The percentage change in a country's output or income from time period 't' to 't+1' is the growth rate of the country's economy.

If GDP is an indicator of growth then are the countries with high growth rate of GDP richer or more developed? And, are countries with lower growth rate of GDP poorer or less developed? The answer is not easy. GDP growth rate increases the possibility of economic development and welfare, but countries with high growth rate of GDP are not always developed and those with low growth rate are not always less developed.

Hence, sometimes such figures appear misleading to lay persons. And hence it becomes important to evaluate the growth process of economies.

Objectives:

1. To get an idea regarding measurement of growth.

2. To understand the parameters which cause GDP to rise.

3. To understand how experts have modelled the growth process.

4. Be able to reason if a model on economic growth helps to understand reality.

5. To build an initial clarity on growth models to further understand the Solow model of growth.

GDP growth rate for various countries

Country	GDP Growth 2015, (Annual %)
Canada	1.1
China	6.9
France	1.3
Japan	0.5
India	7.6
Kenya	5.6
Sweden	4.1
Switzerland	0.8
UAE	3.8
UK	2.2
USA	2.6

Source:

http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG

Q. Can we say that India, China and Kenya are richer and more developed than Japan, UK, USA, Sweden and Switzerland?

Q. Students, would you now immediately check the per capita growth rates of GDP (or GNP) for these countries?

Q. While population determines per capita growth rate, which parameters determine the growth of GDP?

Q. Would a high growth rate of GDP or per capita GDP imply higher development or a higher *possibility* of development and welfare?

In the context of rise in GDP (or GNP) we must understand that, 1. Increase in nominal incomes is valuable only if it can buy more goods. If inflation rises as much as the increase in GDP then the increased GDP does not help to buy more goods. 2. Hence the real GDP must rise over years. Real GDP is the income adjusted for inflation.

3. If population growth rate is very high then per capita GDP growth rate will be lower and personal welfare increases when there is a rise in per capita income growth rate.

4. It is also important to note that per capita incomes are only mathematical averages. The real distribution of incomes may be highly inequitable and a significant proportion of the population may be earning much lower than the average per capita income while a few people may be earning much higher than the average per capita income.

5. For welfare of societies, growth must occur continuously for a long period of time.

6. The sources of income (the types of activities from which incomes are earned) determines the growth of employment over a long period of time and employment over a long period of time determines savings and capital formation and savings and capital formation determine further growth.

We may thus wonder as to how we can understand economic growth. Several economists have presented models to show how certain parameters are instrumental in attaining growth.

Most experts believe that savings, capital formation and population growth have a strong bearing on economic growth. However, the role of these parameters differs in each model.

In order to understand the role of savings and capital formation let us first look at the Harrod-Domar model. After grasping this model, the long-term growth model presented by Solow will be easy to understand.

2. Harrod- Domar Model of growth

This model of growth emerged from the works of Roy Harrod (1939) and Evsey Domar (1946).

According to this model, growth occurs when people abstain from current consumption and save. The savings result in investments in capital. With increase in stock of capital, output rises.

In the circular flow model of national income, production is done by firms by employing households \rightarrow In return of their work the households earn incomes from the firms \rightarrow which they spend to buy the goods produced by firms \rightarrow however, households do not spend entire income on consumption. They may save some income which they invest. (In other words, they buy capital goods).

In current times, investment may be made in physical capital or in human capital.

Let us look at the Harrod-Domar model.

If,

Y denotes total output

C denotes consumption

S denotes total savings and

t denotes time period

then,

 $Y_{(t)} = C_{(t)} + S_{(t)}$ (1)

This identity implies that at any given time period, output produced = consumption goods + investment goods OR

Income earned is spent on consumption and savings and savings are then used for investment.

Now we can also write,

 $Y_{(t)} = C_{(t)} + I_{(t)}$ (2)

(where, $I_{(t)}$ is the investment in time period `t').

We must note here that,

 $S_{(t)} = I_{(t)}$ which is a macroeconomic identity. (3)

Now, investment has 2 effects on capital.

a) it augments the stock of capital denoted by 'k' and,

b) some of the new capital replaces the depreciated old capital.

Let us remember that capital assets (which are factors of production) can be used in the process of production and income generation for a long period of time. But as they are used, they depreciate. In other words, their capacity to generate incomes reduces.

Hence, a nation must keep on generating new capital in order to maintain and raise the GDP growth rate.

If, δ stands for depreciation then,

 $K(t+1) = (1 - \delta)K(t) + I(t)$ (4)

OR

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K(t+1) = (1 - \delta)K(t) + S(t)
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Let us understand this equation

The stock of capital at the beginning of time period t+1',

=

the stock of depreciated capital carried forward from the previous year 't'

+

The total of new investment made in time period 't' calculated at the end of the period. This investment adds to stock of capital in the beginning of time period 't+1'.

In other words,

There was a stock of capital denoted by K in time period (t) which depreciated at the rate (1- δ) and was carried forward in

period (t+1) and a new investment I (t) which makes up for new capital in period (t+1).

Consider here that period t+1' is year 2017 and therefore period t' is the previous year which is, 2016.

Now, the saving rate ς is given by $\frac{S(t)}{Y(t)}$ which means that in time period 't', amount 'S' is saved from an income or GDP of amount 'Y'.

This can be re-written as, $S(t) = \zeta Y(t)$ which means, that total savings S(t) are equal to proportion ' ζ ' of the total income Y(t).

And, the capital-output ratio denoted by $\theta = \frac{K(t)}{Y(t)}$ represents the amount of capital required to produce a unit of output or GDP equal to Y.

This can be re-written as $K(t) = \theta Y(t)$ which means, that capital K(t) is equal to capital output ratio multiplied by the total income Y(t).

Let us define growth rate of Output/Income/GDP/National income as, 'g' which is given as,

$$[Y (t+1) - Y (t)] \div Y(t)$$

That is,

[Income in current period minus income in previous period] divided by income in current period.

Thus now, equation (4) develops into:

 $\Theta Y(t+1) = (1-\delta) \Theta Y(t) + \zeta Y(t) \quad (6)$

This means that the growth of income at a given capital-output ratio in time period t+1 = the capital formation from income in time 't' discounted at the rate of depreciation + the savings generated from income in time period 't'. and, this translates into,

 $\frac{Y(t+1)-Y(t)}{Y(t)} = \frac{\varsigma}{\theta} - \delta$

(7)

Using all the above equations, we can derive that, growth of national output can be increased by raising ' ς ' which is the savings rate or by lowering θ which is the capital-output ratio. A higher ' ς ' means that a nation saves more and savings translate into investments according to the macroeconomic balance given by S=I. Higher investment means more capital formation and more capital formation means greater output.

A lower θ means that lesser capital is required to produce a unit of output and so more output can be generated by the existing stock of capital.

Now, equation (7) can be shown as, $\frac{\varsigma}{\Theta} = g + \delta$ (8)

Dear students,

We must think a little here as to,

- How do we increase our savings?
- If we consume very less of what we produce in order to increase savings, what happens to the unconsumed goods which we have produced?
- Is there a right balance between consumption and savings?
- Can we recollect from the topic on national income that a country produces consumer goods as well as producers' goods? Consumer goods are consumed and producers' goods are used for investment. So can we say that savings go into purchase of producers' goods?
- What kind of investments must a country make to increase the growth rate?

This model considers growth of GNP (GDP) as an indicator of growth. However, GNP (GDP) per capita is considered to be a better indicator of growth than gross GNP (GDP). Thus if

population is introduced in the Harrod-Domar model, we may derive equation (6) as, $\theta \gamma(t+1) \frac{P(t+1)}{P(t)} = (1 - \delta) \theta \gamma(t) + s \gamma(t)$ (9) where, $\gamma = \frac{Y(t)}{P(t)} =$ per capita income. If we divide equation (9) through out by $\theta \gamma(t)$, we obtain, $\frac{\gamma(t+1)}{\gamma(t)} \frac{P(t+1)}{P(t)} = (1 - \delta) \frac{s}{\theta}$. Now, $\frac{\gamma(t+1)}{\gamma(t)} = 1 + g^*$ where, g^* is the rate of per capita growth and $\frac{P(t+1)}{P(t)} = 1 + n$ where, n is the rate of population growth. Thus, $\frac{s}{\theta} = (1 + g^*)(1 + n) - (1 - \delta).$

3. Practical applicability of this model for developing countries

1. Many developing countries have a high marginal propensity to consume and lower marginal propensity to save. That is, they can generate very small proportion of additional savings from their additional incomes. This is because they have high population growth rates, high incidence of poverty and thus, all additional incomes are used up in absorbing the increasing population or in eradication of poverty.

Can this mean that rich people or rich nations save more? There might be a possibility that the richest nations may feel that they are already on a higher level of economic well being than most others and hence they may be more attracted towards consuming a very high proportion of their of their new incomes than in accumulating more wealth.

In this sense, even rich nations save lesser.

It might be possible that the middle-class people and the middle-class nations save more than the very poor or the very rich.

Harrod-Domar model does not explain this kind of endogeneity of savings. In other words, this does not explain why growth rates systematically differ at different levels of incomes and hence this is a model of **neutral** theory of economic growth.

2. The macroeconomic balance S = I can be attained only if financial systems are well established and, if all savings from the savers' class are passed on to the investors' class. Savers and investors are two distinct classes in an economy.

Any amount of idle savings, unaccounted money, inadequate banking and financial services etc. create lags in this macroeconomic balance.

3. If there is immense increase in savings then it is implied that incomes are also higher. This does not necessarily imply a very high growth rate as new employment must be created to increase growth. Countries which have reached very high income levels have reached near full employment levels. Hence, further higher incomes cannot fuel very high growth rate.

Students must study the growth rates of national income for the developed countries.

4. If a country attains reasonable savings growth rate and also invests these savings in physical capital but if the productivity of labour is low owing to poor state of health and education; then mere increase in physical capital will not push up the growth rate to desired level. Hence, remember we studied in earlier lectures that development of human capital is important to achieve economic growth.

5. In modern times, production is also a function of technology, research and creation of new ideas. Hence, along with investment in physical capital and investment in health and education, technological up gradation must take place and protection of intellectual property must be ensured.

6. Several times, developing countries borrow from abroad to bridge the gap between savings and investment. This creates a debt burden and a large proportion of increased incomes in the subsequent periods are spent in paying off the debt and thus, growth suffers.

If external debt is incurred for creation of infrastructure etc. then it helps in increasing future incomes but if debt is created owing to unproductive expenses, the future income generation will be lower and debt burdens will appear more difficult to manage.

7. For agrarian economies, public investment in agricultural sector helps in reduction of rural poverty as well as in increasing growth. Hence, it is important that these countries make the right kind of investment.

8. This model assumes that fixed proportion of capital and labour are required to produce output Q in a growth process. If a producer is using (Ko, Lo) to produce an amount Q, then adding only capital or labour will not increase output – capital and labour must be added in the same proportion to increase output. If Z_1 is labour and Z_2 is capital and the k/l ratio is fixed at b/a then the following figure depicts a fixed proportion production function.



The model is not applicable if factor variable factor proportions are needed for the growth process.

4. Summary

Let us summarize what we learnt in this lecture. We learnt that growth of national income can occur when savings and capital formation increase. We also learnt that population growth will reduce the growth of per capita incomes.

We must remember here that,

The growth of income at a given capital-output ratio in time period t+1 = the capital formation from income in time 't' discounted at the rate of depreciation + the savings generated from income in time period 't'.

Annual Percentage Growth Rate of Gross Capital Formation

Country	1971	2015
India	12.3	3.8
Bangladesh	-24.1	7.1
Canada	8.5	-5.4
China	NA	6.2
Denmark	-0.2	-0.5
France	2.8	1.5
Japan	0.9	00
Mauritius	NA	18.8
Netherlands	-1.8	6.2
Norway	11.1	-2.3
Switzerland	4.7	3.9
UK	-0.6	3.5
USA	5.4	4.5

Source: http://data.worldbank.org/indicator

- What do the data indicate?
- For some countries gross capital formation as a percentage of GDP is higher than the gross savings as a percentage of GDP. How do you think is this possible?
- Is gross capital formation as a percentage of GDP higher for developing countries than for developed countries? How do the developed countries then maintain high levels of literacy, education and health?
- If gross capital formation as a percentage of GDP is higher for developing countries than for the developed countries then why do the developing countries face issues of poverty, unemployment, illiteracy, lower levels of education and poor health?