

Learning Objectives

1. Explain the costs and benefits of economic growth.
2. List the four fundamental determinants of growth in real GDP.
3. List the main elements of Neoclassical growth theory.
4. Describe the new growth theories based on endogenous technical change and increasing returns.
5. Explain why resource exhaustion provides society with incentives for technological improvements.

1 The Nature of Economic Growth

Because economic growth (increases in Y^*) can go on over very long periods of time, it is a much more powerful method of raising living standards than the removal of recessionary gaps.

Annual Growth Rate					
Year	1%	2%	3%	5%	7%
0	100	100	100	100	100
10	111	122	135	165	201
30	135	182	246	448	817
50	165	272	448	1218	3312
70	201	406	817	3312	13429
100	272	739	2009	14841	109660

Benefits of Economic Growth

Rising Average Living Standards

For all those who share in it, economic growth is a powerful means of increasing living standards.

Alleviation of Poverty

Many of the poorest are not in the labour force, and hence are unlikely to share in the higher wages that economic growth brings. However, rapid economic growth does make it easier to reduce poverty through income redistribution.

Costs of Growth

Sacrifice of Current Consumption

Future growth is often encouraged by increasing current investment and saving. For the economy as a whole, however, this requires a sacrifice of current consumption — this is an important opportunity cost of economic growth.

Social Costs of Growth

Economic growth usually involves the replacement of some firms and workers with others. The process renders some machines obsolete and also leaves some workers partly obsolete. There are costs involved in making this transition.

Sources of Economic Growth

The four fundamental sources of economic growth are:

1. Growth in the labour force.
2. Growth in human capital.
(Human capital is the term that economists use to refer to the set of skills that workers have. Human capital can be increased through formal education or on-the-job training.)
3. Growth in physical capital.
4. Technological improvement.

2 Established Theories of Economic Growth

Investment, Saving, and Growth

Investment is important because this is how the economy accumulates physical capital. Increases in the stock of capital will increase the future level of Y^* .

We focus on the long run and ignore short-run fluctuations so increases in future Y^* also mean increases in future Y .

Empirically, societies with high rates of national saving have high investment rates and, other things being equal, high growth rates of real GDP.

The Long-Run Connection Between Saving and Investment

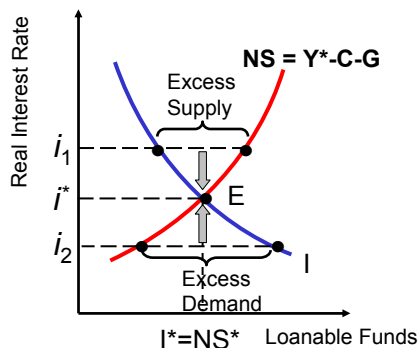
Recall that national saving is the sum of private saving and public saving. Desired private saving is the difference between disposable income and desired consumption. In the long run, when real GDP equals Y^* , we have:

$$\text{Private Saving} = Y^* - T - C$$

Public saving is equal to the combined budget surpluses of federal, provincial and municipal governments:

$$\text{Public Saving} = T - G$$

$$\begin{aligned} \text{Therefore, National Saving} = NS &= Y^* - T - C + (T - G) \\ &= Y^* - C - G \end{aligned}$$



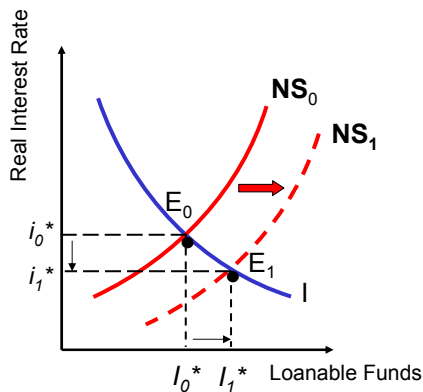
In the long run, the condition that desired national saving equals desired investment determines the equilibrium interest rate.

Investment demand by firms is negatively related to the real interest rate.

The supply of national saving is positively related to the real interest rate, since increases in the interest rate lead to a decline in desired consumption.

At point E, the market for loanable funds clears and the real interest rate is i^* .

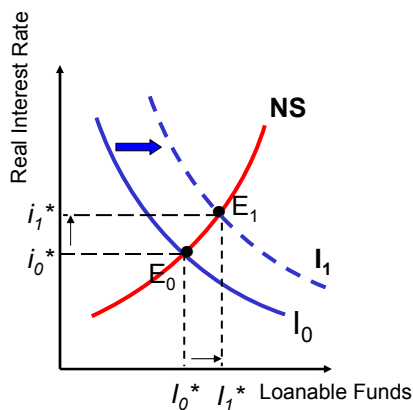
Suppose the supply of national saving increases, either from a decline in household consumption or government purchases. Thus, national saving rises at any interest rate and so the **NS** curve shifts to the right.



In the long run, an increase in the supply of national savings reduces the real interest rate and encourages more investment by firms.

The higher rate of investment leads to a higher growth rate of potential output.

Now suppose that firms' demand for investment increases. This might be caused by technological improvements or by government tax incentives encouraging investment. This will shift the **I** curve to the right.



In the long run, an increase in the demand for investment pushes up the interest rate and encourages more saving by households.

The higher rate of saving (and investment) leads to a higher growth rate of potential output.

Neoclassical Growth Theory

The Neoclassical growth theory is based on the the idea that the four sources of economic growth can be represented with an aggregate production function:

$$\text{GDP} = F_T(\text{L}, \text{K}, \text{H})$$

where **L** is the total amount of labour, **K** is the stock of physical capital, **H** is the quality of labour's human capital, and **T** is the state of technology.

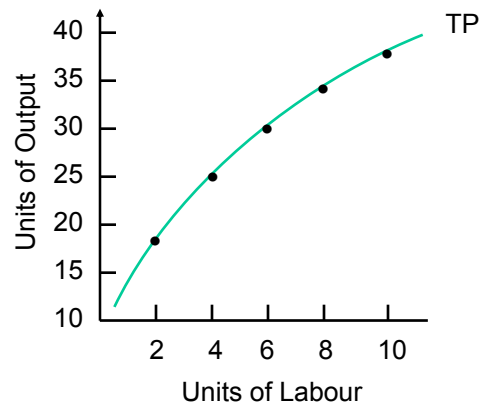
The notation F_T reflects the assumption that changes in technology will change the production function.

When examining long-term economic growth, we interpret output in the Neoclassical approach as potential output.

The key aspects of the Neoclassical aggregate production function are:

1. It displays diminishing marginal product of both **K** and **L** (when either factor is changed in isolation).
2. It displays constant returns to scale (when both **K** and **L** are changed in equal proportions).

L	Units of Output	AP_L	MP_L
1	12.0	12.0	
2	17.0	8.5	5.0
3	20.8	6.9	3.8
4	24.0	6.0	3.2
5	26.8	5.4	2.8
6	29.4	4.9	2.6
7	31.9	4.6	2.5
8	34.0	4.2	2.1
9	36.0	4.0	2.0
10	37.9	3.8	1.9



Holding **K** constant, increases in **L** generate positive but diminishing increments to output.

According to the law of diminishing returns, marginal product eventually falls as each successive unit of the variable factor is added in combination with a fixed amount of another factor.

In the Neoclassical model, whenever diminishing returns applies, increases in population lead to increases in GDP but declines in per capita GDP — and thus falling average living standards.

Similarly, diminishing returns means that capital accumulation on its own brings smaller and smaller increases in real per capita GDP.

If **K** and **L** grow at the same rate, GDP will also increase. But in the Neoclassical growth model with constant returns to scale, this “balanced growth path” will not lead to improvements in living standards. GDP will grow but per capita GDP will be constant.

In the Neoclassical growth model, technological change is necessary in order to have sustained growth in living standards.

Much technological change is embodied in new capital equipment, so the process of investment is central to encouraging technological improvements.

Many — perhaps most — innovations are embodied in either physical or human capital. These innovations cause continual changes in the techniques of production and in the nature of what is produced.

Measuring technical change is difficult. One popular — though imperfect — method is Robert Solow’s “growth accounting.” This method measures technical change as that part of growth that cannot be explained by capital accumulation or labour-force growth.

3 New Growth Theories

Endogenous Technological Change

In the Neoclassical model there is no explanation about how innovation and the incorporation of new technologies are determined. That is, technology is determined exogenously.

New growth theory incorporates the process of innovation and incorporation of new technology into the aggregate production function in a number of ways:

- learning-by-doing,
- knowledge transfer,
- market structure and innovation, and
- shocks and innovation.

Increasing Marginal Returns to Investment

New growth theories emphasize the possibility that as investment in some new area, product, or production technology proceeds through time, each new increment of investment is more productive than the last.

This contrasts with the Neoclassical assumption of diminishing marginal returns.

The sources of increasing returns usually fall into one of two categories:

- fixed costs, or
- knowledge.

Fixed Costs

Successive increments of investment can yield increasing marginal returns if:

- costs that are incurred by earlier investment expenditures provide publicly available knowledge, and
- customer attitudes and abilities become more receptive to new products.

Knowledge

Knowledge is an important factor of production and, because much of it is a pure public good, it may not follow the law of diminishing marginal returns.

4 Are There Limits to Growth?

Resource Exhaustion

Current technology and resources could not support the entire world's population at the average Canadian standard of living.

But most economists agree that absolute limits to growth, based on constant technology and fixed resources are not relevant.

We must keep in mind that technology is constantly improving, and this suggests that living standards can continually improve.

Pollution

Conscious management of pollution was unnecessary when the world's population was one billion people, but such management has now become a pressing matter.

Conclusion

Growth can help the world address many problems. But further growth must be sustainable growth, which should be based on knowledge-driven technological change.