

Handout for Macroeconomics week 5

Production and Growth

The Production Function

A production function describes the relationship between the quantity of inputs used in production and the quantity of output from production.

The production function generally is written like this:

where Y = output, L = quantity of labor, K = quantity of physical capital, H = quantity of human capital, N = quantity of natural resources, A reflects the available production technology, and $F()$ is a function that shows how inputs are combined to produce output.

Many production functions have a property called constant returns to scale.

- ✓ This property implies that as all inputs are doubled, output will exactly double.
- ✓ This implies that the following must be true:
where $x = 2$ if inputs are doubled.
- ✓ This also means that if we want to examine output per worker we could set $x = 1/L$ and we would get the following: This shows that output per worker depends on the amount of physical capital per worker (K/L), the amount of human capital per worker (H/L), and the amount of natural resources per worker (N/L).

Economic Growth and Public Policy

1. Saving and Investment

- ✓ Because capital is a produced factor of production, a society can change the amount of capital that it has.
- ✓ However, there is an opportunity cost of doing so; if resources are used to produce capital goods, fewer goods and services are produced for current consumption.

2. Diminishing Returns and the Catch-Up Effect

$$\begin{aligned} Y &= A F(L, K, H, N) \\ xY &= A F(xL, xK, xH, xN) \\ Y/L &= A F(1, K/L, H/L, N/L) \end{aligned}$$

Definition of diminishing returns: the property whereby the benefit from an extra unit of an input declines as the quantity of the input increases.

- ✓ As the capital stock rises, the extra output produced from an additional unit of capital will fall.
- ✓ This can be shown how the amount of capital per worker determines the amount of output per worker, holding constant all other determinants of output.
- ✓ Thus, if workers already have a large amount of capital to work with, giving them an additional unit of capital will not increase their productivity by much.
- ✓ In the long run, a higher saving rate leads to a higher level of productivity and income, but not to higher growth rates in these variables.

An important implication of diminishing returns is the catch-up effect.

- ✓ Definition of catch-up effect: the property whereby countries that start off poor tend to grow more rapidly than countries that start off rich.
- ✓ When workers have very little capital to begin with, an additional unit of capital will increase their productivity by a great deal.

3. Investment from Abroad

- ✓ Saving by domestic residents is not the only way for a country to invest in new capital.
- ✓ Investment in the country by foreigners can also occur.
 - a. Foreign direct investment occurs when a capital investment is owned and operated by a foreign entity.
 - b. Foreign portfolio investment occurs when a capital investment is financed with foreign money but operated by domestic residents.
- ✓ Some of the benefits of foreign investment flow back to foreign owners. But the economy still experiences an increase in the capital stock, which leads to higher productivity and higher wages.
- ✓ The World Bank is an organization that tries to encourage the flow of investment to poor countries.
 - a. The World Bank obtains funds from developed countries such as the United States and makes loans to less-developed countries so that they can invest in roads, sewer systems, schools, and other types of capital.
 - b. The World Bank also offers these countries advice on how best to use these funds.

4. Education

- ✓ Investment in human capital also has an opportunity cost.
 - a. When students are in class, they cannot be producing goods and services for consumption.
 - b. In less-developed countries, this opportunity cost is considered to be high; as a result, children often drop out of school at a young age.
- ✓ Because there are positive externalities in education, the effect of lower education on the economic growth rate of a country can be large.
- ✓ Many poor countries also face a “brain drain”—the best educated often leave to go to other countries where they can enjoy a higher standard of living.
- ✓ Promoting Human Capital
 - a. Human capital is a key to economic growth.
 - b. This is an article that describes how some developing countries now give parents an immediate financial incentive to keep their children in school.

5. Health and Nutrition

- ✓ Human capital can also be used to describe another type of investment in people: expenditures that lead to a healthier population.
- ✓ Other things being equal, healthier workers are more productive.
- ✓ Making the right investments in the health of the population is one way for a nation to increase productivity.

6. Property Rights and Political Stability

- ✓ Protection of property rights and promotion of political stability are two other important ways that policymakers can improve economic growth.
- ✓ There is little incentive to produce products if there is no guarantee that they cannot be taken. Contracts must also be enforced.
- ✓ Countries with questionable enforcement of property rights or an unstable political climate will also have difficulty in attracting foreign (or even domestic) investment.

7. Free Trade

- ✓ Some countries have tried to achieve faster economic growth by avoiding transacting with the rest of the world.
- ✓ However, trade allows a country to specialize in what it does best and thus consume beyond its production possibilities.
- ✓ When a country trades wheat for steel, it is as well off as it would be if it had developed a new technology for turning wheat into steel.
- ✓ The amount a nation trades is determined not only by government policy but also by geography.
 - a. Countries with good, natural seaports find trade easier than countries without this resource.
 - b. Many African countries, for example, are landlocked. This may be one reason why the continent is so poor.
- ✓ In the News: Rich Farmers versus the World's Poor
 - a. According to the Presidents of Mali and Burkina Faso, if the United States and other developed countries more consistently followed the tenets of free trade, the world's poor would benefit.
 - b. This is an article written by these two Presidents appealing to the U.S. to end farm subsidies because the subsidies hurt the ability of these countries to competitively engage in international trade.

8. Research and Development

- ✓ The primary reason why living standards have improved over time has been due to large increases in technological knowledge.
- ✓ Knowledge can be considered a public good.
- ✓ The U.S. government promotes the creation of new technological information by providing research grants and providing tax incentives for firms engaged in research.
- ✓ The patent system also encourages research by granting an inventor the exclusive right to produce the product for a specified number of years.

9. Population Growth

- ✓ Stretching Natural Resources
 - a. Thomas Malthus (an English minister and early economic thinker) argued that an ever-increasing population meant that the world was doomed to live in poverty forever.
 - b. However, he failed to understand that new ideas would be developed to increase the production of food and other goods, including pesticides, fertilizers, mechanized equipment, and new crop varieties.
- ✓ Diluting the Capital Stock
 - a. High population growth reduces GDP per worker because rapid growth in the number of workers forces the capital stock to be spread more thinly.

- b. Countries with a high population growth have large numbers of schoolage children, placing a burden on the education system.
- ✓ Some countries have already instituted measures to reduce population growth rates.
- ✓ Policies that foster equal treatment for women should raise economic opportunities for women leading to lower rates of population.
- ✓ Promoting Technological Progress
 - a. Some economists have suggested that population growth has driven technological progress and economic prosperity.
 - b. In a 1993 journal article, economist Michael Kremer provided evidence that increases in population lead to technological progress.