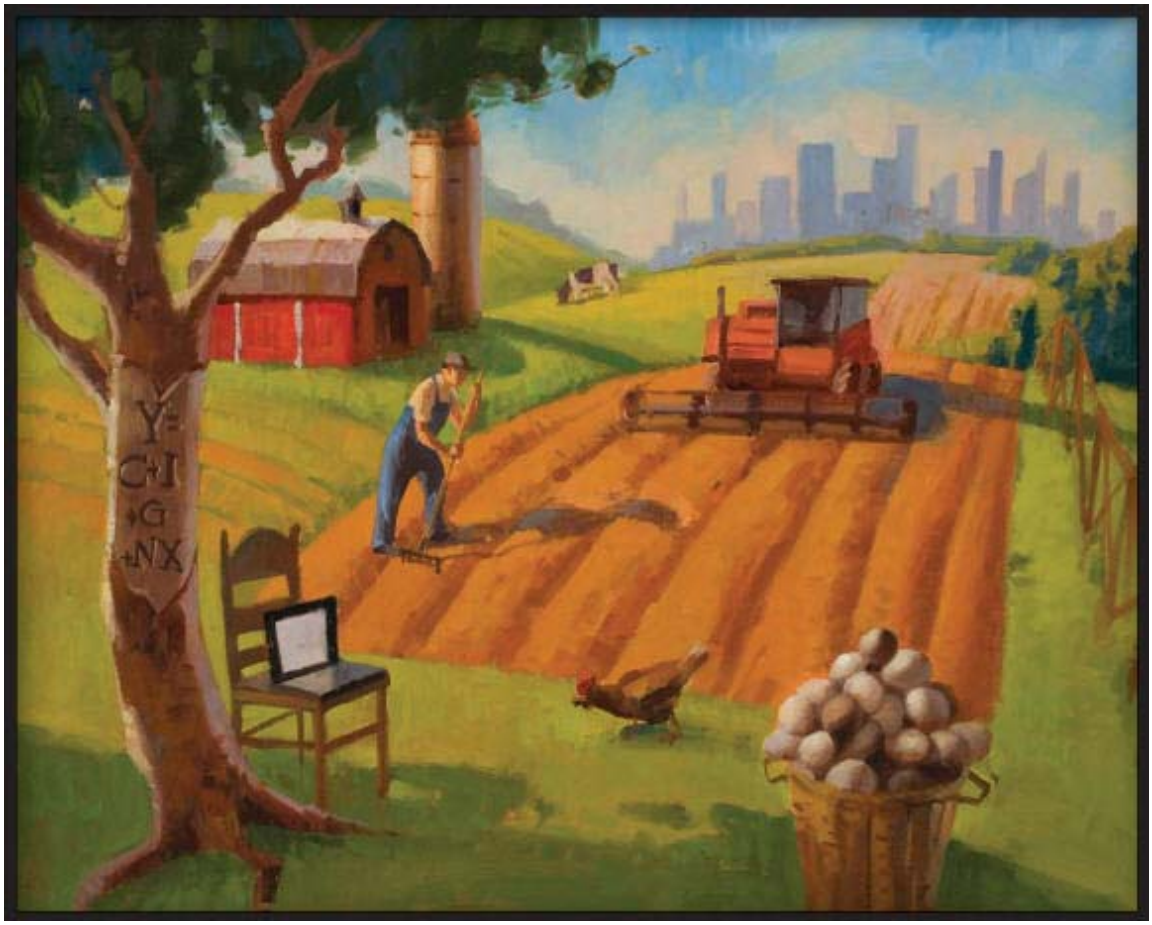
Production and Growth

Chapter Outline

Print This Chapter

Chapter Introduction



When you travel around the world, you see tremendous variation in the standard of living. The average income in a rich country, such as the United States, Japan, or Germany, is more than ten times the average income in a poor country, such as India, Indonesia, or Nigeria. These large differences in income are reflected in large differences in the quality of life. People in richer countries have better nutrition, safer housing, better healthcare, and longer life expectancy as well as more automobiles, more telephones, and more televisions.

Even within a country, there are large changes in the standard of living over time. In the United States over the past century, average income as measured by real GDP per person has grown by about 2 percent per year. Although 2 percent might seem small, this rate of growth implies that average income doubles every 35 years. Because of this growth, average income today is about eight times the average income a century ago. As a result, the typical American enjoys much greater economic prosperity than did his or her parents, grandparents, and great-grandparents.

Growth rates vary substantially from country to country. In recent history, some East Asian countries, such as Singapore, South Korea, and Taiwan, have experienced economic growth of about 7 percent per year; at this rate, average income doubles every 10 years. Over the past two decades, China has enjoyed an even higher rate of growth—about 12 percent per year, according to some estimates. A country experiencing such rapid growth can, in one generation, go from being among the poorest in the world to being among the richest. By contrast, in some African countries, such as Chad, Gabon, and Senegal, average income has been stagnant for many years.

What explains these diverse experiences? How can rich countries maintain their high standard of living? What policies should poor countries pursue to promote more rapid growth and join the developed world? These are among the most important questions in macroeconomics. As the Nobel-Prize-winning economist Robert Lucas put it, "The consequences for human welfare in questions like these are simply staggering: Once one starts to think about them, it is hard to think about anything else."

In the previous two chapters, we discussed how economists measure macroeconomic quantities and prices. We can now begin to study the forces that determine these variables. As we have seen, an economy's gross domestic product (GDP) measures both the total income earned in the economy and the total expenditure on the economy's output of goods and services. The level of real GDP is a good gauge of economic

prosperity, and the growth of real GDP is a good gauge of economic progress. In this chapter we focus on the long-run determinants of the level and growth of real GDP. Later in this book, we study the short-run fluctuations of real GDP around its long-run trend.

We proceed here in three steps. First, we examine international data on real GDP per person. These data will give you some sense of how much the level and growth of living standards vary around the world. Second, we examine the role of *productivity*—the amount of goods and services produced for each hour of a worker's time. In particular, we see that a nation's standard of living is determined by the productivity of its workers, and we consider the factors that determine a nation's productivity. Third, we consider the link between productivity and the economic policies that a nation pursues.

12-1 Economic Growth around the World

As a starting point for our study of long-run growth, let's look at the experiences of some of the world's economies. Table 1 shows data on real GDP per person for thirteen countries. For each country, the data cover more than a century of history. The first and second columns of the table present the countries and time periods. (The time periods differ somewhat from country to country because of differences in data availability.) The third and fourth columns show estimates of real GDP per person about a century ago and for a recent year.

Table 1. The Variety of Growth Experiences

Country	Period	Real GDP per Person at Beginning of Period*	Real GDP per Person at End of Period*	Growth Rate (per year)
Japan	1890–2008	$1,504	$35,220	2.71%
Brazil	1900–2008	779	10,070	2.40
Mexico	1900–2008	1,159	14,270	2.35
Germany	1870–2008	2,184	35,940	2.05
Canada	1870–2008	2,375	36,220	1.99
China	1900–2008	716	6,020	1.99
United States	1870–2008	4,007	46,970	1.80
Argentina	1900–2008	2,293	14,020	1.69
United Kingdom	1870–2008	4,808	36,130	1.47
India	1900–2008	675	2,960	1.38
Indonesia	1900–2008	891	3,830	1.36
Pakistan	1900–2008	737	2,700	1.21
Bangladesh	1900–2008	623	1,440	0.78

*Real GDP is measured in 2008 dollars.

The data on real GDP per person show that living standards vary widely from country to country. Income per person in the United States, for instance, is about eight times that in China and about sixteen times that in India. The poorest countries have average levels of income not seen in the developed world for many decades. The typical citizen of India in 2008 had less real income than the typical resident of England in 1870. The typical person in Bangladesh in 2008 had about two-thirds the real income of a typical American a century ago.

The last column of the table shows each country's growth rate. The growth rate measures how rapidly real GDP per person grew in the typical year. In the United States, for example, where real GDP per person was $4,007 in 1870 and $46,970 in 2008, the growth rate was 1.80 percent per year. This means that if real GDP per person, beginning at $4,007, were to increase by 1.80 percent for each of 138 years, it would end up at $46,970. Of course, real GDP per person did not actually rise exactly 1.80 percent every year: Some years it rose by more, other years it rose by less, and in still other years it fell. The growth rate of 1.80 percent per year ignores short-run fluctuations around the long-run trend and represents an average rate of growth for real GDP per person over many years.

The countries in Table 1 are ordered by their growth rate from the most to the least rapid. Japan tops the list, with a growth rate of 2.71 percent per year. A hundred years ago, Japan was not a rich country. Japan's average income was only somewhat higher than Mexico's, and it was well behind Argentina's. The standard of living in Japan in 1890 was less than half of that in India today. But because of its spectacular growth, Japan is now an economic superpower, with average income more than twice that of Mexico and Argentina and similar to Germany, Canada, and the United Kingdom. At the bottom of the list of countries are Pakistan and Bangladesh, which have experienced growth of less than 1.3 percent per year over the past century. As a result, the typical resident of these countries continues to live in abject poverty.

Because of differences in growth rates, the ranking of countries by income changes substantially over time. As we have seen, Japan is a country that has risen relative to others. One country that has fallen behind is the United Kingdom. In 1870, the United Kingdom was the richest country in the world, with average income about 20 percent higher than that of the United States and more than twice Canada's. Today, average income in the United Kingdom is 20 percent below that of the United States and similar to Canada's.

These data show that the world's richest countries have no guarantee they will stay the richest and that the world's poorest countries are not doomed forever to remain in poverty. But what explains these changes over time? Why do some countries zoom ahead while others lag

behind? These are precisely the questions that we take up next.

FYI: A Picture Is Worth a Thousand Statistics

George Bernard Shaw once said, "The sign of a truly educated man is to be deeply moved by statistics." Most of us, however, have trouble being deeply moved by data on GDP—until we see what these statistics represent.

The three photos on these pages show a typical family from each of three countries—the United Kingdom, Mexico, and Mali. Each family was photographed outside their home, together with all their material possessions.

These nations have very different standards of living, as judged by these photos, GDP, or other statistics.

- The United Kingdom is an advanced economy. In 2008, its GDP per person was $36,130. A negligible share of the population lives in extreme poverty, defined here as less than $2 a day. Educational attainment is high: Among children of high school age, 91 percent are in school. Residents of the United Kingdom can expect to enjoy a long life: The probability of a person surviving to age 65 is 85 percent for men and 91 percent for women.

- Mexico is a middle-income country. In 2008, its GDP per person was $14,270. About 5 percent of the population lives on less than $2 a day. Among children of high school age, 71 percent are in school. The probability of a person surviving to age 65 is 78 percent for men and 86 percent for women.

- Mali is a poor country. In 2008, its GDP per person was only $1,090. Extreme poverty is the norm: More than three-quarters of the population lives on less than $2 per day. Educational attainment in Mali is low: Among children of high school age, only 29 percent are in school. And life is often cut short: The probability of a person surviving to age 65 is only 38 percent for men and 42 percent for women.

Economists who study economic growth try to understand what causes such large differences in the standard of living.

A Typical Family in the United Kingdom

A Typical Family in Mexico

A Typical Family in Mali

FYI: Are You Richer Than the Richest American?

American Heritage magazine once published a list of the richest Americans of all time. The number 1 spot went to John D. Rockefeller, the oil entrepreneur who lived from 1839 to 1937. According to the magazine's calculations, his wealth would today be the equivalent of about

$200 billion, almost four times that of Bill Gates, the software entrepreneur who is today's richest American.

John D. Rockefeller

Despite his great wealth, Rockefeller did not enjoy many of the conveniences that we now take for granted. He couldn't watch television, play video games, surf the Internet, or send e-mail. During the heat of summer, he couldn't cool his home with air conditioning. For much of his life, he couldn't travel by car or plane, and he couldn't use a telephone to call friends or family. If he became ill, he couldn't take advantage of many medicines, such as antibiotics, that doctors today routinely use to prolong and enhance life.

Now consider: How much money would someone have to pay you to give up for the rest of your life all the modern conveniences that Rockefeller lived without? Would you do it for $200 billion? Perhaps not. And if you wouldn't, is it fair to say that you are better off than John D. Rockefeller, allegedly the richest American ever?

The preceding chapter discussed how standard price indexes, which are used to compare sums of money from different points in time, fail to fully reflect the introduction of new goods in the economy. As a result, the rate of inflation is overestimated. The flip side of this observation is that the rate of real economic growth is underestimated. Pondering Rockefeller's life shows how significant this problem might be. Because of tremendous technological advances, the average American today is arguably "richer" than the richest American a century ago, even if that fact is lost in standard economic statistics.

QUICK QUIZ

What is the approximate growth rate of real GDP per person in the United States? Name a country that has had faster growth and a country that has had slower growth.

12-2 Productivity: Its Role and Determinants

Explaining the large variation in living standards around the world is, in one sense, very easy. As we will see, the explanation can be summarized in a single word—*productivity*. But in another sense, the international variation is deeply puzzling. To explain why incomes are so much higher in some countries than in others, we must look at the many factors that determine a nation's productivity.

12-2a Why Productivity Is So Important

Ask the Author: Is higher productivity a problem? Will it lead to widespread job losses?

Let's begin our study of productivity and economic growth by developing a simple model based loosely on Daniel Defoe's famous novel *Robinson Crusoe* about a sailor stranded on a desert island. Because Crusoe lives alone, he catches his own fish, grows his own vegetables, and makes his own clothes. We can think of Crusoe's activities—his production and consumption of fish, vegetables, and clothing—as a simple economy. By examining Crusoe's economy, we can learn some lessons that also apply to more complex and realistic economies.

What determines Crusoe's standard of living? In a word, **productivity**, the quantity of goods and services produced from each unit of labor input. If Crusoe is good at catching fish, growing vegetables, and making clothes, he lives well. If he is bad at doing these things, he lives poorly. Because Crusoe gets to consume only what he produces, his living standard is tied to his productivity.

In the case of Crusoe's economy, it is easy to see that productivity is the key determinant of living standards and that growth in productivity is the key determinant of growth in living standards. The more fish Crusoe can catch per hour, the more he eats at dinner. If Crusoe finds a better place to catch fish, his productivity rises. This increase in productivity makes Crusoe better off: He can eat the extra fish, or he can spend less time fishing and devote more time to making other goods he enjoys.

Productivity's key role in determining living standards is as true for nations as it is for stranded sailors. Recall that an economy's gross domestic product (GDP) measures two things at once: the total income earned by everyone in the economy and the total expenditure on the economy's output of goods and services. GDP can measure these two things simultaneously because, for the economy as a whole, they must be equal. Put simply, an economy's income is the economy's output.

Like Crusoe, a nation can enjoy a high standard of living only if it can produce a large quantity of goods and services. Americans live better than Nigerians because American workers are more productive than Nigerian workers. The Japanese have enjoyed more rapid growth in living standards than Argentineans because Japanese workers have experienced more rapid growth in productivity. Indeed, one of the *Ten Principles of Economics* in Chapter 1 is that a country's standard of living depends on its ability to produce goods and services.

Hence, to understand the large differences in living standards we observe across countries or over time, we must focus on the production of goods and services. But seeing the link between living standards and productivity is only the first step. It leads naturally to the next question: Why are some economies so much better at producing goods and services than others?

12-2b How Productivity Is Determined

BBC Video: BMW Workers

Although productivity is uniquely important in determining Robinson Crusoe's standard of living, many factors determine Crusoe's productivity. Crusoe will be better at catching fish, for instance, if he has more fishing poles, if he has been trained in the best fishing techniques, if his island has a plentiful fish supply, or if he invents a better fishing lure. Each of these determinants of Crusoe's productivity —which we can call *physical capital*, *human capital*, *natural resources*, and *technological knowledge*—has a counterpart in more complex and realistic economies. Let's consider each factor in turn.

Physical Capital per Worker

Workers are more productive if they have tools with which to work. The stock of equipment and structures used to produce goods and services is called **physical capital**, or just *capital*. For example, when woodworkers make furniture, they use saws, lathes, and drill presses. More tools allow the woodworkers to produce their output more quickly and more accurately: A worker with only basic hand tools can make less furniture each week than a worker with sophisticated and specialized woodworking equipment.

As you may recall, the inputs used to produce goods and services—labor, capital, and so on—are called the *factors of production*. An important feature of capital is that it is a *produced* factor of production. That is, capital is an input into the production process that in the past was an output from the production process. The woodworker uses a lathe to make the leg of a table. Earlier, the lathe itself was the output of a firm that manufactures lathes. The lathe manufacturer in turn used other equipment to make its product. Thus, capital is a factor of production used to produce all kinds of goods and services, including more capital.

Human Capital per Worker

A second determinant of productivity is human capital. **Human capital** is the economist's term for the knowledge and skills that workers acquire through education, training, and experience. Human capital includes the skills accumulated in early childhood programs, grade school, high school, college, and on-the-job training for adults in the labor force.

Education, training, and experience are less tangible than lathes, bulldozers, and buildings, but human capital is like physical capital in many ways. Like physical capital, human capital raises a nation's ability to produce goods and services. Also like physical capital, human capital is a produced factor of production. Producing human capital requires inputs in the form of teachers, libraries, and student time. Indeed, students can be viewed as "workers" who have the important job of producing the human capital that will be used in future production.

Natural Resources per Worker

A third determinant of productivity is **natural resources**. Natural resources are inputs into production that are provided by nature, such as land, rivers, and mineral deposits. Natural resources take two forms: renewable and nonrenewable. A forest is an example of a renewable resource. When one tree is cut down, a seedling can be planted in its place to be harvested in the future. Oil is an example of a nonrenewable resource. Because oil is produced by nature over many millions of years, there is only a limited supply. Once the supply of oil is depleted, it is impossible to create more.

Differences in natural resources are responsible for some of the differences in standards of living around the world. The historical success of the United States was driven in part by the large supply of land well suited for agriculture. Today, some countries in the Middle East, such as Kuwait and Saudi Arabia, are rich simply because they happen to be on top of some of the largest pools of oil in the world.

Although natural resources can be important, they are not necessary for an economy to be highly productive in producing goods and services. Japan, for instance, is one of the richest countries in the world, despite having few natural resources. International trade makes Japan's success possible. Japan imports many of the natural resources it needs, such as oil, and exports its manufactured goods to economies rich in natural resources.

Technological Knowledge

A fourth determinant of productivity is **technological knowledge**—the understanding of the best ways to produce goods and services. A hundred years ago, most Americans worked on farms because farm technology required a high input of labor to feed the entire population. Today, thanks to advances in farming technology, a small fraction of the population can produce enough food to feed the entire country. This technological change made labor available to produce other goods and services.

Technological knowledge takes many forms. Some technology is common knowledge—after one person uses it, everyone becomes aware of it. For example, once Henry Ford successfully introduced production in assembly lines, other carmakers quickly followed suit. Other technology is proprietary—it is known only by the company that discovers it. Only the Coca-Cola Company, for instance, knows the secret recipe for making its famous soft drink. Still other technology is proprietary for a short time. When a pharmaceutical company discovers a new drug, the patent system gives that company a temporary right to be its exclusive manufacturer. When the patent expires, however, other companies are allowed to make the drug. All these forms of technological knowledge are important for the economy's production of goods and services.

It is worthwhile to distinguish between technological knowledge and human capital. Although they are closely related, there is an important difference. Technological knowledge refers to society's understanding about how the world works. Human capital refers to the resources expended transmitting this understanding to the labor force. To use a relevant metaphor, knowledge is the quality of society's textbooks, whereas human capital is the amount of time that the population has devoted to reading them. Workers' productivity depends on both.

FYI: The Production Function

Economists often use a *production function* to describe the relationship between the quantity of inputs used in production and the quantity of output from production. For example, suppose Y denotes the quantity of output, L the quantity of labor, K the quantity of physical capital, H the quantity of human capital, and N the quantity of natural resources. Then we might write

$$Y = A\,F(L, K, H, N),$$

where $F(\ )$ is a function that shows how the inputs are combined to produce output. A is a variable that reflects the available production technology. As technology improves, A rises, so the economy produces more output from any given combination of inputs.

Many production functions have a property called *constant returns to scale.* If a production function has constant returns to scale, then doubling all inputs causes the amount of output to double as well. Mathematically, we write that a production function has constant returns to scale if, for any positive number x,

$$xY = A\,F(xL, xK, xH, xN).$$

A doubling of all inputs would be represented in this equation by $x = 2$. The right side shows the inputs doubling, and the left side shows output doubling.

Production functions with constant returns to scale have an interesting and useful implication. To see this implication, it will prove instructive to set $x = 1/L$. Then the preceding equation becomes

$$Y/L = A\,F(1, K/L, H/L, N/L).$$

Notice that Y/L is output per worker, which is a measure of productivity. This equation says that labor productivity depends on physical capital per worker (K/L), human capital per worker (H/L), and natural resources per worker (N/L). Productivity also depends on the state of technology, as reflected by the variable A. Thus, this equation provides a mathematical summary of the four determinants of productivity we have just discussed.

Case Study: Are Natural Resources a Limit to Growth?

Today, the world's population is almost 7 billion, more than four times what it was a century ago. At the same time, many people are enjoying a much higher standard of living than did their great-grandparents. A perennial debate concerns whether this growth in population and living standards can continue in the future.

Many commentators have argued that natural resources will eventually limit how much the world's economies can grow. At first, this argument might seem hard to ignore. If the world has only a fixed supply of nonrenewable natural resources, how can population, production, and living standards continue to grow over time? Eventually, won't supplies of oil and minerals start to run out? When these shortages start to occur, won't they stop economic growth and, perhaps, even force living standards to fall?

Despite the apparent appeal of such arguments, most economists are less concerned about such limits to growth than one might guess. They argue that technological progress often yields ways to avoid these limits. If we compare the economy today to the economy of the past, we see various ways in which the use of natural resources has improved. Modern cars have better gas mileage. New houses have better insulation and require less energy to heat and cool them. More efficient oil rigs waste less oil in the process of extraction. Recycling allows some nonrenewable resources to be reused. The development of alternative fuels, such as ethanol instead of gasoline, allows us to substitute renewable for nonrenewable resources.

Sixty years ago, some conservationists were concerned about the excessive use of tin and copper. At the time, these were crucial commodities: Tin was used to make many food containers, and copper was used to make telephone wire. Some people advocated mandatory recycling and rationing of tin and copper so that supplies would be available for future generations. Today, however, plastic has replaced tin as a material for making many food containers, and phone calls often travel over fiber-optic cables, which are made from sand. Technological progress has made once crucial natural resources less necessary.

But are all these efforts enough to permit continued economic growth? One way to answer this question is to look at the prices of natural resources. In a market economy, scarcity is reflected in market prices. If the world were running out of natural resources, then the prices of those resources would be rising over time. But in fact, the opposite is more often true. Natural resource prices exhibit substantial short-run fluctuations, but over long spans of time, the prices of most natural resources (adjusted for overall inflation) are stable or falling. It appears that our ability to conserve these resources is growing more rapidly than their supplies are dwindling. Market prices give no reason to believe that natural resources are a limit to economic growth.

QUICK QUIZ

List and describe four determinants of a country's productivity.

12-3 Economic Growth and Public Policy

So far, we have determined that a society's standard of living depends on its ability to produce goods and services and that its productivity in turn depends on physical capital per worker, human capital per worker, natural resources per worker, and technological knowledge. Let's now turn to the question faced by policymakers around the world: What can government policy do to raise productivity and living standards?

12-3a Saving and Investment

Because capital is a produced factor of production, a society can change the amount of capital it has. If today the economy produces a large quantity of new capital goods, then tomorrow it will have a larger stock of capital and be able to produce more goods and services. Thus, one way to raise future productivity is to invest more current resources in the production of capital.

One of the *Ten Principles of Economics* presented in Chapter 1 is that people face trade-offs. This principle is especially important when considering the accumulation of capital. Because resources are scarce, devoting more resources to producing capital requires devoting fewer resources to producing goods and services for current consumption. That is, for society to invest more in capital, it must consume less and save more of its current income. The growth that arises from capital accumulation is not a free lunch: It requires that society sacrifice consumption of goods and services in the present to enjoy higher consumption in the future.

The next chapter examines in more detail how the economy's financial markets coordinate saving and investment. It also examines how government policies influence the amount of saving and investment that takes place. At this point, it is important to note that encouraging saving and investment is one way that a government can encourage growth and, in the long run, raise the economy's standard of living.

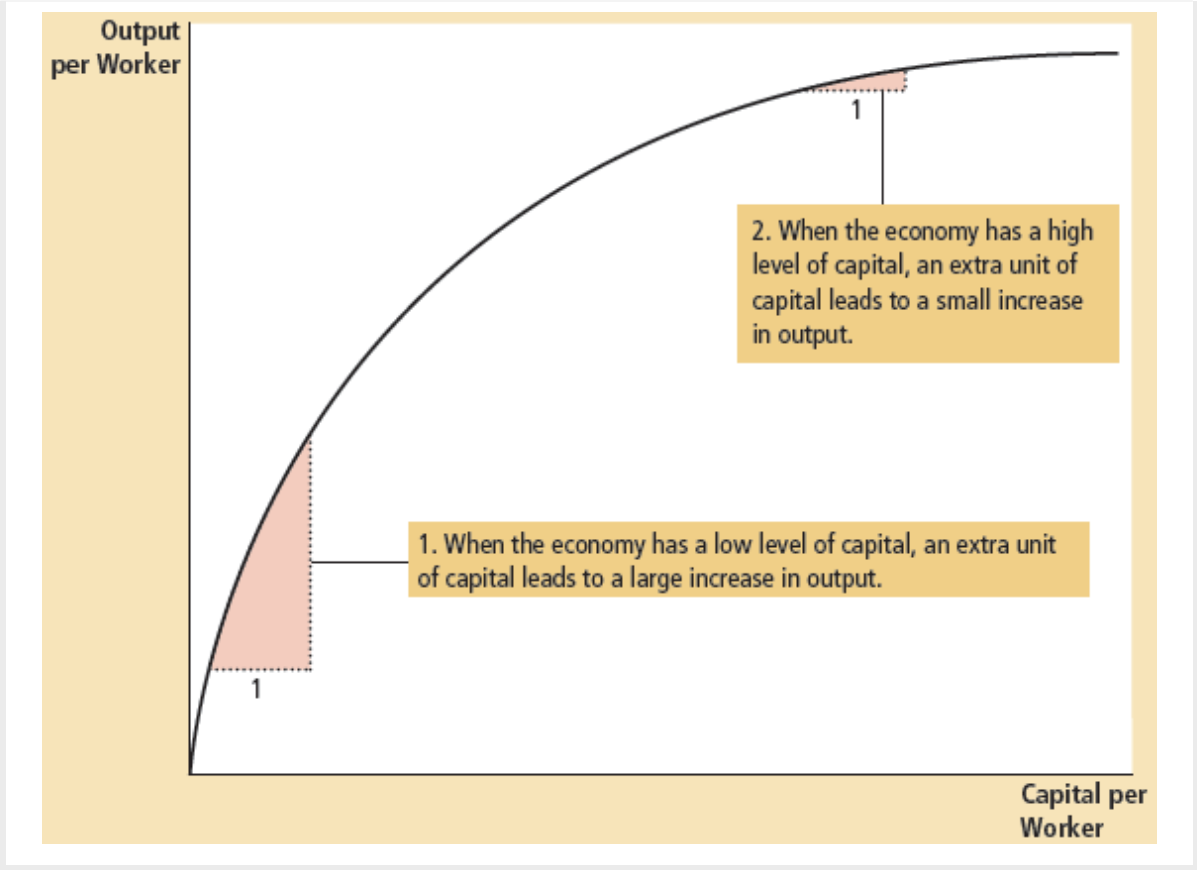
12-3b Diminishing Returns and the Catch-Up Effect

Suppose that a government pursues policies that raise the nation's saving rate—the percentage of GDP devoted to saving rather than consumption. What happens? With the nation saving more, fewer resources are needed to make consumption goods, and more resources are available to make capital goods. As a result, the capital stock increases, leading to rising productivity and more rapid growth in GDP. But how long does this higher rate of growth last? Assuming that the saving rate remains at its new higher level, does the growth rate of GDP stay high indefinitely or only for a period of time?

The traditional view of the production process is that capital is subject to **diminishing returns**: As the stock of capital rises, the extra output produced from an additional unit of capital falls. In other words, when workers already have a large quantity of capital to use in producing goods and services, giving them an additional unit of capital increases their productivity only slightly. This is illustrated in Figure 1, which shows how the amount of capital per worker determines the amount of output per worker, holding constant all the other determinants of output.

Figure 1. Illustrating the Production Function

This figure shows how the amount of capital per worker influences the amount of output per worker. Other determinants of output, including human capital, natural resources, and technology, are held constant. The curve becomes flatter as the amount of capital increases because of diminishing returns to capital.



Because of diminishing returns, an increase in the saving rate leads to higher growth only for a while. As the higher saving rate allows more capital to be accumulated, the benefits from additional capital become smaller over time, and so growth slows down. *In the long run, the higher saving rate leads to a higher level of productivity and income but not to higher growth in these variables.* Reaching this long run, however, can take quite a while. According to studies of international data on economic growth, increasing the saving rate can lead to substantially higher growth for a period of several decades.

The diminishing returns to capital has another important implication: Other things equal, it is easier for a country to grow fast if it starts out relatively poor. This effect of initial conditions on subsequent growth is sometimes called the **catch-up effect**. In poor countries, workers lack even the most rudimentary tools and, as a result, have low productivity. Small amounts of capital investment would substantially raise these workers' productivity. By contrast, workers in rich countries have large amounts of capital with which to work, and this partly explains their high productivity. Yet with the amount of capital per worker already so high, additional capital investment has a relatively small effect on productivity. Studies of international data on economic growth confirm this catch-up effect: Controlling for other variables, such as the percentage of GDP devoted to investment, poor countries tend to grow at faster rates than rich countries.

This catch-up effect can help explain some otherwise puzzling facts. Here's an example: From 1960 to 1990, the United States and South Korea devoted a similar share of GDP to investment. Yet over this time, the United States experienced only mediocre growth of about 2 percent, while South Korea experienced spectacular growth of more than 6 percent. The explanation is the catch-up effect. In 1960, South Korea had GDP per person less than one-tenth the U.S. level, in part because previous investment had been so low. With a small initial capital stock, the benefits to capital accumulation were much greater in South Korea, and this gave South Korea a higher subsequent growth rate.

This catch-up effect shows up in other aspects of life. When a school gives an end-of-year award to the "Most Improved" student, that student is usually one who began the year with relatively poor performance. Students who began the year not studying find improvement easier than students who always worked hard. Note that it is good to be "Most Improved," given the starting point, but it is even better to be "Best Student." Similarly, economic growth over the last several decades has been much more rapid in South Korea than in the United States, but GDP per person is still higher in the United States.

12-3c Investment from Abroad

So far, we have discussed how policies aimed at increasing a country's saving rate can increase investment and, thereby, long-term economic

growth. Yet saving by domestic residents is not the only way for a country to invest in new capital. The other way is investment by foreigners.

Investment from abroad takes several forms. Ford Motor Company might build a car factory in Mexico. A capital investment that is owned and operated by a foreign entity is called *foreign direct investment*. Alternatively, an American might buy stock in a Mexican corporation (that is, buy a share in the ownership of the corporation); the Mexican corporation can use the proceeds from the stock sale to build a new factory. An investment that is financed with foreign money but operated by domestic residents is called *foreign portfolio investment*. In both cases, Americans provide the resources necessary to increase the stock of capital in Mexico. That is, American saving is being used to finance Mexican investment.

When foreigners invest in a country, they do so because they expect to earn a return on their investment. Ford's car factory increases the Mexican capital stock and, therefore, increases Mexican productivity and Mexican GDP. Yet Ford takes some of this additional income back to the United States in the form of profit. Similarly, when an American investor buys Mexican stock, the investor has a right to a portion of the profit that the Mexican corporation earns.

Investment from abroad, therefore, does not have the same effect on all measures of economic prosperity. Recall that gross domestic product (GDP) is the income earned within a country by both residents and nonresidents, whereas gross national product (GNP) is the income earned by residents of a country both at home and abroad. When Ford opens its car factory in Mexico, some of the income the factory generates accrues to people who do not live in Mexico. As a result, foreign investment in Mexico raises the income of Mexicans (measured by GNP) by less than it raises the production in Mexico (measured by GDP).

Nonetheless, investment from abroad is one way for a country to grow. Even though some of the benefits from this investment flow back to the foreign owners, this investment does increase the economy's stock of capital, leading to higher productivity and higher wages. Moreover, investment from abroad is one way for poor countries to learn the state-of-the-art technologies developed and used in richer countries. For these reasons, many economists who advise governments in less developed economies advocate policies that encourage investment from abroad. Often, this means removing restrictions that governments have imposed on foreign ownership of domestic capital.

An organization that tries to encourage the flow of capital to poor countries is the World Bank. This international organization obtains funds from the world's advanced countries, such as the United States, and uses these resources to make loans to less developed countries so that they can invest in roads, sewer systems, schools, and other types of capital. It also offers the countries advice about how the funds might best be used. The World Bank, together with its sister organization, the International Monetary Fund, was set up after World War II. One lesson from the war was that economic distress often leads to political turmoil, international tensions, and military conflict. Thus, every country has an interest in promoting economic prosperity around the world. The World Bank and the International Monetary Fund were established to achieve that common goal.

12-3d Education

Education—investment in human capital—is at least as important as investment in physical capital for a country's long-run economic success. In the United States, each year of schooling has historically raised a person's wage by an average of about 10 percent. In less developed countries, where human capital is especially scarce, the gap between the wages of educated and uneducated workers is even larger. Thus, one way government policy can enhance the standard of living is to provide good schools and to encourage the population to take advantage of them.

Investment in human capital, like investment in physical capital, has an opportunity cost. When students are in school, they forgo the wages they could have earned as members of the labor force. In less developed countries, children often drop out of school at an early age, even though the benefit of additional schooling is very high, simply because their labor is needed to help support the family.

Some economists have argued that human capital is particularly important for economic growth because human capital conveys positive externalities. An *externality* is the effect of one person's actions on the well-being of a bystander. An educated person, for instance, might generate new ideas about how best to produce goods and services. If these ideas enter society's pool of knowledge so that everyone can use them, then the ideas are an external benefit of education. In this case, the return to schooling for society is even greater than the return for the individual. This argument would justify the large subsidies to human-capital investment that we observe in the form of public education.

One problem facing some poor countries is the *brain drain*—the emigration of many of the most highly educated workers to rich countries, where these workers can enjoy a higher standard of living. If human capital does have positive externalities, then this brain drain makes those people left behind poorer than they otherwise would be. This problem offers policymakers a dilemma. On the one hand, the United States and other rich countries have the best systems of higher education, and it would seem natural for poor countries to send their best students abroad to earn higher degrees. On the other hand, those students who have spent time abroad may choose not to return home, and this brain drain

will reduce the poor nation's stock of human capital even further.

In the News: Promoting Human Capital

Because human capital is a key to economic growth, some developing countries give parents an immediate financial incentive to keep their children in school.

Brazil Pays Parents to Help Poor Be Pupils, Not Wage Earners

By Celia W. Dugger

Vandelson Andrade, 13, often used to skip school to work 12-hour days on the small, graceful fishing boats that sail from the picturesque harbor here. His meager earnings helped pay for rice and beans for his desperately poor family.

But this year he qualified for a small monthly cash payment from the government that his mother receives on the condition that he shows up in the classroom.

"I can't skip school anymore," said Vandelson, whose hand-me-down pants were so big that the crotch ended at his knees and the legs bunched up around his ankles. "If I miss one more day, my mother won't get the money."

This year, Vandelson will finally pass the fourth grade on his third try—a small victory in a new breed of social program that is spreading swiftly across Latin America. It is a developing-country version of American welfare reform: to break the cycle of poverty, the government gives the poor small cash payments in exchange for keeping their children in school and taking them for regular medical checkups.

Vandelson Andrade, student

"I think these programs are as close as you can come to a magic bullet in development," said Nancy Birdsall, president of the Center for Global Development, a nonprofit research group in Washington. "They're creating an incentive for families to invest in their own children's futures. Every decade or so, we see something that can really make a difference, and this is one of those things." . . .

Antônio Souza, 48, and Maria Torres, 37, are raising seven children in a mud hut a couple of hills away from Ms. Andrade. Every member of the family is sinewy and lean. The parents cannot remember the last time the family ate meat or vegetables. But their grant of $27 a month makes it possible to buy rice, sugar, pasta and oil.

Mr. Souza and Ms. Torres, illiterate believers in the power of education, have always sent their children to school. "If they don't study, they'll turn into dummies like me," said their father, whose weathered, deeply creased face broke into a wide smile as he surveyed his bright-eyed daughters, Ana Paula, 11, and Daniele, 8, among them. "All I can do is work in the fields."

His wife said proudly: "There are fathers who don't want their children to go to school. But this man here has done everything he could to send his children to school."

New York Times, January 3, 2004.

12-3e Health and Nutrition

The term *human capital* usually refers to education, but it can also be used to describe another type of investment in people: expenditures that lead to a healthier population. Other things equal, healthier workers are more productive. The right investments in the health of the population provide one way for a nation to increase productivity and raise living standards.

Economic historian Robert Fogel has suggested that a significant factor in long-run economic growth is improved health from better nutrition. He estimates that in Great Britain in 1780, about one in five people were so malnourished that they were incapable of manual labor. Among those who could work, insufficient caloric intake substantially reduced the work effort they could put forth. As nutrition improved, so did workers' productivity.

Fogel studies these historical trends in part by looking at the height of the population. Short stature can be an indicator of malnutrition, especially during gestation and the early years of life. Fogel finds that as nations develop economically, people eat more, and the population gets taller. From 1775 to 1975, the average caloric intake in Great Britain rose by 26 percent, and the height of the average man rose by 3.6 inches. Similarly, during the spectacular economic growth in South Korea from 1962 to 1995, caloric consumption rose by 44 percent, and average male height rose by 2 inches. Of course, a person's height is determined by a combination of genetic predisposition and environment. But because the genetic makeup of a population is slow to change, such increases in average height are most likely due to changes in the environment—nutrition being the obvious explanation.

Moreover, studies have found that height is an indicator of productivity. Looking at data on a large number of workers at a point in time, researchers have found that taller workers tend to earn more. Because wages reflect a worker's productivity, this finding suggests that taller workers tend to be more productive. The effect of height on wages is especially pronounced in poorer countries, where malnutrition is a bigger risk.

Fogel won the Nobel Prize in Economics in 1993 for his work in economic history, which includes not only his studies of nutrition but also his studies of American slavery and the role of railroads in the development of the American economy. In the lecture he gave when he was awarded the prize, he surveyed the evidence on health and economic growth. He concluded that "improved gross nutrition accounts for roughly 30 percent of the growth of per capita income in Britain between 1790 and 1980."

Today, malnutrition is fortunately rare in developed nations such as Great Britain and the United States. (Obesity is a more widespread problem.) But for people in developing nations, poor health and inadequate nutrition remain obstacles to higher productivity and improved living standards. The United Nations estimates that almost a third of the population in sub-Saharan Africa is undernourished.

The causal link between health and wealth runs in both directions. Poor countries are poor in part because their populations are not healthy, and their populations are not healthy in part because they are poor and cannot afford adequate healthcare and nutrition. It is a vicious circle. But this fact opens the possibility of a virtuous circle: Policies that lead to more rapid economic growth would naturally improve health outcomes, which in turn would further promote economic growth.

12-3f Property Rights and Political Stability

Another way policymakers can foster economic growth is by protecting property rights and promoting political stability. This issue goes to the very heart of how market economies work.

Production in market economies arises from the interactions of millions of individuals and firms. When you buy a car, for instance, you are buying the output of a car dealer, a car manufacturer, a steel company, an iron ore mining company, and so on. This division of production among many firms allows the economy's factors of production to be used as effectively as possible. To achieve this outcome, the economy has to coordinate transactions among these firms, as well as between firms and consumers. Market economies achieve this coordination through market prices. That is, market prices are the instrument with which the invisible hand of the marketplace brings supply and demand into balance in each of the many thousands of markets that make up the economy.

An important prerequisite for the price system to work is an economy-wide respect for *property rights*. Property rights refer to the ability of people to exercise authority over the resources they own. A mining company will not make the effort to mine iron ore if it expects the ore to be

stolen. The company mines the ore only if it is confident that it will benefit from the ore's subsequent sale. For this reason, courts serve an important role in a market economy: They enforce property rights. Through the criminal justice system, the courts discourage direct theft. In addition, through the civil justice system, the courts ensure that buyers and sellers live up to their contracts.

Those of us in developed countries tend to take property rights for granted, but those living in less developed countries understand that a lack of property rights can be a major problem. In many countries, the system of justice does not work well. Contracts are hard to enforce, and fraud often goes unpunished. In more extreme cases, the government not only fails to enforce property rights but actually infringes upon them. To do business in some countries, firms are expected to bribe government officials. Such corruption impedes the coordinating power of markets. It also discourages domestic saving and investment from abroad.

One threat to property rights is political instability. When revolutions and coups are common, there is doubt about whether property rights will be respected in the future. If a revolutionary government might confiscate the capital of some businesses, as was often true after communist revolutions, domestic residents have less incentive to save, invest, and start new businesses. At the same time, foreigners have less incentive to invest in the country. Even the threat of revolution can act to depress a nation's standard of living.

Thus, economic prosperity depends in part on political prosperity. A country with an efficient court system, honest government officials, and a stable constitution will enjoy a higher economic standard of living than a country with a poor court system, corrupt officials, and frequent revolutions and coups.

12-3g Free Trade

Some of the world's poorest countries have tried to achieve more rapid economic growth by pursuing *inward-oriented policies*. These policies attempt to increase productivity and living standards within the country by avoiding interaction with the rest of the world. Domestic firms often advance the infant-industry argument, claiming they need protection from foreign competition to thrive and grow. Together with a general distrust of foreigners, this argument has at times led policymakers in less developed countries to impose tariffs and other trade restrictions.

Most economists today believe that poor countries are better off pursuing *outward-oriented policies* that integrate these countries into the world economy. International trade in goods and services can improve the economic well-being of a country's citizens. Trade is, in some ways, a type of technology. When a country exports wheat and imports textiles, the country benefits as if it had invented a technology for turning wheat into textiles. A country that eliminates trade restrictions will, therefore, experience the same kind of economic growth that would occur after a major technological advance.

The adverse impact of inward orientation becomes clear when one considers the small size of many less developed economies. The total GDP of Argentina, for instance, is about that of Philadelphia. Imagine what would happen if the Philadelphia city council were to prohibit city residents from trading with people living outside the city limits. Without being able to take advantage of the gains from trade, Philadelphia would need to produce all the goods it consumes. It would also have to produce all its own capital goods, rather than importing state-of-the-art equipment from other cities. Living standards in Philadelphia would fall immediately, and the problem would likely only get worse over time. This is precisely what happened when Argentina pursued inward-oriented policies throughout much of the 20th century. In contrast, countries that pursued outward-oriented policies, such as South Korea, Singapore, and Taiwan, enjoyed high rates of economic growth.

The amount that a nation trades with others is determined not only by government policy but also by geography. Countries with natural seaports find trade easier than countries without this resource. It is not a coincidence that many of the world's major cities, such as New York, San Francisco, and Hong Kong, are located next to oceans. Similarly, because landlocked countries find international trade more difficult, they tend to have lower levels of income than countries with easy access to the world's waterways. For example, countries with more than 80 percent of their population living within 100 kilometers of a coast have an average GDP per person about four times as large as countries with less than 20 percent of their population living near a coast. The critical importance of access to the sea helps explain why the African continent, which contains many landlocked countries, is so poor.

12-3h Research and Development

The primary reason that living standards are higher today than they were a century ago is that technological knowledge has advanced. The telephone, the transistor, the computer, and the internal combustion engine are among the thousands of innovations that have improved the ability to produce goods and services.

Most technological advances come from private research by firms and individual inventors, but there is also a public interest in promoting these efforts. To a large extent, knowledge is a *public good*: That is, once one person discovers an idea, the idea enters society's pool of knowledge, and other people can freely use it. Just as government has a role in providing a public good such as national defense, it also has a role in encouraging the research and development of new technologies.

The U.S. government has long played a role in the creation and dissemination of technological knowledge. A century ago, the government sponsored research about farming methods and advised farmers how best to use their land. More recently, the U.S. government, through the Air Force and NASA, has supported aerospace research; as a result, the United States is a leading maker of rockets and planes. The government continues to encourage advances in knowledge with research grants from the National Science Foundation and the National Institutes of Health and with tax breaks for firms engaging in research and development.

Yet another way in which government policy encourages research is through the patent system. When a person or firm invents a new product, such as a new drug, the inventor can apply for a patent. If the product is deemed truly original, the government awards the patent, which gives the inventor the exclusive right to make the product for a specified number of years. In essence, the patent gives the inventor a property right over his invention, turning his new idea from a public good into a private good. By allowing inventors to profit from their inventions—even if only temporarily—the patent system enhances the incentive for individuals and firms to engage in research.

12-3i Population Growth

Economists and other social scientists have long debated how population affects a society. The most direct effect is on the size of the labor force: A large population means more workers to produce goods and services. The tremendous size of the Chinese population is one reason China is such an important player in the world economy.

At the same time, however, a large population means more people to consume those goods and services. So while a large population means a larger total output of goods and services, it need not mean a higher standard of living for a typical citizen. Indeed, both large and small nations are found at all levels of economic development.

Beyond these obvious effects of population size, population growth interacts with the other factors of production in ways that are more subtle and open to debate.

Stretching Natural Resources

Thomas Robert Malthus (1766–1834), an English minister and early economic thinker, is famous for his book called *An Essay on the Principle of Population as It Affects the Future Improvement of Society*. In it, he offered what may be history's most chilling forecast. Malthus argued that an ever-increasing population would continually strain society's ability to provide for itself. As a result, mankind was doomed to forever live in poverty.

Thomas Robert Malthus

Malthus's logic was simple. He began by noting that "food is necessary to the existence of man" and that "the passion between the sexes is necessary and will remain nearly in its present state." He concluded that "the power of population is infinitely greater than the power in the earth to produce subsistence for man." According to Malthus, the only check on population growth was "misery and vice." Attempts by charities or governments to alleviate poverty were counterproductive, he argued, because they merely allowed the poor to have more children, placing even greater strains on society's productive capabilities.

Malthus may have correctly described the world at the time when he lived, but fortunately, his dire forecast was far off the mark. The world population has increased about sixfold over the past two centuries, but living standards around the world are on average much higher. As a result of economic growth, chronic hunger and malnutrition are less common now than they were in Malthus's day. Modern famines occur from time to time but are more often the result of an unequal income distribution or political instability than inadequate food production.

Where did Malthus go wrong? As we discussed in a case study earlier in this chapter, growth in human ingenuity has offset the effects of a larger population. Pesticides, fertilizers, mechanized farm equipment, new crop varieties, and other technological advances that Malthus never imagined have allowed each farmer to feed ever greater numbers of people. Even with more mouths to feed, fewer farmers are necessary because each farmer is much more productive.

Diluting the Capital Stock

Whereas Malthus worried about the effects of population on the use of natural resources, some modern theories of economic growth emphasize its effects on capital accumulation. According to these theories, high population growth reduces GDP per worker because rapid growth in the number of workers forces the capital stock to be spread more thinly. In other words, when population growth is rapid, each worker is equipped with less capital. A smaller quantity of capital per worker leads to lower productivity and lower GDP per worker.

This problem is most apparent in the case of human capital. Countries with high population growth have large numbers of school-age children. This places a larger burden on the educational system. It is not surprising, therefore, that educational attainment tends to be low in countries with high population growth.

The differences in population growth around the world are large. In developed countries, such as the United States and those in Western Europe, the population has risen only about 1 percent per year in recent decades and is expected to rise even more slowly in the future. By contrast, in many poor African countries, population grows at about 3 percent per year. At this rate, the population doubles every 23 years. This rapid population growth makes it harder to provide workers with the tools and skills they need to achieve high levels of productivity.

Rapid population growth is not the main reason that less developed countries are poor, but some analysts believe that reducing the rate of population growth would help these countries raise their standards of living. In some countries, this goal is accomplished directly with laws

that regulate the number of children families may have. China, for instance, allows only one child per family; couples who violate this rule are subject to substantial fines. In countries with greater freedom, the goal of reduced population growth is accomplished less directly by increasing awareness of birth control techniques.

Another way in which a country can influence population growth is to apply one of the *Ten Principles of Economics*: People respond to incentives. Bearing a child, like any decision, has an opportunity cost. When the opportunity cost rises, people will choose to have smaller families. In particular, women with the opportunity to receive a good education and desirable employment tend to want fewer children than those with fewer opportunities outside the home. Hence, policies that foster equal treatment of women may be one way for less developed economies to reduce the rate of population growth and, perhaps, raise their standards of living.

In the News: One Economist's Answer

MIT economist Daron Acemoglu considers why some nations thrive while others do not.

What Makes a Nation rich?

By Daron Acemoglu

We are the rich, the haves, the developed. And most of the rest—in Africa, South Asia, and South America, the Somalias and Bolivias and Bangladeshes of the world—are the nots. It's always been this way, a globe divided by wealth and poverty, health and sickness, food and famine, though the extent of inequality across nations today is unprecedented: The average citizen of the United States is ten times as prosperous as the average Guatemalan, more than twenty times as prosperous as the average North Korean, and more than forty times as prosperous as those living in Mali, Ethiopia, Congo, or Sierra Leone.

The question social scientists have unsuccessfully wrestled with for centuries is, Why? But the question they should have been asking is, How? Because inequality is not predetermined. Nations are not like children—they are not born rich or poor. Their governments make them that way.

You can chart the search for a theory of inequality to the French political philosopher Montesquieu, who in the mid-eighteenth century came up with a very simple explanation: People in hot places are inherently lazy. Other no less sweeping explanations soon followed: Could it be that Max Weber's Protestant work ethic is the true driver of economic success? Or perhaps the richest countries are those that were former British colonies? Or maybe it's as simple as tracing which nations have the largest populations of European descent? The problem with all of these theories is that while they superficially fit some specific cases, others radically disprove them.

It's the same with the theories put forth today. Economist Jeffrey Sachs, director of Columbia University's Earth Institute, attributes the relative success of nations to geography and weather: In the poorest parts of the world, he argues, nutrient-starved tropical soil makes agriculture a challenge, and tropical climates foment disease, particularly malaria. Perhaps if we were to fix these problems, teach the citizens of these nations better farming techniques, eliminate malaria, or at the very least equip them with artemisinin to fight this deadly disease, we could eliminate poverty. Or better yet, perhaps we just move these people and abandon their inhospitable land altogether.

Jared Diamond, the famous ecologist and best-selling author, has a different theory: The origin of world inequality stems from the historical endowment of plant and animal species and the advancement of technology. In Diamond's telling, the cultures that first learned to plant crops were the first to learn how to use a plow, and thus were first to adopt other technologies, the engine of every successful economy. Perhaps then the solution to world inequality rests in technology—wiring the developing world with Internet and cell phones.

And yet while Sachs and Diamond offer good insight into certain aspects of poverty, they share something in common with Montesquieu and others who followed: They ignore incentives. People need incentives to invest and prosper; they need to know that if they work hard, they can make money and actually keep that money. And the key to ensuring those incentives is sound institutions—the rule of law and security and a governing system that offers opportunities to achieve and innovate. That's what determines the haves from the have-nots—not geography or weather or technology or disease or ethnicity.

Put simply: Fix incentives and you will fix poverty. And if you wish to fix institutions, you have to fix governments.

How do we know that institutions are so central to the wealth and poverty of nations? Start in Nogales, a city cut in half by the Mexican-American border fence. There is no difference in geography between the two halves of Nogales. The weather is the same. The winds are the same, as are the soils. The types of diseases prevalent in the area given its geography and climate are the same, as is the ethnic, cultural, and

linguistic background of the residents. By logic, both sides of the city should be identical economically.

And yet they are far from the same.

On one side of the border fence, in Santa Cruz County, Arizona, the median household income is $30,000. A few feet away, it's $10,000. On one side, most of the teenagers are in public high school, and the majority of the adults are high school graduates. On the other side, few of the residents have gone to high school, let alone college. Those in Arizona enjoy relatively good health and Medicare for those over sixty-five, not to mention an efficient road network, electricity, telephone service, and a dependable sewage and public-health system. None of those things are a given across the border. There, the roads are bad, the infant-mortality rate high, electricity and phone service expensive and spotty.

The key difference is that those on the north side of the border enjoy law and order and dependable government services—they can go about their daily activities and jobs without fear for their life or safety or property rights. On the other side, the inhabitants have institutions that perpetuate crime, graft, and insecurity.

Nogales may be the most obvious example, but it's far from the only one. Take Singapore, a once-impoverished tropical island that became the richest nation in Asia after British colonialists enshrined property rights and encouraged trade. Or China, where decades of stagnation and famine were reversed only after Deng Xiaoping began introducing private-property rights in agriculture, and later in industry. Or Botswana, whose economy has flourished over the past forty years while the rest of Africa has withered, thanks to strong tribal institutions and farsighted nation building by its early elected leaders.

Now look at the economic and political failures. You can begin in Sierra Leone, where a lack of functioning institutions and an overabundance of diamonds have fueled decades of civil war and strife and corruption that continue unchecked today. Or take communist North Korea, a geographical, ethnic, and cultural mirror of its capitalist neighbor to the south, yet ten times poorer. Or Egypt, cradle of one of the world's great civilizations yet stagnant economically ever since its colonization by the Ottomans and then the Europeans, only made worse by its post-independence governments, which have restricted all economic activities and markets. In fact, the theory can be used to shed light on the patterns of inequality for much of the world.

If we know why nations are poor, the resulting question is what can we do to help them. Our ability to impose institutions from the outside is limited, as the recent U.S. experiences in Afghanistan and Iraq demonstrate. But we are not helpless, and in many instances, there is a lot to be done. Even the most repressed citizens of the world will stand up to tyrants when given the opportunity. We saw this recently in Iran and a few years ago in Ukraine during the Orange Revolution.

The U.S. must not take a passive role in encouraging these types of movements. Our foreign policy should encourage them by punishing repressive regimes through trade embargoes and diplomacy. . . . At the microlevel, we can help foreign citizens by educating them and arming them with the modern tools of activism, most notably the Internet, and perhaps even encryption technology and cell-phone platforms that can evade firewalls and censorship put in place by repressive governments, such as those in China or Iran, that fear the power of information.

There's no doubt that erasing global inequality, which has been with us for millennia and has expanded to unprecedented levels over the past century and a half, won't be easy. But by accepting the role of failed governments and institutions in causing poverty, we have a fighting chance of reversing it.

Daron Acemoglu

Esquire, November 18, 2009.

Promoting Technological Progress

Rapid population growth may depress economic prosperity by reducing the amount of capital each worker has, but it may also have some benefits. Some economists have suggested that world population growth has been an engine of technological progress and economic prosperity. The mechanism is simple: If there are more people, then there are more scientists, inventors, and engineers to contribute to technological advance, which benefits everyone.

Economist Michael Kremer has provided some support for this hypothesis in an article titled "Population Growth and Technological Change: One Million B.C. to 1990," which was published in the *Quarterly Journal of Economics* in 1993. Kremer begins by noting that over the broad span of human history, world growth rates have increased with world population. For example, world growth was more rapid when the world population was 1 billion (which occurred around the year 1800) than when the population was only 100 million (around 500 B.C.). This fact is consistent with the hypothesis that a larger population induces more technological progress.

Kremer's second piece of evidence comes from comparing regions of the world. The melting of the polar icecaps at the end of the Ice Age around 10,000 B.C. flooded the land bridges and separated the world into several distinct regions that could not communicate with one another for thousands of years. If technological progress is more rapid when there are more people to discover things, then larger regions should have experienced more rapid growth.

According to Kremer, that is exactly what happened. The most successful region of the world in 1500 (when Columbus reestablished technological contact) comprised the "Old World" civilizations of the large Eurasia-Africa region. Next in technological development were the Aztec and Mayan civilizations in the Americas, followed by the hunter-gatherers of Australia, and then the primitive people of Tasmania, who lacked even fire-making and most stone and bone tools.

The smallest isolated region was Flinders Island, a tiny island between Tasmania and Australia. With the smallest population, Flinders Island had the fewest opportunities for technological advance and, indeed, seemed to regress. Around 3000 B.C., human society on Flinders Island died out completely. A large population, Kremer concludes, is a prerequisite for technological advance.

QUICK QUIZ

Describe three ways a government policymaker can try to raise the growth in living standards in a society. Are there any drawbacks to these policies?

12-4 Conclusion: The Importance of Long-Run Growth

In this chapter, we have discussed what determines the standard of living in a nation and how policymakers can endeavor to raise the standard of living through policies that promote economic growth. Most of this chapter is summarized in one of the *Ten Principles of Economics*: A country's standard of living depends on its ability to produce goods and services. Policymakers who want to encourage growth in living standards must aim to increase their nation's productive ability by encouraging rapid accumulation of the factors of production and ensuring that these factors are employed as effectively as possible.

Economists differ in their views of the role of government in promoting economic growth. At the very least, government can lend support to the invisible hand by maintaining property rights and political stability. More controversial is whether government should target and subsidize specific industries that might be especially important for technological progress. There is no doubt that these issues are among the most important in economics. The success of one generation's policymakers in learning and heeding the fundamental lessons about economic growth determines what kind of world the next generation will inherit.

Chapter Recap: Summary

- Economic prosperity, as measured by GDP per person, varies substantially around the world. The average income in the world's richest countries is more than ten times that in the world's poorest countries. Because growth rates of real GDP also vary substantially, the relative positions of countries can change dramatically over time.
- The standard of living in an economy depends on the economy's ability to produce goods and services. Productivity, in turn, depends on the physical capital, human capital, natural resources, and technological knowledge available to workers.
- Government policies can try to influence the economy's growth rate in many ways: by encouraging saving and investment, encouraging investment from abroad, fostering education, promoting good health, maintaining property rights and political stability, allowing free trade, and promoting the research and development of new technologies.
- The accumulation of capital is subject to diminishing returns: The more capital an economy has, the less additional output the economy gets from an extra unit of capital. As a result, while higher saving leads to higher growth for a period of time, growth eventually slows down as capital, productivity, and income rise. Also because of diminishing returns, the return to capital is especially high in poor countries. Other things equal, these countries can grow faster because of the catch-up effect.
- Population growth has a variety of effects on economic growth. On the one hand, more rapid population growth may lower productivity by stretching the supply of natural resources and by reducing the amount of capital available for each worker. On the other hand, a larger population may enhance the rate of technological progress because there are more scientists and engineers.

Ask the Instructor: Have computers affected worker productivity?

Ask the Instructor: How important is the rate of economic growth to you?

Chapter Recap: Questions for Review

1. What does the level of a nation's GDP measure? What does the growth rate of GDP measure? Would you rather live in a nation with a high level of GDP and a low growth rate or in a nation with a low level of GDP and a high growth rate?
2. List and describe four determinants of productivity.
3. In what way is a college degree a form of capital?
4. Explain how higher saving leads to a higher standard of living. What might deter a policymaker from trying to raise the rate of saving?
5. Does a higher rate of saving lead to higher growth temporarily or indefinitely?
6. Why would removing a trade restriction, such as a tariff, lead to more rapid economic growth?
7. How does the rate of population growth influence the level of GDP per person?
8. Describe two ways the U.S. government tries to encourage advances in technological knowledge.

Chapter Recap: Problems and Applications

1. Most countries, including the United States, import substantial amounts of goods and services from other countries. Yet the chapter says that a nation can enjoy a high standard of living only if it can produce a large quantity of goods and services itself. Can you reconcile these two facts?

2. Suppose that society decided to reduce consumption and increase investment.
   a. How would this change affect economic growth?

   b. What groups in society would benefit from this change? What groups might be hurt?

3. Societies choose what share of their resources to devote to consumption and what share to devote to investment. Some of these decisions involve private spending; others involve government spending.
   a. Describe some forms of private spending that represent consumption and some forms that represent investment. The national income accounts include tuition as a part of consumer spending. In your opinion, are the resources you devote to your education a form of consumption or a form of investment?

   b. Describe some forms of government spending that represent consumption and some forms that represent investment. In your opinion, should we view government spending on health programs as a form of consumption or investment? Would you distinguish between health programs for the young and health programs for the elderly?

4. What is the opportunity cost of investing in capital? Do you think a country can "overinvest" in capital? What is the opportunity cost of investing in human capital? Do you think a country can "overinvest" in human capital? Explain.

5. Suppose that an auto company owned entirely by German citizens opens a new factory in South Carolina.
   a. What sort of foreign investment would this represent?

   b. What would be the effect of this investment on U.S. GDP? Would the effect on U.S. GNP be larger or smaller?

6. In the 1990s and the first decade of the 2000s, investors from the Asian economies of Japan and China made significant direct and portfolio investments in the United States. At the time, many Americans were unhappy that this investment was occurring.
   a. In what way was it better for the United States to receive this foreign investment than not to receive it?

   b. In what way would it have been better still for Americans to have made this investment?

7. In many developing nations, young women have lower enrollment rates in secondary school than do young men. Describe several ways in which greater educational opportunities for young women could lead to faster economic growth in these countries.

8. International data show a positive correlation between income per person and the health of the population.
   a. Explain how higher income might cause better health outcomes.

   b. Explain how better health outcomes might cause higher income.

   c. How might the relative importance of your two hypotheses be relevant for public policy?

9. International data show a positive correlation between political stability and economic growth.
   a. Through what mechanism could political stability lead to strong economic growth?

   b. Through what mechanism could strong economic growth lead to political stability?

10. From 1950 to 2000, manufacturing employment as a percentage of total employment in the U.S. economy fell from 28 percent to 13 percent. At the same time, manufacturing output experienced slightly more rapid growth than the overall economy.
    a. What do these facts say about growth in labor productivity (defined as output per worker) in manufacturing?

    b. In your opinion, should policymakers be concerned about the decline in the share of manufacturing employment? Explain.

For further information on topics in this chapter, additional problems, applications, examples, online quizzes, and more, please visit our website at **www.cengage.com/economics/mankiw** **(http://www.cengage.com/economics/mankiw)**.

Chapter Recap: Key Terms

- catch-up effect

  the property whereby countries that start off poor tend to grow more rapidly than countries that start off rich

- diminishing returns

  the property whereby the benefit from an extra unit of an input declines as the quantity of the input increases

- human capital

  the knowledge and skills that workers acquire through education, training, and experience

- natural resources

  the inputs into the production of goods and services that are provided by nature, such as land, rivers, and mineral deposits

- physical capital

  the stock of equipment and structures that are used to produce goods and services

- productivity

  the quantity of goods and services produced from each unit of labor input

- technological knowledge

  society's understanding of the best ways to produce goods and services