In developed nations, diarrhea is a pain, an annoyance, and, of course, an embarrassment. In much of the developing world, diarrhea is a killer, especially of children. Every year 1.8 million children die from diarrhea. To prevent the deaths of these children, we do not need any scientific breakthroughs, nor do we need new drugs or fancy medical devices. What these children need most is one thing: economic growth.

Economic growth brings piped water and flush toilets, which together cut infant mortality from diarrhea by 70% or more. Malaria, measles, and infections also kill millions of children a year. Again, the lesson is clear: millions of children are dying who would live if there were more economic growth.

Figure 27.1 on the next page illustrates how health and wealth go together. The vertical axis shows GDP per capita and the horizontal axis shows infant survival rates: how many children, out of every 1,000 births, survive to the age of 5. In the United States, one of the world’s richest countries, 993 out of every 1,000 children born survive to the age of 5 (i.e., 7 out of every 1,000 die before the age of 5). In Liberia, one of the world’s poorest countries, only about 765 children survive to age 5 (i.e., 235 of every 1,000 children die before seeing their fifth birthday). The graph illustrates a strong correlation between a country’s GDP per capita and infant survival. The graph doesn’t show a perfectly straight line—countries with the same level of income often have different levels of infant mortality, which means that factors other than income, such as government policies, culture, and geography, also matter. However, the correlation between income and infant mortality is quite strong. Notice also that the size of each country’s data bubble is proportional to the population of that country; notice that India and China each have populations of more than 1 billion people so economic growth in these countries has the potential to save millions of infants from an early death.

Infant health and wealth tend to move together; indeed, just about any standard indicator of societal well-being tends to increase with wealth. Infant survival rates, life expectancy, and nutrition (caloric intake levels), for example, all tend to be higher in wealthier nations. Educational opportunities, leisure, and entertainment also tend to be higher in wealthier nations. Wealthier nations even have fewer conflicts such as civil wars and riots. And, of course, wealthier nations...
nations have more material goods such as televisions, iPhones, and swimming pools.

Wealth is clearly important so we want answers to the following questions. Why are some nations wealthy, while others are poor? Why are some nations getting wealthier faster than others? Can anything be done to help poor nations become wealthy? The answers to these questions are literally a matter of life and death. In this chapter and the next, we will try to answer these questions.

Key Facts About the Wealth of Nations and Economic Growth

Let’s begin with some important facts about the wealth of nations and economic growth.

Fact One: GDP per Capita Varies Enormously Among Nations

We already have some understanding of the enormous differences that exist in the wealth of nations and how these differences affect infant mortality and other measures of well-being. Figure 27.2 shows in more detail how GDP per capita differed around the world in recent years. To construct this figure, we start on the left with the world’s poorest country, which happens to be the Democratic Republic of the Congo (DRC). The DRC (not labeled) accounts for just over 1% of the world’s population. As we add successively...
richer countries and their populations, we move further to the right in population and upward in GDP per capita. The graph tells us, for example, that about 10% of the world’s population—or 772 million people in 2014—lived in a country with a GDP per capita of less than $2,900—about the level in Bangladesh. Moving farther to the right, we see that about 70% of the world’s population lived in a country with a GDP per capita equal to or less than $12,472, about the level in China. The red horizontal dashed line shows the world’s average level of GDP per capita in 2014, which is a little less than in Mexico. Fully 73% of the world’s population—or 5.2 billion people—lived in a country with a GDP per capita less than average. In other words, most of the world’s population is poor relative to the United States.

In thinking about poverty, remember that GDP per capita is simply an average, and there is a distribution of income within each country. In India, GDP per capita was around $5,224, but many Indians have yearly incomes that are less than $5,224 and some have yearly incomes that are higher than the average income in the United States. Around the world, about a billion people have incomes of less than $3 per day.

**Fact Two: Everyone Used to Be Poor**

The distribution of world income tells us that poverty is normal. It’s wealth that is unusual. Poverty is even more normal when we think about human history. What was GDP per capita like in the year 1? No one knows for sure,

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**FIGURE 27.2**

**The Distribution of World Income (2014)**

Data from: Penn World Tables, 8.0. PPP adjusted.
but a good guesstimate is around $700–$1,000 per year in 2015 dollars, not much different from the very poorest people living in the world today. What’s surprising is not that people in the past were poor, but that everyone in the past was poor.

Figure 27.3 shows some estimates of GDP per capita in different regions of the world in different periods from the year 1 to 2000 AD. In the year 1, GDP per capita was about $700–$1,000 and this was approximately the same in all the major regions of the world. Today, GDP per capita is more than 50 times as large in the richest countries as in the poorest countries.

Figure 27.3 illustrates something else of interest: GDP per capita was about the same in year 1 as it would be 1,000 years later and indeed about the same as it had been 1,000 years earlier. For most of recorded human history, there was no long-run growth in real per capita GDP. Countries might grow in particular good years, but soon enough a disaster would ensue and the gains would be given back. Only beginning in the nineteenth century does it become clear that some parts of the world began to grow at a rate unprecedented in human history.

Figure 27.3 tells us that economic growth is unusual. But once economic growth begins, it can make some parts of the world rich, while other parts languish at levels of per capita GDP similar to that in the Dark Ages. To see more clearly how small changes in economic growth can have enormous effects on GDP per capita, we pause for a primer on economic growth rates.

**A Primer on Growth Rates** Recall from the previous chapter on GDP that a growth rate is the percentage change in a variable over a given period such as
a year. When we refer to **economic growth**, we mean the growth rate of real per capita GDP.

While computing growth rates is simple math, grasping the impact of growth rates on economic progress is critical. Keep in mind that even slow growth, if sustained over many years, produces large differences in real GDP per capita.

To appreciate the power of economic growth, let’s consider a few cases. Suppose that the annual growth rate of real GDP per capita is 2%. How long will it take for real per capita GDP to double from $40,000 to $80,000? An average person on the street might answer, “It will take 50 years to double your income at a 2% growth rate.” But that is wrong because growth builds on top of growth. This is called “compounding” or “exponential growth.”

There is a simple approximation, called the rule of 70, for determining the length of time necessary for a growing variable to double:

**Rule of 70:** If the annual growth rate of a variable is \( x \)%, then the doubling time is \( \frac{70}{x} \) years.

At a growth rate of 1%, GDP per capita will double approximately every 70 years (70/1 = 70). If growth increases to 2%, GDP per capita will double every 35 years (70/2 = 35). Consider the impact of a 7% growth rate. If this growth can be sustained, then GDP per capita doubles every 10 years! China has been growing at this rate or a bit higher for several decades, which explains why China has become much richer in the past 30 years. China, however, is still a relatively poor country, so this also tells you how very, very poor they were in the recent past.

The rule of 70 is just a mathematical approximation, but it bears out the key concept that small differences in growth rates have large effects on economic progress. See the appendix to this chapter for a discussion of how you can use Excel to understand the magic of compounding.

Another way of seeing how small changes in the rate of economic growth can lead to big effects is to think about how rich people will be in the future. U.S. per capita GDP is about $50,000 (as of 2014). How many years will it take for real per capita GDP to increase to $1 million? If growth is 2% per year, which would be a little low by U.S. standards, average income will be $1 million per year in just 150 years. If GDP per capita grows at 3% per year, which is a little high by U.S. standards but certainly not impossible, then in just 100 years the average income will be approximately $1 million per year. You and I are unlikely to see this future, but if our grandchildren are lucky, they will see a world in which U.S. GDP per capita is a million dollars, more than 22 times higher than it is today.

**Fact Three: There Are Growth Miracles and Growth Disasters**

The United States is one of the wealthiest countries in the world because the United States has grown slowly but relatively consistently for more than 200 years. Can other countries catch up to the United States, and if so, will it take 200 years? Fortunately, other countries can catch up, and amazingly quickly. Figure 27.4 shows two “growth miracles.” Following World War II, Japan was one of the poorest countries in the world with a per capita GDP less than that of Mexico. From 1950 to 1970, however, Japan grew at an astonishing rate of 8.5% per year. Remember, at that rate, GDP per capita doubles in
In 1950, South Korea was even poorer than Japan with a GDP per capita about the same as that of Nigeria. South Korea’s growth miracle began a little later than Japan’s, but between 1970 and 1990, South Korea grew at a rate of 7.2% per year. Today, South Korea is a thriving, modern economy on par with many European economies.

Growth miracles are possible but so are growth disasters. Nigeria has barely grown since 1950 and was poorer in 2005 than in 1974 when high oil prices briefly bumped up its per capita GDP. More surprising is the case of Argentina. In 1900, Argentina was one of the richest countries in the world with a per capita GDP almost as large (75%) as that of the United States. By 1950, Argentina’s per capita GDP had fallen to half that in the United States. In 1950, however, Argentina was still a relatively wealthy country with a per capita GDP more than twice as high as that of Japan and more than five times as high as that of South Korea. Argentina failed to grow much, however, and by 2000 Argentina’s per capita GDP was less than one-third of that of the United States; Japan and South Korea are now much wealthier than Argentina.

The gap between Argentina and many other countries is continuing to grow. China (not pictured) began its own growth miracle in the late 1970s. China is still a very poor nation with a per capita GDP that in 2011 is a little more than half that of Argentina. But China is growing rapidly—remember, if China continues to grow at 7% or 8% per year, it will double its income in about 10 years. Even if Argentina grows modestly, China could pass Argentina in per capita GDP in less than 20 years.
Summarizing the Facts: Good and Bad News

The facts presented above imply both good and bad news. The bad news is that most of the world is poor and more than 1 billion people live on incomes of less than $3 per day. These people have greatly reduced prospects for health, happiness, and peace. The bad news, however, is old news. For most of human history, people were poor and there was no economic growth.

The good news is this: Despite being a relatively recent phenomenon, economic growth has quickly transformed the world. It has raised the standard of living of most people in developed nations many times above the historical norm. Even though economic growth has yet to reach all of the world, there appears to be no reason why, in principle, economic growth cannot occur everywhere. Indeed, growth miracles tell us that it doesn’t take 250 years to reach the level of wealth of the United States—South Korea was as poor as Nigeria in 1950, but today has a per capita GDP not far behind Germany or the United Kingdom.

Progress, however, is not guaranteed. The growth disasters tell us that economic growth is not automatic. Some countries such as Nigeria show few signs that they have started along the growth path, while other countries such as Argentina seem to have fallen off the growth path.

Growth miracles and disasters, however, are not purely random events over which people have no control. Inquiring into the nature and causes of the wealth of nations is critical if we are to raise the standard of living and better the human condition.

Understanding the Wealth of Nations

Let’s begin with Figure 27.5 on the next page, a guide to the major factors behind the wealth of nations. At the bottom of the figure is what we would like to explain, GDP per capita. As we move up the figure, we see some of the causes of the wealth of nations, beginning with the immediate or most direct causes and moving toward the ultimate or indirect causes.

The Factors of Production

The most immediate cause of the wealth of nations is this: Countries with a high GDP per capita have a lot of physical and human capital per worker and that capital is organized using the best technological knowledge to be highly productive. Physical capital, human capital, and technological knowledge are called factors of production. Let’s take a look at each factor of production.

By physical capital (or just “capital”), economists mean tools in the broadest sense: pencils, desks, computers, hammers, shovels, tractors, cell phones, factories, roads, and bridges. More and better tools make workers more productive.

Farming is a good illustration of the role of capital. In much of the world, farmers are laborers pure and simple: They dig, seed, cut, and harvest using hard labor and a few simple tools like hoes and plows (often pulled by oxen). In the United States, farmers use a lot more capital—tractors, trucks, combines, and harvesters.

It’s not just farmers who use a lot of capital. The typical worker in the United States works with more than $100,000 worth of capital. A typical worker in India works with less than one-tenth as much capital.
It’s also not just physical capital that makes U.S. farmers productive. A farmer in the United States riding a tractor uses a GPS receiver to triangulate his exact location using signals from a series of satellites orbiting the earth some 16,500 miles high. The tractor’s location is combined with data from other satellites and land-based sensors to precisely adjust the amount of seed, fertilizer, and water to be applied to the land. The fertilizer has been carefully designed, and the seeds almost certainly have been genetically engineered.

The high-tech nature of farming in the United States draws our attention to the importance of human capital and technological knowledge. **Human capital** is tools in the mind, or the stuff in people’s heads that makes them productive. Human capital is not something we are born with—it is produced by an investment of time and other resources in education, training, and experience. Farmers in the United States, for example, have more human capital than farmers in most of the world, and it’s this human capital that enables them to take advantage of tools like GPS receivers. The same is true in the larger economy—the typical person in the United States, for example, has about 12 years of human capital.
of schooling, while in Pakistan the typical person has less than 5 years of schooling.

The greater quantities of physical and human capital per worker used in U.S. farming make U.S. farmers more productive. U.S. farmers produce more than three times as much corn per acre than do farmers in Pakistan, for example.

The third factor of production is technological knowledge. This factor includes, for instance, the genetics, chemistry, and physics that form the basis of the techniques used in modern agriculture. (Did you know that the clocks on GPS satellites must be adjusted to account for the effects of Einstein’s theory of relativity?)

Technological knowledge and human capital are related but different. Human capital is the knowledge and skills that a farmer needs to understand and to make productive use of technology. Technological knowledge is knowledge about how the world works—the kind of knowledge that makes technology possible. We increase human capital with education. We increase technological knowledge with research and development. Technological knowledge is potentially boundless. We can learn more and more about how the world works even if human capital remains relatively constant.

Improved technological knowledge has made U.S. farmers more productive over time. U.S. farms today produce more than two and a half times as much output as they did in 1950 and they do so using less land! More physical and human capital has helped to drive this increase in output, but better technological knowledge has been the primary factor.1

The final factor, a factor often taken for granted, is organization. Human capital, physical capital, and technological knowledge must be organized to produce valuable goods and services. Who does this organizing and why? To answer this question, we turn to the issue of incentives and institutions.

Incentives and Institutions

South Korea has a per capita GDP nearly 20 times higher than that of North Korea. Why? In one sense, we have just given an answer: South Korea has more physical and human capital per worker than North Korea. But this answer is incomplete and partial. The answer is incomplete because we still want to know why does South Korea have more physical and human capital than North Korea? The answer is partial because poor countries like North Korea not only have less physical and human capital than rich countries, they also fail to organize the capital that they do have in the most productive ways. To understand the wealth of nations more deeply, we need to take a look at some of the indirect or more ultimate causes.

The example of South and North Korea is useful because we can rule out some explanations for the huge differences in wealth between these two

* What about technological knowledge? North Korea has access to most of the world’s technological knowledge and is able, for example, to build sophisticated weapons—perhaps even a nuclear bomb; thus differences in technological knowledge explain probably only a small fraction of the differences in the wealth of nations.

Increases in technological knowledge, however, are clearly important for growth at the world level (as opposed to explaining differences in wealth across nations)—as we will discuss at greater length in the next chapter.
countries. The explanation, for example, cannot be differences in the people, culture, or geography. Before South and North Korea were divided at the end of World War II, they shared the same people and culture—in other words, the same human capital. South and North Korea also had similar levels of physical capital—natural resources were about the same in the South as in the North, and if there were any advantages in human-made physical capital, they went to the North, which was at that time more industrialized than the South. When the two regions were split, therefore, South and North Korea were in all important respects the same, almost as if the split was designed as a giant social experiment.

South and North Korea differed in their economic institutions. Broadly speaking, South Korea had capitalism, and North Korea had communism. South Korea was never a pure capitalist economy, of course, but in South Korea the organizers of human capital, physical capital, and technological knowledge are private, profit-seeking firms and entrepreneurs to a much greater extent than in North Korea. In South Korea a worker earns more money if he provides goods and services of value to consumers or if she invents new ideas for more efficient production. Those same incentives do not exist in North Korea, where workers are rewarded for being loyal to the ruling Communist Party. In short, South Korea uses markets to organize its production much more than North Korea and so is able to take advantage of all the efficiency properties of markets discussed in Chapters 3 and 4.

Over fifty years later, the results of the “experiment” splitting North and South Korea are so clear they can be seen from outer space, as seen in Figure 27.6. The differences between these two countries are especially dramatic. But wherever similar experiments have been tried, such as in East and West Germany, or Taiwan and China, the results have been similar.

We said earlier that countries with a high GDP per capita have a lot of physical and human capital that is organized using the best technological knowledge to be highly productive. But factors of production do not fall from the sky like manna from heaven. Factors of production must be produced. Similarly, factors of production do not organize themselves. Physical capital, human capital, and technology must be combined and organized purposively to be productive.

Do you remember Big Idea One and Big Idea Two from the introductory chapter? These ideas were that incentives matter and good institutions align self-interest with the social interest.

Thus, we can now deepen our understanding of the wealth of nations. Countries with a high GDP per capita have institutions
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that make it in people’s self-interest to invest in physical capital, human capital, and technological knowledge and to efficiently organize these resources for production.

In short, the key to producing and organizing the factors of production are institutions that create appropriate incentives. Let’s look at institutions and the incentives that they create in more detail.

Institutions

Institutions include laws and regulations but also customs, practices, organizations, and social mores— institutions are the “rules of the game” that shape human interaction and structure economic incentives within a society.

What kinds of institutions encourage investment and the efficient organization of the factors of production? Understanding institutions is an important area of research in economics, and there is considerable agreement that the key institutions include the following:

Institutions of Economic Growth

- Property rights
- Honest government
- Political stability
- A dependable legal system
- Competitive and open markets

Entire books have been written about each of these institutions and their roles in economic growth. Indeed, much of this book is about property rights and the benefits of open markets and rivalrous economic competition. Thus, we will give only a few examples here of how each of these institutions creates appropriate incentives, incentives that align self-interest with the social interest.

Property Rights

When the Communist revolutionaries took control of China, they abolished private property in land. In the “Little Leap Forward,” they put farmers to work in collectives of 100–300 families. Communal property meant that the incentives to invest in the land and to work hard were low. Imagine that a day’s work can produce an extra bushel of corn. Thus, an extra day’s work on a commune with 100 families earned the worker 1/100th of a bushel of corn. Would you work an extra day for a few earfuls of corn? Under communal property, working an extra day doesn’t add much to a worker’s take-home pay and working a day less doesn’t subtract much. Thus, under communal property, effort is divorced from payment so there is little incentive to work—in fact, there is an incentive not to work and to free ride on the work of others. In the “Great Leap Forward,” the incentive to free ride was made even stronger when communes were increased to 5,000 families. But if everyone free rides, the commune will starve. Communal property in agricultural land did not align a farmer’s self-interest with the social interest. And, as a result of this and many similar errors on the part of the Chinese leadership, some 20–40 million Chinese farmers and workers starved during this period.

The Great Leap Forward was actually a great leap backward—agricultural land was less productive in 1978 than it had been in 1949 when the Communists took over. In 1978, however, farmers in the village of Xiaogang held a secret meeting. The farmers agreed to divide the communal land and assign it to individuals—each farmer had to produce a quota for the government but anything...
he or she produced in excess of the quota that farmer would keep. The agreement violated government policy and, as a result, the farmers also pledged that if any of them was sent to jail, the others would raise his or her children. The remarkable secret agreement of the Xiaogang farmers is shown at left.

The change from collective property rights to something closer to private property rights had an immediate effect: Investment, work effort, and productivity increased. “You can’t be lazy when you work for your family and yourself,” said one of the farmers.

Word of the secret agreement leaked out and local bureaucrats cut off Xiaogang from fertilizer, seeds, and pesticides. But amazingly, before Xiaogang could be stopped, farmers in other villages also began to abandon collective property. In Beijing, Mao Zedong was dead and a new set of rulers, seeing the productivity improvements, decided to let the experiment proceed.

In the five short years between 1978 and 1983, when China’s central government endorsed individual farming, food production increased by nearly 50% and 170 million people were lifted above the World Bank’s lowest poverty line. Simply put, the increase in agricultural productivity brought about by the switch to individual farming was the greatest antipoverty program in the history of the world. By 1984, the collective farms were gone and soon after that China’s leader Deng Xiaoping announced a new government policy: “It is glorious to be rich.”

Property rights in land greatly increased China’s agricultural productivity. With fewer workers producing more food, more workers were available to produce other goods. To take advantage of its millions of workers, China opened up to foreign investment, making the label “Made in China” common throughout the world. With their secret pact, the farmers of Xiaogang had begun a second and more successful Chinese revolution.

Property rights are important institutions for encouraging investment in physical and human capital, not just in agriculture but throughout the economy. It can take decades, for example, for an investment in a new apartment building or a factory to pay off. As we will discuss further in the chapter on savings, investment, and the financial system, savings are necessary to generate investment and thus growth. But why do people save and invest? Savers won’t save and investors won’t invest if they don’t expect that their property will be secure and they will receive a return for their savings and investment. Property rights are also important for encouraging technological innovation. For instance, investments in new pharmaceuticals take decades to pay off and they are risky—years of research and development sometimes have to be abandoned when the guinea pigs start to die unexpectedly. Just like farmers, investors and workers throughout the economy need to know that they will reap what they sow.
Honest Government  China under its former Communist rulers was extreme in abolishing most forms of private property. In many other countries, private property rights exist on paper—but only on paper. In a country like Venezuela, for example, an individual might have a legal right to land or a factory, but everyone knows that the government can take these goods at any moment. Venezuela lacks the rule of law.

More generally, corruption is like a heavy tax that bleeds resources away from productive entrepreneurs. Resources “invested” in bribing politicians and bureaucrats cannot be invested in machinery and equipment, thus reducing productivity. Corrupt government officials will also harass entrepreneurs, creating excessive rules and regulations that force entrepreneurs to pay them to stop making trouble.

Not all taxes are bad, of course. A tax that funds investment in roads, universities, or law and order can increase the productivity of private investments. Corruption, therefore, is a doubly bad tax because corruption makes it less profitable to be an entrepreneur at the same time as it makes it more profitable to be a corrupt politician or bureaucrat. At some point, corruption can feed on itself, creating a poverty trap: Few people want to be entrepreneurs because they know that their wealth will be stolen and thus there is no wealth to steal.

Figure 27.7 graphs corruption on the horizontal axis. The most corrupt countries like Somalia, Liberia, and North Korea are on the right, scoring about 2 on a 5-point scale running from −2.5 (least corrupt) to 2.5 (most corrupt). The least corrupt countries like Singapore, Iceland, the United States, and Norway are on the left. Real GDP per capita is on the vertical axis. Countries that are more corrupt have much lower per capita GDP.

**FIGURE 27.7**

**Corrupt Countries Have Lower GDP per Capita**

Data from: Penn World Tables and World Bank Group, World Development Indicators, 2005.

*Note: Not all countries are labeled. GDP on ratio scale.*
Political Stability Investors have more to fear than government expropriation—sometimes the threat of anarchy can be even worse. Liberia, for example, has had little but conflict for the past 40 years. Prior to the election in 2006 of President Ellen Johnson-Sirleaf, the first elected female head of state in Africa, it had been 35 years since a Liberian president assumed office by means other than bloodshed. Both the previous two national leaders (Charles Taylor and Samuel Doe) consistently used the force of government to eradicate their opposition. Who wants to invest in the future when civil war threatens to wash away all plans?

More generally, in many nations, civil war, military dictatorship, and anarchy have destroyed the institutions necessary for economic growth.

A Dependable Legal System The problem of poorly protected property rights is not always a problem of too much government—sometimes property rights are poorly protected because there is too little government. The legal system in many countries, for example, is of such low quality that no one knows for certain who owns what. In India, residents who purchase land often have to do so two or three times (from different parties), as there exists no reliable record of true ownership. A lawsuit, if you even bother to bring one, can take 20 years or more to resolve. In a major urban area, it’s very difficult to build something as simple as a supermarket because developers cannot acquire good title to a modestly sized piece of land. No one wants to build when they cannot protect their investment.

A good legal system facilitates contracts and protects private parties from expropriating one another. Few people think of the U.S. legal system as a paradigm of productivity, but it is compared to the Indian legal system. In the United States, for example, it takes 17 procedures and 300 days to collect on a debt (say, a bounced check). In India, it takes 56 procedures and 1,420 days to do the same thing. That’s one reason why it is relatively difficult for people living in India to borrow money in the first place: Lenders know how hard it is to get their money back.

Competitive and Open Markets The factors of production must not only be produced—they must also be organized. Detailed studies from a large number of countries suggest that the failure to organize capital efficiently has a huge effect on the wealth of nations. Poor countries are poor, in other words, not just because they lack capital but also because they use the capital that they do have inefficiently. Overall, about half the differences in per capita income across countries are explained by differences in the amount of physical and human capital (some of those differences in capital spring from deeper differences in institutions) and about half the differences are explained by a failure to use capital efficiently. One study, for example, estimates that if India used its physical and human capital as efficiently as the United States uses its capital, India would be four times richer than it is today.3

Why does India use its capital inefficiently? The reasons are numerous, but competitive and open markets are one of the best ways to encourage the efficient organization of resources. India, as well as other poor countries, has many inefficient and unnecessary regulations, which create monopolies or otherwise impede markets.
For instance, Indian shirts are usually made by hand in small shops of three or four tailors who design, measure, sew, and sell, all on the same premises. It sounds elegant but this is not London’s Savile Row, where the finest tailors in the world create custom suits for the rich and powerful. India’s shirts would be cheaper and of higher quality if they were mass-manufactured in factories—the way shirts for Americans are produced. Why doesn’t this happen in India? Shirts in India are produced inefficiently because, until recently, large-scale production was illegal.

In an effort to protect small firms, India prohibited investment in shirt factories from exceeding about $200,000. This restriction meant that Indian shirt manufacturers could not take advantage of economies of scale, the decrease in the average cost of production that often occurs as the total quantity of production increases. India has been reforming its economy, which is one reason why economic growth in India has increased in recent years (as we discussed in the previous chapter). India recently lifted the ban on large garment factories, for example, but many, many regulations remain that reduce the productivity of the Indian economy.

Poor countries also suffer from expensive red tape. Economists at the World Bank have estimated the time and cost to do simple tasks such as starting a business or enforcing a contract in a court of law. In the United States, for example, it takes about 4 days to start a business and the total costs of the procedures are minor, about 1% of the average income per capita. In India, starting a business takes 26 days and 13.8% of income per capita. In Haiti, it takes 97 days and 219% of income per capita (data from World Bank, Doing Business). Thus, even before a business is begun, an Indian or Haitian entrepreneur must invest extensively in dealing with bureaucracies—that same physical and human capital is not being used to produce goods and services.

Markets can also be made more competitive and open with free trade. Most countries, for example, aren’t large enough to support more than a handful of auto manufacturers so free trade is necessary to keep auto manufacturers and other large firms competitive. Perhaps even more importantly, countries that are open to trade are also open to new ideas. Walmart made retailing more efficient in the United States and then it brought these efficiencies to other countries when it expanded internationally. Countries where Walmart was forbidden or discouraged from expanding gained these efficiencies more slowly, if at all. In fact, multinationals like Walmart are the best managed of all firms—they get the most output from the same quantity and quality of inputs—and multinationals are one of the best ways of spreading new and better ideas around the world.

**The Ultimate Causes of the Wealth of Nations**

When China changed its institutions from collective farming to individual farming, agricultural productivity increased dramatically and China began to grow. The example of China is enormously encouraging because it suggests that growth miracles could become common if more countries changed their institutions. But take a look again at Figure 27.5. Institutions have a large effect on increasing and organizing the factors of production, and institutions thus have a large effect on economic growth. But where do institutions come from? Are they products of geography? History? Ideas? Culture? Luck? Try “all of the above” and then some.

Consider geography, which we might also think of as a country’s “natural resources.” Simple natural resources like oil and diamonds are usually good to have but in rich, developed countries, physical and human capital are typically much more important. But natural resources more broadly conceived—climate, topography, and the prevalence of parasites, to give just a few examples—may help explain
why a country is able to accumulate physical and human capital. We said earlier that free trade opens a country up to new ideas and innovation. But free trade is not just a matter of policy or choice—it also depends on natural conditions. It’s much cheaper to move goods and people over water than over land, so countries that have easy access to water are naturally more open to trade than countries that are landlocked. In fact, as Figure 27.8 reveals, landlocked countries have lower per capita GDP than countries that have access to a coast. It’s not that being landlocked dooms a country to poverty, but countries that are landlocked face the equivalent—from their setting—of permanently high tariff barriers. That can make it more difficult to generate growth, especially in the age before modern communications.

You can also see the importance of history, ideas, geography, and luck in the growth of the United States. The U.S. constitution was written at a time when the ideas of John Locke and Adam Smith were popular and it inherited a tendency toward a market economy and democratic institutions from its colonizer, Great Britain. An open frontier meant cheap land and plenty of freedom to try new ideas and ways of living, perhaps influencing America’s entrepreneurial culture even into modern times. And we are very lucky that George Washington had the virtue to stop at two presidential terms, rather than trying to become the next king.

An even more important example of a growth miracle comes from the Industrial Revolution, a period of sustained European technological advances; it is sometimes identified with 1770–1830, but that it has deeper roots reaching back to the seventeenth century or earlier. The Industrial Revolution brought us large-scale factories, mass production, the steam engine, the railroad, and the beginnings of a consumer society, among many other benefits. It is the first time that human living standards climbed noticeably above subsistence and stayed there for a long period. We are all still enjoying the benefits of an ongoing industrial revolution in the world’s wealthy economies.

The Industrial Revolution, centered in Great Britain, required a combination of multiple distinct advantages. Britain’s status as an island and the strong English Navy protected the country against invaders and made property rights more secure. Labor markets had been relatively free for centuries and the ethic of the time encouraged commerce, entrepreneurship, and the accumulation of wealth. The growth of the power of Parliament checked royal tyranny and encouraged economic policies that allowed wealth to spread more widely. Slow increases in agricultural productivity kept living standards above subsistence and enabled the rise of a professional class. Perhaps most important, Britain developed a strong culture of science and engineering and brought the scientific method to bear on economic production, whether it was designing a better spinning jenny or using coal to power a factory more effectively.

From the beginning, positive feedback effects of the Industrial Revolution were strong. More wealth meant more people could devote their lives to science, invention, and turning new ideas into practical commercial developments. That in turn led to new wealth and then again to more applied science. Eventually the Industrial Revolution gave us electricity, the automobile, the flush toilet, and most of the other inventions that define the conveniences of modern life. To sum this all up, the effects of the Industrial Revolution owe much to good institutions for business, science, and governance.
No one understands for certain all the influences that go into creating a nation’s institutions, which means that changing institutions isn’t easy. When it comes to institutions, we know where we want to go but we don’t always know how to get there. Understanding institutions, where they come from, and how they can be changed is thus a key research question in economics.

Takeaway

It’s hard to overstate the importance of economic growth. Once, everyone was poor. Today, GDP per capita is more than 50 times higher in the richest countries than in the poorest. Economic growth has raised billions of people out of near-starvation poverty, but billions more remain in dire poverty with shocking consequences for their quality of life.

Fortunately, poor countries can catch up to rich countries and in a surprisingly short period. Growth “miracles” have brought Japan and South Korea up to European levels of wealth within the lifespan of a single generation. Since the agricultural reforms beginning in 1978, poverty in China has been reduced to an unprecedented degree and China continues to grow rapidly.

What makes a country rich? The most proximate cause is that countries with a high GDP per capita have lots of physical and human capital per worker and that capital is organized using the best technological knowledge to be highly productive.

How do countries get a lot of physical and human capital and how do they organize it using the best technological knowledge? Countries with a high GDP per capita have institutions that encourage investment in physical capital, human capital, technological innovation, and the efficient organization of resources. Among the most powerful institutions for increasing economic growth are property rights, honest government, political stability, a dependable legal system, and competitive and open markets.
a. What is the world’s total GDP?

b. About 20% of the world’s population produces 50% of the world’s total GDP. (Notice the use of “produces,” not “consumes.” In popular discussion, you are more likely to hear about the people at the top “consuming” more than their share, not “producing” more than their share. But remember what the last letter of GDP stands for!) How much GDP does the top 20% produce?

c. What is the average GDP per capita of the most productive 20% of the world’s population? (Hint: 20% of 7 billion people equals how many people?)

4. Now let’s look at the productivity of the world’s least productive 80%.

a. How much GDP do they produce? (Hint: You’ve already calculated this number in the previous question.)

b. What is the average GDP per capita of the least productive 80% of the world’s population?

c. Now, the payoff: How productive is the average person in the top 20% compared with the average person in the bottom 80% of the planet? Answer this by dividing your answer to question 3c by your answer to question 4b. This chapter and the next are devoted to explaining why this ratio is so large.

5. According to Fact Two—Everyone Used to Be Poor—what would your answer to question 4c have been if you calculated it 2,000 years ago?

6. What are the factors of production? Name them and briefly describe them in plain English.

7. Using data from the Penn World Tables, calculate the annual growth rate of real GDP per person for China for the years in the table. The Penn World Tables, available free online, are a reliable source of international economic data, and they are very popular among economists.

<table>
<thead>
<tr>
<th>Year</th>
<th>Real GDP per Capita (in 1996 U.S. dollars)</th>
<th>Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>4,001</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>4,389</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>4,847</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>5,321</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>5,771</td>
<td></td>
</tr>
</tbody>
</table>

8. Practice with the rule of 70: If you inherit $10,000 this year and you invest your money so that it grows 7% per year, how many years will it take for your investment to be worth $20,000? $40,000? $160,000? (Note: Investments in stocks have grown at an average inflation-adjusted rate of 7% per year since the U.S. Civil War. We’ll practice this some more in the next chapter.)

Value today: $10,000. Growth rate: 7%

Number of years until money doubles: ______

Number of years until money quadruples: ______

Number of years until your inheritance is 16X larger: ______

9. More practice with the rule of 70: Suppose that, instead, you put your money into a savings account that grows at an inflation-adjusted return of 2% per year. How many years will it take to be worth $20,000? $40,000? $160,000? (Note: Bank deposits have grown at roughly this rate over the last 50 years in the United States.)

Value today: $10,000. Growth rate: 2%

Number of years until money doubles: ______

Number of years until money quadruples: ______

Number of years until your inheritance is 16X larger: ______

10. India and China come up a lot in this chapter. You might wonder why so much time is spent talking about just two countries out of more than 180 on the planet. But what fraction of humans live in India and China together?

11. Let’s convert Figure 27.5 into words.

Institutions create _______, which in turn affect the amount of _______, and _______ in a country, which, combined with the right kind of _______, generates a level of _______ per person.

12. In the CIA World Factbook, GDP per capita in the United States in 2010 was approximately $47,400. The formula for growth for any given year, $y_t$, is $y_t = y_{t-1} (1 + g)$, where $y_0$ is the value of GDP in the beginning year, $y_t$ is the value of GDP for the specific year in question, and $t$ is the number of years after $y_0$. If $y_0$ is GDP per capita in 2010 and the economy continues to grow at approximately 3% as it did in 2010, what will be the value of GDP per capita in 10 years?
THINKING AND PROBLEM SOLVING

15. The average person in Argentina today is about as rich (in inflation-adjusted terms) as his or her parents. How can this be called a “growth disaster”?

16. Before the rise of affordable automobiles and subways, many people used trolleys—small trains on rails that ran along ordinary streets—to get around in urban areas. On trolleys, there is a literal “free rider problem”: Since the trains were right next to sidewalks, and since trolleys were wide open and never had doors, people could hop on and off very easily. How much money will a trolley lose if it is easy to ride for free? If “free riders” are a big problem, what will happen to the supply of trolley rides? What are a few things the trolley industry could do to solve the problem of free riders?

17. During the Great Leap Forward, millions of Chinese starved to death because not enough food was produced by farmers. Why didn’t farmers grow food? In particular, was it because there wasn’t enough human capital or physical capital?

The slogan of the Great Leap Forward was “Long live the People’s Commune!” Unfortunately, this patriotic appeal didn’t work as well as good economic incentives, and millions lost their lives. (Information from: Wikipedia, “Great Leap Forward.”)

18. Laws that encourage businesses to stay small are often very popular. The laws governing Indian shirt tailors discussed in this chapter are just one example. What are some noneconomic (e.g., social,
moral, ethical) reasons why voters might want businesses to stay small? What are some economic reasons they might want businesses to grow large?

19. Economists use the term “human capital” to refer to education and job skills. How is education like a piece of capital?

20. Many people say that natural resources like oil and minerals are the way to prosperity. Indeed, in an old cartoon by Matt Groening, creator of The Simpsons, a professor taught his students, “The nation that controls magnesium controls the universe!” But natural resources have been left out of this chapter completely. Is this a big mistake? (Information from: Sala-i-Martin, X., G. Doppelhofer, and R. Miller. 2004. Determinants of long-term economic growth: A Bayesian averaging of classical estimates (BACE). The American Economic Review 94(4) (September): 813–835.)

a. Here are the 10 countries in the world that have the highest amounts of hydrocarbons (oil, natural gas, etc.) per person, in rank order:
   1. Kuwait
   2. United Arab Emirates (UAE)
   3. Saudi Arabia
   4. Iraq
   5. Norway
   6. Venezuela
   7. Oman
   8. Iran
   9. Trinidad and Tobago
   10. Gabon

Use the CIA World Factbook, a convenient online source of information, to see if most of these countries are prosperous. How many of these 10 countries have a GDP per person that is at least half of the U.S. level? How many are less than 10% of the U.S. level? Are any actually higher than the U.S. level?

b. Now, let’s look at the reverse: Let’s see if the 10 richest countries in GDP per capita have a lot of hydrocarbon wealth:
   1. Luxembourg
   2. United States
   3. Singapore
   4. Hong Kong
   5. Norway

   6. Australia
   7. Sweden
   8. Canada
   9. Denmark
   10. Japan

The one country on both lists also makes another list in this chapter. Which one is it?

21. Economists often refer to the “natural resource curse,” by which they mean that large amounts of natural resources tend to create bad politics because as long as the oil keeps flowing or the diamonds remain plentiful, political leaders don’t need to care much about what goes on in the rest of the country.

a. Which one of the three factors of production do you think matters most to a leader of a resource-rich country? Why? (Note: Does this help explain what you see happening in many resource-rich countries?)

b. Which one of the five key institutions do you think matters most to a leader of a resource-rich republic? Why? (Note: Does this help explain what you see happening in many resource-rich countries?)

22. In the Soviet Union, especially in the early decades under Lenin and Stalin, the official doctrine was Communism, and the use of incentives was considered a form of treason. One important exception was the military equipment sector, where bonuses were common for engineers who designed and manufactured jets, nuclear missiles, tanks, and rifles. Why was this an exception?

23. Free rider problems are everywhere. For example, some restaurants let each food server keep his or her own tips. Other restaurants require all of the food servers to put their tips into a tip pool, which then gets divided up equally among all of the servers. It’s easy to adjust the tip pool so that people who work more hours or serve more tables get their “fair share,” so that’s not the issue we’re concerned about here. Instead, let’s think about how the tip pool changes the server’s incentive to be nice to the customer.

a. To keep it simple, let’s assume that a server can be “nice” and earn $100 in tips per shift, or be “mean” and earn $40 in tips per shift. If an individual server goes from being mean to being nice, how much more will he or she earn in a non-tip-pooling world? (Yes, this is an easy question.)
b. Now let’s look at incentives in a tip pool. If all the servers are mean, how much will the average server earn? If all the servers are nice, how much will the average server earn? What’s the change in tips per server if all of them switch from being mean to being nice?

c. But in the real world, of course, each server makes his or her own decision to be mean or nice. Suppose that some servers are being nice and others are being mean, and you’re trying to decide whether to be nice or mean. What’s the payoff to you if you switch your behavior? Does your answer depend on how many other servers are being nice?

d. So when are you most likely to be nice: when you’re in a tip pool or when you keep your own tips? If the restaurant cares a lot about keeping its customers happy, which policy will it follow?

24. If “everyone used to be poor,” then how could some ancient civilizations afford to create massive buildings like the pyramids of Egypt and the Buddhist statues of Afghanistan (sadly, many of the latter were destroyed by the Taliban in the 1990s)?

25. In England during the Wars of the Roses (late 1400s), two parties fought for the crown. Contrast the prospects for economic growth during this period and after this period when Henry VII became the unquestioned head of the country.

26. One way to learn about what makes some countries richer is to run statistical tests to see which factors are good at predicting a nation’s level of productivity. Sometimes it turns out that a relationship is just a coincidence (like the fact that people in rich countries eat more ice cream), but other statistical tests really can tell you about the ultimate causes of productivity. A statistical test can’t tell you everything, but it might help point you in the right direction. In courses on econometrics and statistics, you can learn about how to run sensible tests.

Let’s look at one well-known set of tests, to see if what you learned in this chapter matches the statistical evidence. Here are 17 variables that turned out to be very strong predictors of a nation’s long-run economic performance in literally millions of statistical tests (Information from: Sala-i-Martin, X., G. Doppelhofer, and R. Miller. 2004. Determinants of long-term economic growth: A Bayesian averaging of classical estimates (BACE). The American Economic Review, 94(4) (September): 813–835.) They are in rank order, and a “+” means more of that value was good for long-run productivity:

- Whether a country is in East Asia (+)
- Level of K–6 schooling (+)
- Price of capital goods (–)
- Fraction of land close to the coast (+)
- Fraction of population close to the coast (–)
- Malaria prevalence (–)
- Life expectancy (+)
- Fraction of population Confucian (+)
- Whether a country is in Africa (–)
- Whether a country is in Latin America (–)
- Fraction of GDP in mining industries (+)
- Whether a country was a Spanish colony (–)
- Years open to relatively free trade (+)
- Fraction of population Muslim (+)
- Fraction of population Buddhist (+)
- Number of languages widely spoken (–)
- Fraction of GDP spent on government purchases (–)

a. Which of these factors sound like the “three factors of production”? Which ones do they sound like?

b. Which of these factors sound like the “five key institutions”? Which ones do they sound like?

c. Which of these factors sound like geography?

d. The Western United States was a Spanish colony until 1849. On average, former Spanish colonies have had poor economic performance. Does the Western United States fit that pattern? Why or why not?

27. What do you think creates the good institutions that exist in rich countries? Why don’t these institutions—property rights, markets, a society where you can usually trust strangers—exist everywhere on the planet?

28. Why do you think expensive red tape is difficult to get rid of in many poor countries? Yes, this is a miniature version of the previous question.
29. Communists believed that their system would be much more efficient than capitalism: They thought that competition between companies was wasteful. Why build three separate headquarters for carmakers (General Motors, Chrysler, and Ford), when you can just build one? Why have three advertising budgets? Why pay for three CEOs? Why not put all the factories together, so that the same engineers can fix problems at all of the plants? Doesn’t one large firm maximize economies of scale? These are all good questions. So why do you think Communism turned out to be such an economic disaster, when it sounded like it would be so efficient?

30. The chapter lists five key institutions of economic growth. But isn’t there really just one: good government? Support your argument with facts from this chapter.

31. Figure 27.5 and its discussion in the text identify some of the ultimate causes of the Wealth of Nations as Institutions of Economic Growth. One of these is honest government. Go to Gapminder at http://www.gapminder.org to explore this relationship. Once there, click on the tab for “Gapminder World” and wait a moment for the first graph to load. Once it has loaded, click on the axes and explore the number of variables available for choosing. For this problem, click on the vertical axis, look under “Society,” and choose the “Corruption Perceptions Index (CPI).” You should still have GDP per capita on the horizontal axis.
   a. After noting that higher values in the CPI represent lower levels of corruption, describe what these data are telling you.
   b. Next to the upper-right-hand corner of the diagram is a “Color” box. Click on it and set it to “Geographic regions.” Now hover over a color and explore where these regions are in the world. Where are the richest countries? Where are the poorest?
   c. Can you find some very corrupt countries that are also quite rich? Name some of these countries and determine what they have in common.
   d. Does this evidence generally support the claim that an honest government contributes to the wealth of a nation? Why or why not?

32. Figure 27.5 and its discussion in the text identify one of the immediate causes of the wealth of nations as human capital. Visit Gapminder World again at Gapminder http://www.gapminder.org and select “Education” and “Literacy Rate, Adult Total” for the vertical axis while leaving GDP per capita on the horizontal axis. (See the previous problem for more detailed instructions.)
   a. What does this display of data convey to you about the value of education?
   b. Now change the vertical axis to the “Mean Number of Years in School” for men older than age 25 and then create a second graph for women older than age 25. How do your conclusions change? Is education still as valuable?
   c. Finally, select eighth-grade math achievement for the vertical axis and determine if this measure of education is also positively associated with GDP per capita.
   d. How do these measures of education work to support or refute the relationship between education levels and GDP per capita?
   e. Now try an additional educational measure using two graphs. Under “Schooling Cost,” explore “Expenditures per Student, Primary” and “Expenditures per Student, Secondary.” What do you find in these cases and how can you explain these differences?

33. Suppose two countries start with the same real GDP per capita, but country A is growing at 2% per year and Country B is growing at 3% per year. After 140 years, Country B’s GDP per capita will be—larger than Country A’s.

WORK IT OUT

For interactive, step-by-step help in solving this problem, go online.

Let’s figure out how long it will take for the average Indian to be as wealthy as the average Western European is today. Note that all numbers are adjusted for inflation, so we’re measuring output in “piles of stuff,” not “piles of money.” India’s GDP per capita is $5,000, and (somewhat optimistically) let’s say that real output per person there grows at 5% per year. Using the rule of 70, how many years will it take for India to reach Italy’s current level of GDP per capita, about $36,000 per year?
### MARGINAL REVOLUTION UNIVERSITY VIDEOS

**Basic Facts of Wealth**  
[mruniversity.com/wealth-nations](mruniversity.com/wealth-nations)  
Problems: 3, 4

**Growth Rates Are Crucial**  
[mruniversity.com/growth-rates](mruniversity.com/growth-rates)  
Problems: 5, 7, 12

**An Orgy of Innovation**  
[mruniversity.com/innovation](mruniversity.com/innovation)  
Problems: 25

**Growth Miracles and Growth Disasters**  
[mruniversity.com/growth-miracle-disaster](mruniversity.com/growth-miracle-disaster)  
Problems: 15

**The Importance of Institutions**  
[mruniversity.com/institutions](mruniversity.com/institutions)  
Problems: 11, 16–18, 21, 23, 31–32

**Geography and Economic Growth**  
[mruniversity.com/geography-growth](mruniversity.com/geography-growth)  
Problems: 20, 27

**Puzzle of Growth: Rich Countries and Poor Countries**  
[mruniversity.com/puzzle-of-growth](mruniversity.com/puzzle-of-growth)  
Problems: 6, 11, 17, 19, 24, 28–30

**The Hockey Stick of Human Prosperity**  
[mruniversity.com/hockey-stick](mruniversity.com/hockey-stick)  
Problems: 5

**The Rule of 70**  
[mruniversity.com/rule-70](mruniversity.com/rule-70)  
Problems: 8, 9

**Office Hours: The Rule of 70**  
[mruniversity.com/rule-of-70](mruniversity.com/rule-of-70)  
Problems: 33
**CHAPTER 27  APPENDIX**

**The Magic of Compound Growth Using a Spreadsheet**

The rule of 70 gives us a quick way to compute doubling times given a growth rate. We can also use a Microsoft Excel spreadsheet to easily answer more difficult questions. We know, for example, that if GDP per capita starts at $40,000 and if the growth rate is 2%, then GDP per capita after 1 year will be $40,800 and after just 35 years it will double to $79,996. We can show this using a simple spreadsheet as in Figure A27.1.

Once we understand the principles, however, we don’t need to write each year on a separate line. Instead, we can simplify by using a little bit of mathematical notation.

If our Starting value for GDP per capita is $40,000 and the growth rate is \( r \)% for example, 2%, and we grow for one year, then our Ending value will be $40,000 \times (1 + r/100)$. If we grow for two years, our Ending value will be $40,000 \times (1 + r/100) \times (1 + r/100)$, which is the same thing as $40,000 \times (1 + r/100)^2$. More generally, if the growth rate is \( r \)% and we grow for \( n \) years, then

\[
\text{Ending value} = \text{Starting value} \times \left(1 + \frac{r}{100}\right)^n \quad (A1)
\]

We can use this formula to simplify our spreadsheet, as in Figure A27.2.

Notice that we put the starting level of GDP per capita, or whatever quantity we are interested in (this could also be the amount of money in a bank account, for example), in cell A6, the growth rate is in cell B1, the number of years we want to grow is in cell B2, and thus the formula in cell B6, “=A6*(1+B1/100)^B2”, is exactly as in equation A1.

![Figure A27.1: Compound Growth in a Spreadsheet: The Long Method](image-url)
By adjusting the Starting value, the Growth rate, and the Number of years, we can find out how much any amount will grow to given any interest rate over any number of years.

We can also use Excel's Goal Seek ability to work backward to find, say, the number of years it will take to reach a certain level of GDP per capita when growth is r% per year. Suppose, for example, that GDP per capita is $46,000 and that growth is 2% per year. How long will it take to reach a GDP per capita of $1,000,000? Here's how you can easily find numbers like this. Go to the Tools menu and click on Goal Seek (in Excel 2007, go to the Data menu and under the submenu What-If Analysis, click on Goal Seek). A box will pop up asking you for three inputs: Set cell _____, To value _____, By changing cell _____.

In our case, we want Set cell B6, the Ending Value; To value 1,000,000; By changing cell B2; and the number of years. Figure A27.3 shows you what you should see and input. Notice that we also changed the Starting value to $46,000.
Clicking OK produces what you see in Figure A27.4.

Goal Seek has solved the problem! If we start at a value of GDP per capita of $46,000 and we grow at 2% a year, then in 155.49 years we will reach a value of GDP per capita of $1,000,000.

By using Goal Seek and varying the inputs, you can find the answer to all kinds of questions. Can you find, for example, how high the growth rate would have to be to reach a level of GDP per capita of $1,000,000 in, say, 50 years?

Chapter 27 Appendix Questions

- If a country starts off as rich as the United States, with a GDP per capita of $46,000, and if GDP per capita grows 3% per year, then how many years will it take before GDP per capita is $1,000,000 per year?
- If a country with a GDP per capita of $4,000 at its start grows at 8% per year, then how many years will it take before GDP per capita is $46,000?
- If you wanted to double $1,000 in 10 years’ time, what average rate of return would you require on your investment?