In this chapter, we introduce five key principles that provide a foundation for economic analysis. A principle is a self-evident truth that most people readily understand and accept. For example, most people readily accept the principle of gravity. As you read through the book, you will see the five key principles of economics again and again as you do your own economic analysis.

2.1 THE PRINCIPLE OF OPPORTUNITY COST

Economics is all about making choices, and to make good choices we must compare the benefit of something to its cost. Opportunity cost incorporates the notion of scarcity: No matter what we do, there is always a trade-off. We must trade off one thing for another because resources are limited and can be used in different ways. By acquiring something, we use up resources that could have been used to acquire something else. The notion of opportunity cost allows us to measure this trade-off.

**PRINCIPLE OF OPPORTUNITY COST**

The opportunity cost of something is what you sacrifice to get it.

Most decisions involve several alternatives. For example, if you spend an hour studying for an economics exam, you have one less hour to pursue other activities. To determine the opportunity cost of an activity, we look at what you consider the best of these “other” activities. For example, suppose the alternatives to studying economics are studying for a history exam or working in a job that pays $10 per hour. If you consider studying for history a better use of your time than working, then the opportunity cost of studying economics is the 4 extra points you could have received on a history exam if you studied history instead of economics. Alternatively, if working is the best alternative, the opportunity cost of studying economics is the $10 you could have earned instead.

The principle of opportunity cost can also be applied to decisions about how to spend money from a fixed budget. For example, suppose that you have a fixed budget to spend on music. You can either buy your music at a local music store for $15 per CD or you can buy your music online for $1 per song. The opportunity cost of 1 CD is 15 one-dollar online songs. A hospital with a fixed salary budget can increase the number of doctors only at the expense of nurses or physician’s assistants. If a doctor costs five times as much as a nurse, the opportunity cost of a doctor is 5 nurses.

In some cases, a product that appears to be free actually has a cost. That’s why economists are fond of saying, “There’s no such thing as a free lunch.” Suppose someone offers to buy you lunch if you agree to listen to a sales pitch for a time-share condominium. Although you don’t pay any money for the lunch, there is an opportunity cost because you could spend that time in another way—such as studying for your economics or history exam. The lunch isn’t free because you sacrifice an hour of your time to get it.

**The Cost of College**

What is the opportunity cost of a college degree? Consider a student who spends a total of $40,000 for tuition and books. Instead of going to college, the student could have spent this money on a wide variety of goods, including housing, stereo equipment, and world travel. Part of the opportunity cost of college is the $40,000 worth of other goods the student sacrifices to pay for tuition and books. Also, instead of going to college, the student could have worked as a bank clerk for $20,000 per year and earned
duction possibilities curve in Figure 2.1, we sacrifice 50 tons steel (700 tons − 650 tons) to get 10 more tons of wheat (20 tons − 10 tons). Further down the curve, if we move from point $c$ to point $d$, we sacrifice 180 tons of steel to get the same 10-ton increase in wheat.

Why is the production possibilities curve bowed outward, with the opportunity cost of wheat increasing as we move down the curve? The reason is that resources are not perfectly adaptable for the production of both goods. Some resources are more suitable for steel production, while others are more suitable for wheat production. Starting at point $a$, the economy uses its most fertile land to produce wheat. A 10-ton increase in wheat reduces the quantity of steel by only 50 tons, because plenty of fertile land is available for conversion to wheat farming. As the economy moves downward along the production possibilities curve, farmers will be forced to use land that is progressively less fertile, so to increase wheat output by 10 tons, more and more resources must be diverted from steel production. In the move from point $c$ to point $d$, the land converted to farming is so poor that increasing wheat output by 10 tons decreases steel output by 180 tons.

The production possibilities curve shows the production options for a given set of resources. As shown in Figure 2.2, an increase in the amount of resources available to the economy shifts the production possibilities outward. For example, if we start at point $f$, and the economy's resources increase, we can produce more steel (point $g$), more wheat (point $h$), or more of both goods (points between $g$ and $h$). The curve will also shift outward as a result of technological innovations that enable us to produce more output with a given quantity of resources.

### 2.2 THE MARGINAL PRINCIPLE

Economics is about making choices, and we rarely make all-or-nothing choices. For example, if you sit down to read a book, you don’t read the entire book in a single sitting, but instead decide how many pages or chapters to read. Economists think in marginal terms, considering how a one-unit change in one variable affects the value of another variable and people’s decisions. When we say *marginal*, we’re looking at the effect of a small, or incremental, change.

The marginal principle is based on a comparison of the marginal benefits and marginal costs of a particular activity. The *marginal benefit* of an activity is the additional benefit resulting from a small increase in the activity. For example, the marginal benefit of keeping a bookstore open for one more hour equals the additional revenue from book sales. Similarly, the *marginal cost* is the additional cost resulting from a small increase in the activity. For example, the marginal cost of keeping a bookstore open for one more hour equals the additional expenses for workers and utilities. Applying the marginal principle, the bookstore should stay open for one more hour if the marginal benefit (the additional revenue) is at least as large as the marginal cost (the additional cost). For example, if the marginal benefit is $80 of additional revenue and the marginal cost is $30 of additional cost for workers and utilities, staying open for the additional hour increases the bookstore’s profit by $50.

**MARGINAL PRINCIPLE**

> Increase the level of an activity as long as its marginal benefit exceeds its marginal cost. Choose the level at which the marginal benefit equals the marginal cost.

Thinking at the margin enables us to fine-tune our decisions. We can use the marginal principle to determine whether a one-unit increase in a variable would make us better off. Just as a bookstore owner could decide whether to stay open for one
more hour, you could decide whether to study one more hour for a psychology midterm. When we reach the level where the marginal benefit equals the marginal cost, we cannot do any better, and the fine-tuning is done.

**How Many Movie Sequels?**

To illustrate the marginal principle, let’s consider movie sequels. When a movie is successful, its producer naturally thinks about doing another movie, continuing the story line with the same set of characters. If the first sequel is successful, too, the producer thinks about producing a second sequel, then a third, and so on. We can use the marginal principle to explore the decision of how many movies to produce.

Figure 2.3 shows the marginal benefits and marginal costs for movies. On the benefit side, a movie sequel typically generates about 30 percent less revenue than the original movie, and revenue continues to drop for additional movies. In the second column of the table, the first movie generates $300 million in revenue, the second generates $210 million, and the third generates $135 million. This is shown in the graph as a negatively sloped marginal-benefit curve, with the marginal benefit decreasing from $300 for the first movie (point a), to $210 (point b), and then to $135 (point c). On the cost side, the typical movie in the United States costs about $50 million to produce and about $75 million to promote. In the third column of the table, the marginal cost increases with the number of movies because film stars typically demand higher salaries to appear in sequels. For example, Angelina Jolie was paid more for *Tomb Raider 2* than for *Tomb Raider*, and the actors in *Charlie’s Angels 2* received raises, too. In the table and the graph, the marginal cost increases to $150 million for the second movie (point e) and to $175 for the third (point f).

In this example, the first two movies are profitable, but the third is not. For the original movie, the marginal benefit ($300 million at point a) exceeds the marginal...
cost ($125 million at point $d$), generating a profit of $175 million. Although the second movie has a higher cost and a lower benefit, it is profitable because the marginal benefit still exceeds the marginal cost, so the profit on the second movie is $60 million ($210 million – $150 million). In contrast, the marginal cost of the third movie of $175 million exceeds its marginal benefit of only $135 million, so the third movie loses $40 million. In this example, the movie producer should stop after the second movie.

Although this example shows that only two movies are profitable, other outcomes are possible. If the revenue for the third movie were larger, making the marginal benefit greater than the marginal cost, it would be sensible to produce the third movie. Similarly, if the marginal cost of the third movie were lower—if the actors didn’t demand such high salaries—the third movie could be profitable. Many movies have had multiple sequels, such as *The Matrix* and *Star Wars*. Conversely, many profitable movies, such as *Rushmore* and *Groundhog Day*, didn’t result in any sequels. In these cases, the expected drop-off in revenues and the run-up in costs for the second movie were large enough to make a sequel unprofitable.

**Renting College Facilities**

Recall the chapter opener about renting a college auditorium for your student film society. Suppose the society offers to pay $150 for using the auditorium. Should the college accept the offer? The college could use the marginal principle to make the decision.

To decide whether to accept your group’s offer, the college should determine the marginal cost of renting out the auditorium. The marginal cost equals the extra costs the college incurs by allowing the student group to use an otherwise vacant auditorium. In our example, the extra cost is $100 for additional electricity and janitorial services. It would be sensible for the college to rent the auditorium, because the marginal benefit ($150 offered by the student group) exceeds the marginal cost ($100). In fact, the college should be willing to rent the facility for any amount greater than $100. If the students and the college’s facility manager split the difference between the $200 the students are willing to pay and the $100 marginal cost, they would agree on a price of $150, leaving both parties better off by $50.

Most colleges do not use this sort of logic. Instead, they use complex formulas to compute the perceived cost of renting out a facility. In most cases, the perceived cost includes some costs that are unaffected by renting out the facility for the day. In our example, the facility manager included $300 worth of construction costs and $50 worth of insurance, for a total cost of $450 instead of just $100. Because many colleges include costs that aren’t affected by the use of a facility, they overestimate the actual cost of renting out their facilities, missing opportunities to serve student groups and make some money at the same time.

**Automobile Emissions Standards**

We can use the marginal principle to analyze emissions standards for automobiles. The U.S. government specifies how much carbon monoxide a new car is allowed to emit per mile. The marginal question is: “Should the standard be stricter, with fewer units of carbon monoxide allowed?” On the benefit side, a stricter standard reduces health-care costs resulting from pollution: If the air is cleaner, people with respiratory ailments will make fewer visits to doctors and hospitals, have lower medication costs, and lose fewer work days. On the cost side, a stricter standard requires more expensive control equipment on cars and may also reduce fuel efficiency. Using the marginal principle, the government should make the emissions standard stricter as long as the marginal benefit (savings in health-care costs and work time lost) exceeds the marginal cost (the cost of additional equipment and extra fuel used).
2.3 THE PRINCIPLE OF VOLUNTARY EXCHANGE

The principle of voluntary exchange is based on the notion that people act in their own self-interest. Self-interested people won’t exchange one thing for another unless the trade makes them better off.

Here are some examples.

- If you voluntarily exchange money for a college education, you must expect you’ll be better off with a college education. The college voluntarily provides an education in exchange for your money, so the college must be better off, too.
- If you have a job, you voluntarily exchange your time for money, and your employer exchanges money for your labor services. Both you and your employer are better off as a result.

Exchange and Markets

Adam Smith stressed the importance of voluntary exchange as a distinctly human trait.2 He noticed
a propensity in human nature... to truck, barter, and exchange one thing for another... It is common to all men, and to be found in no other... animals... Nobody ever saw a dog make a fair and deliberate exchange of one bone for another with another dog.

As we saw in Chapter 1, a market is an institution or arrangement that enables people to exchange goods and services. If participation in a market is voluntary and people are well informed, both people in a transaction—buyer and seller—will be better off. The next time you see a market transaction, listen to what people say after money changes hands. If both people say “Thank you,” that’s the principle of voluntary exchange in action: The double thank you reveals that both people are better off.

The rationale for voluntary exchange. The alternative to exchange is self-sufficiency: Each of us could produce everything for ourselves. For most of us it is more sensible to specialize, doing what we do best and then buying products from other people, who in turn are doing what they do best. For example, if you are good with numbers but an awful carpenter, you could specialize in accounting and buy furniture from Woody, who could specialize in making furniture and pay someone to do his bookkeeping. In general, exchange allows us to take advantage of differences in people’s talents and skills.

Online Games and Market Exchange

As another illustration of the power of exchange, consider the virtual world of online games. EverQuest is a role-playing game that allows thousands of people to interact online, moving their characters through a landscape of survival challenges. Each player constructs a character—called an avatar—by choosing some initial traits for it. The player then navigates the avatar through the game’s challenges, where it acquires skills and accumulates assets, including clothing, weapons, armor, and even magic spells. The currency in EverQuest is a platinum piece (PP). Avatars can earn PPs by performing various tasks and use PPs to buy and sell assets.

The curious part about EverQuest is that players use real-life auction sites, including eBay and Yahoo! Auctions, to buy products normally purchased in the game with PPs. Byron, who wants a piece of armor for his avatar (say, a Rubicite girdle), can use eBay to buy one for $50 from Selma. The two players then enter the online game, and Selma’s avatar transfers the armor to Byron’s avatar. It is even possible to buy another player’s avatar, with all of its skills and assets. Given the time required to acquire various objects such as Rubicite girdles in the game versus the prices paid for them on eBay, the implicit wage earned by the typical online player auctioning them off is $3.42 per hour: That’s how much the player could earn by first taking the time to acquire the assets in the game and then selling them on eBay.

2.4 THE PRINCIPLE OF DIMINISHING RETURNS

Xena has a small copy shop, with one copying machine and one worker. When the backlog of orders piled up, she decided to hire a second worker, expecting that doubling her workforce would double the output of her copy shop from 500 pages per hour to 1,000. She was surprised when output increased to only 800 pages per hour. If she had known about the principle of diminishing returns, she would not have been surprised.

PRINCIPLE OF DIMINISHING RETURNS

Suppose output is produced with two or more inputs, and we increase one input while holding the other input or inputs fixed. Beyond some point—called the point of diminishing returns—output will increase at a decreasing rate.
APPLICATION

TIGER WOODS AND WEEDS

APPLYING THE CONCEPTS #4: What is the rationale for specialization and exchange?

Should Tiger Woods whack his own weeds? The swinging skills that make Tiger Woods one of the world’s best golfers also make him a skillful weed whacker. His large estate has a lot of weeds, and it would take the best gardener 20 hours to take care of all of them. With his powerful and precise swing, Tiger could whack down all the weeds in just one hour. Since Tiger is 20 times more productive than the best gardener, should he take care of his own weeds?

We can use the principle of voluntary exchange to explain why Tiger should hire the less productive gardener. Suppose Tiger earns $1,000 per hour playing golf—either playing in tournaments or giving lessons. For Tiger, the opportunity cost of weed whacking is $1,000—the income he sacrifices by spending an hour cutting weeds rather than playing golf. If the gardener charges $10 per hour, Tiger could hire him to take care of the weeds for only $200. By switching one hour of his time from weed whacking to golf, Tiger earns $1,000 and incurs a cost of only $200, so he is better off by $800. Tiger Woods specializes in what he does best, and then buys goods and services from other people.

Related to Exercise 3.5.

Xena added a worker (one input) while holding the number of copying machines (the other input) fixed. Because the two workers shared a single copying machine, each worker spent some time waiting for the machine to be available. As a result, adding the second worker increased the number of copies, but did not double the output. With a single worker and a single copy machine, Xena has reached the point of diminishing returns: That is, as she increases the number of workers, output increases, but at a decreasing rate. The first worker increases output by 500 pages (from 0 to 500), but the second worker increases output by only 300 pages (from 500 to 800).

Diminishing Returns from Sharing a Production Facility

This principle of diminishing returns is relevant when we try to produce more output in an existing production facility (a factory, a store, an office, or a farm) by increasing the number of workers sharing the facility. When we add a worker to the facility, each worker becomes less productive because he or she works with a smaller piece of the facility. More workers share the same machinery, equipment, and factory space. As we pack more and more workers into the factory, total output increases, but at a decreasing rate.

It’s important to emphasize that diminishing returns occurs because one of the inputs to the production process is fixed. When a firm can vary all of its inputs, including the size of the production facility, the principle of diminishing returns is not relevant. For example, if a firm doubled all of its inputs, building a second
APPENDIX

FERTILIZER AND CROP YIELDS

APPLYING THE CONCEPTS #5: Do farmers experience diminishing returns?

The notion of diminishing returns applies to all inputs to the production process. For example, one of the inputs in the production of corn is nitrogen fertilizer. Suppose a farmer has a fixed amount of land (an acre) and must decide how much fertilizer to apply. The first 50-pound bag of fertilizer will increase the crop yield by a relatively large amount, but the second bag is likely to increase the yield by a smaller amount, and the third bag is likely to have an even smaller effect. Because the farmer is changing just one of the inputs, the output will increase, but at a decreasing rate. Eventually, additional fertilizer will actually decrease output as the other nutrients in the soil are overwhelmed by the fertilizer.

Table 2.1 shows the relationship between the amount of fertilizer and the corn output. The first 50-pound bag of fertilizer increases the crop yield from 85 to 120 bushels per acre, a gain of 35 bushels. The next bag of fertilizer increases the yield by only 15 bushels (from 120 to 135), followed by a gain of 9 bushels (from 135 to 144) and then a gain of only 3 bushels (from 144 to 147). The farmer experienced diminishing returns because the other inputs to the production process are fixed.

Related to Exercises 4.5 and 4.6.

Table 2.1  FERTILIZER AND CROP YIELD

<table>
<thead>
<tr>
<th>Bags of Nitrogen Fertilizer</th>
<th>Bushels of Corn Per Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>85</td>
</tr>
<tr>
<td>1</td>
<td>120</td>
</tr>
<tr>
<td>2</td>
<td>135</td>
</tr>
<tr>
<td>3</td>
<td>144</td>
</tr>
<tr>
<td>4</td>
<td>147</td>
</tr>
</tbody>
</table>

THE REAL-NOMINAL PRINCIPLE

One of the key ideas in economics is that people are interested not just in the amount of money they have but also in how much their money will buy.

REAL-NOMINAL PRINCIPLE

What matters to people is the real value of money or income—its purchasing power—not the “face” value of money or income.

To illustrate this principle, suppose you work in your college bookstore to earn extra money for movies and newspapers. If your take-home pay is $10 per hour, is this a high wage or a low wage? The answer depends on the prices of the goods you buy. If

factory and hiring a second workforce, we would expect the total output of the firm to at least double. The principle of diminishing returns does not apply when a firm is flexible in choosing all its inputs.
A P P L I C A T I O N

THE DECLINING REAL MINIMUM WAGE

APPLYING THE CONCEPTS #6: How does inflation affect the real minimum wage?

Between 1974 and 2005, the federal minimum wage increased from $2.00 to $5.15. Was the typical minimum-wage worker better or worse off in 2005? We can apply the real-nominal principle to see what's happened over time to the real value of the federal minimum wage.

As shown in the first row of Table 2.2, the minimum wage was $2.00 per hour in 1974, and by 2005 it had risen to $5.15. These are nominal figures, indicating the face value of the minimum wage. By working 40 hours per week, a minimum-wage worker could earn $80 in 1974 and $206 in 2005. The third row of Table 2.2 shows the cost of a standard basket of consumer goods, which includes a standard mix of housing, food, clothing, and transportation. In 1974, consumer prices were relatively low, and the cost of buying all the goods in the standard basket was only $49. Between 1974 and 2005, consumer prices increased, and the cost of this standard basket of goods increased to $193.

The last row in Table 2.2 shows the purchasing power of the minimum wage in 1974 and 2005. In 1974, the $80 in weekly income could buy 1.63 standard baskets of goods. Between 1974 and 2005, the weekly income more than doubled, but the cost of the standard basket of goods nearly quadrupled, from $49 to $193. As a result, the weekly income of $206 in 2005 could buy only 1.07 baskets of goods. Because prices increased faster than the nominal wage, the real value of the minimum wage actually decreased over this period. Related to Exercises 5.4 and 5.6.

<table>
<thead>
<tr>
<th>Table 2.2</th>
<th>THE REAL VALUE OF THE MINIMUM WAGE, 1974–2005</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1974</td>
</tr>
<tr>
<td>Minimum wage per hour</td>
<td>$2.00</td>
</tr>
<tr>
<td>Weekly income from minimum wage</td>
<td>80.00</td>
</tr>
<tr>
<td>Cost of a standard basket of goods</td>
<td>49.00</td>
</tr>
<tr>
<td>Number of baskets per week</td>
<td>1.63</td>
</tr>
</tbody>
</table>

a movie costs $4 and a newspaper costs $1, with 1 hour of work you could afford to see 2 movies and buy 2 papers. The wage may seem high enough for you. But if a movie costs $8 and a newspaper costs $2, an hour of work would buy only 1 movie and 1 paper, and the same $10 wage doesn’t seem so high. This is the real-nominal principle in action: What matters is not how many dollars you earn, but what those dollars will purchase.

The real-nominal principle can explain how people choose the amount of money to carry around with them. Suppose you typically withdraw $40 per week from an ATM to cover your normal expenses. If the prices of all the goods you purchase during the week double, you would have to withdraw $80 per week to make the same purchases. The amount of money people carry around depends on the prices of the goods and services they buy.
Economists use special terms to express the ideas behind the real-nominal principle:

- **nominal value**
  The face value of an amount of money.
- **real value**
  The value of an amount of money in terms of what it can buy.

The **nominal value** of an amount of money is simply its face value. For example, the nominal wage paid by the bookstore is $10 per hour.

The **real value** of an amount of money is measured in terms of the quantity of goods the money can buy. For example, the real value of your bookstore wage would fall as the prices of movies and newspapers increase, even though your nominal wage stayed the same.

Government officials use the real-nominal principle when they design public programs. For example, Social Security payments are increased each year to ensure that the checks received by the elderly and other recipients will purchase the same amount of goods and services, even if prices have increased.

The government also uses this principle when it publishes statistics about the economy. For example, when the government issues reports about changes in “real wages” in the economy over time, these statistics take into account the prices of the goods purchased by workers. Therefore, the real wage is stated in terms of its buying power, rather than its face value or nominal value.

### APPLICATION

**REPAYING STUDENT LOANS**

**APPLYING THE CONCEPTS #7**: How does inflation affect lenders and borrowers?

Suppose you finish college with student loans that must be repaid in 10 years. Which is better for you, inflation (rising prices) or deflation (falling prices)? As an example, suppose you finish college this year with $20,000 in student loans and start a job that pays a salary of $40,000 in the first year. In 10 years, you will repay your college loans. Which would you prefer, stable prices, rising prices, or falling prices?

We can use the real-nominal principle to compute the real cost of repaying your loans. The first row of Table 2.3 shows the cost of the loan when all prices in the economy are stable—including the price of labor, your salary. In this case, your nominal salary in 10 years is $40,000, and the real cost of repaying your loan is the half year of work you must do to earn the $20,000. However, if all prices double over the 10-year period, your nominal salary will double to $80,000, and, as shown in the second row of Table 2.3, it will take you only a quarter of a year to earn $20,000 to repay the loan. In other words, a general increase in prices lowers the real cost of your loan. In contrast, if all prices decrease and your annual salary drops to $20,000, it will take you a full year to earn the money to repay the loan. In general, people who owe money prefer inflation to deflation.

Related to Exercises 5.5 and 5.8.

<table>
<thead>
<tr>
<th>Change in Prices and Wages</th>
<th>Annual Salary</th>
<th>Years of Work to Repay $20,000 Loan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable</td>
<td>$40,000</td>
<td>1/2 year</td>
</tr>
<tr>
<td>Inflation: Salary doubles</td>
<td>80,000</td>
<td>1/4 year</td>
</tr>
<tr>
<td>Deflation: Salary cut in half</td>
<td>20,000</td>
<td>1 year</td>
</tr>
</tbody>
</table>